

D. 15- THROUGH 20- PASSENGER CHASSIS SPECIFICATIONS

D.1. GENERAL REQUIREMENTS:

- 1.1. **GENERAL SPECIFICATIONS:** The requirements for gross vehicle weight ratings (GVWR), gross axle weight ratings front and rear (GAWR) and tire sizes and load ranges, as specified in Table No.'s Three through Seven (3 -- 7) for each size chassis are minimum requirements [See Paragraph A.4.5.]. The requirements are for school buses with standard equipment. The added weights of optional equipment such as alternative fuel storage tanks, air conditioning, luggage racks, lifts for the physically impaired, or other heavy accessories were not considered in establishing the capacity ratings to be certified for the chassis. If additional optional equipment is ordered which necessitates increased capacity ratings of either axles, springs or tires, it is the responsibility of the vendor to furnish them so that proper certification can be made on the vehicle.
- 1.2. **COLOR:** The chassis, including bumpers and wheels shall be enameled or powder coated black (Color 17038); cowl, fenders and hood shall be painted school bus yellow (Color 13432); and bumpers and wheels shall be painted the chassis manufacturer's standard color.

D.2. AXLES, SUSPENSION, AND RELATED COMPONENTS:

- 2.1. **AXLE CAPACITIES:** Axle capacities and gross axle weight ratings (GAWRs) shall be as specified in Table No.'s Three through Seven (3 -- 7) for each make of vehicle. Increased axle capacities shall be furnished to accommodate optional equipment such as diesel engines or other heavy accessories as required [See Paragraphs A.4.5., D.1.1, and G.1.7.2.].
- 2.2. **REAR AXLE RATIOS:** Rear axle ratios shall be compatible with the required engines and gradeability requirements for school buses driven at governed top rated road speeds of fifty-five miles per hour (55 mph) minimum [See Paragraph D.5.3.3.].
- 2.3. **BRAKES AND RELATED COMPONENTS:**
 - 2.3.1. **Service Brakes:** Service brakes shall be manufacturer's standard hydraulic front power disc brakes and rear disc or drum brakes meeting FMVSS No. 105 as applicable to school buses.
 - 2.3.2. **Warning, Low Fluid:** Hydraulic assist-boosters shall audibly and visually warn of fluid or power loss.
 - 2.3.3. The hydraulic braking system shall include the service brake, an emergency brake that is a part of the service brake system and controlled by the service brake control, and a parking brake.
- 2.4. **HUBODOMETER, OPTIONAL:** When so specified in the Invitation for Bid [See Option 15], chassis shall be equipped with one (1) hubodometer with standard mounting bracket which shall be calibrated in miles and installed by the manufacturer. The preferred mounting location is on the right rear axle drive wheel. The hubodometer shall be one of the following:

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- 2.4.1. Accu-Trak, Standard Car Truck, Park Ridge, IL 60068.
- 2.4.2. Engler Instruments, 250 Culver Ave., Jersey City, NJ 07305.
- 2.4.3. Veeder-Root 80, Hartford, CT 06102.
- 2.5. SHOCK ABSORBERS: Two (2) front and two (2) rear heavy-duty, double-acting shock absorbers shall be installed.
- 2.6. SPRINGS: The ground ratings for the front and rear springs shall be as specified in Table No.'s Three through Seven (3 -- 7) for each make of vehicle [See Paragraphs A.4.5, D.1.1, and G.1.7.2.].
- 2.7. TIRES AND WHEELS:
 - 2.7.1. Tires: All standard tires shall be the steel belted radial tubeless type. All tires shall be new and the tread style furnished shall be the tire manufacturer's standard design and the brand normally furnished on regular production orders unless otherwise specified in the Invitation for Bids. All tires shall be "Original Equipment Line Quality." For tire size and load range for each size chassis, see Table No.'s Three through Seven (3 -- 7).
 - 2.7.2. Wheel, Spare: When so specified in the Invitation for Bid [See Option No. 31], the bus shall have a spare wheel; however carrier and tire/tube for spare wheel will not be provided under this option.

D.3. CHASSIS FRAME AND RELATED COMPONENTS:

- 3.1. BUMPERS, FRONT AND REAR: Front and rear bumpers shall be chassis manufacturer's standard except the rear bumper furnished by body manufacturer shall be of the size and type and attached to frame as described in Paragraph C.1.2.
- 3.2. CHASSIS FRAME SIDE MEMBERS: Each frame side member shall be of one-piece (1-piece) construction between the rear most spring hanger and the forward most spring hanger. If the frame side members are extended, such extension shall be designed, furnished, and guaranteed by the installing manufacturer. The installation shall be made by either the chassis or body manufacturer. Extensions of frame lengths are permissible only when such alterations are welded on behind the hanger of the rear spring. This specification does not permit wheelbase extensions. Any welding, heating (for frame straightening or repairs), or the drilling of holes in chassis frame members shall be in accordance with chassis manufacturer's recommendations.
- 3.3. FUEL TANKS, CONVENTIONAL Fuel: Standard and auxiliary fuel tanks shall meet FMVSS No. 301 as applicable to school buses and shall meet the current design objectives of the SBMI. Fuel tanks installed on Texas school buses shall have a minimum "draw" of eighty-three percent (83%) of capacity.
 - 3.3.1. Fuel Tanks, Standard: The standard fuel tank shall have a minimum capacity of twenty-one (21) gallons. The tank shall be mounted, filled, and vented entirely outside the body [See Paragraph D.5.4.3.].

3.3.2. Fuel Tank (s), Optional: When so specified in the Invitation for Bid, [See Option No. 12], the bus shall be furnished with a minimum capacity thirty (30) gallon fuel tank or tanks furnished and installed by the chassis manufacturer.

3.4. STEERING, POWER: The bus shall be furnished with the chassis manufacturer's standard power steering which will provide safe and accurate performance at maximum load and speed.

D.4. ELECTRICAL SYSTEM AND RELATED COMPONENTS:

4.1. ALTERNATORS: The twelve (12) volt alternators with rectifier shall have the electrical outputs and the minimum charging rates shown below when tested in accordance with SAE rating at the manufacturer's recommended engine speed. These alternators shall be ventilated and voltage controlled and, if necessary, current-controlled. Alternators shall be provided as follows:

4.1.1. Alternator, Standard: "Type A" buses and "Type B" buses shall be furnished with a standard alternator with a minimum electrical output of one-hundred (100) amperes with gasoline or alternative fuel engines (seventy-five amperes (75 amps) with diesel) and one-hundred-thirty amperes (130 amps), respectively.

4.1.2. Alternators, Other: School buses equipped with the following equipment shall have alternators as follows:

4.1.2.1. Air-Conditioned Buses: "Type A" buses and "Type B" buses equipped with air conditioning shall have alternators with a minimum electrical output of one-hundred-thirty amperes and one-hundred-sixty amperes (130 and 160 amps), respectively.

4.1.2.2. Wheelchair Lift-Equipped Buses: "Type A" buses and "Type B" buses equipped with wheelchair lifts shall have alternators with a minimum electrical output of one-hundred-thirty and one-hundred-sixty amperes (130 and 160 amps), respectively.

4.1.2.3. Air-Conditioned and Wheelchair-Equipped Buses: "Type A" buses and "Type B" buses equipped with both air conditioning and wheelchair lifts shall have alternators with a minimum electrical output of one-hundred-thirty and one-hundred-sixty amperes (130 and 160 amps), respectively.

4.2. BATTERY AND RELATED COMPONENTS: The storage battery furnished on each chassis shall have sufficient capacity to supply current for adequate operation of the engine starter, lights, signals, heater, and all other electrical equipment. The batteries for 15- through 20-passenger school buses shall have a potential of twelve (12) volts and meet the following:

4.2.1. Battery, Diesel Engines: The batteries furnished with diesel engines shall be as specified by the chassis manufacturer. When two (2) batteries are provided, they shall both be installed under the hood or one (1) shall be installed under the hood and the other shall be installed in a battery box having outside access. Single batteries shall be installed under the hood.

- 4.2.2. **Battery, Gasoline Engines:** The minimum performance level shall be a BCI cold cranking capacity of no less than three-hundred-sixty amperes (360 amps) at zero degrees (0°F) with a minimum one-hundred (100) minute reserve capacity.
- 4.2.3. **Battery (s), Alternative Fueled Vehicles:** Dedicated alternative fueled vehicles shall have batteries meeting or exceeding those required for a gasoline engine school bus with comparable horsepower.
- 4.3. **HORNS:** Each bus shall be equipped with horn or horns of standard make. Each horn shall be capable of producing audible sounds in the frequency range from two-hundred-fifty to two-thousand (250 to 2,000) hertz and at an intensity of between eighty-two (82) and one-hundred-two (102) decibels. The sound level measurements shall be made at a distance of fifty (50) feet directly in front of the vehicle in accordance with SAE J377.
- 4.4. **INSTRUMENTS AND INSTRUMENT PANEL:** The bus shall be equipped with the following non-glare illuminated instruments controlled by an independent rheostat¹⁶ and gauges mounted for easy maintenance and repairs and clearly visible to the seated driver. Indicator warning lights in lieu of gauges are permissible as shown below:
 - 4.4.1. Ammeter (or Voltmeter) with graduated charge and discharge indications.
 - 4.4.2. Fuel Gauge.
 - 4.4.3. Glow Plug Indicator Light (for diesel buses with glow plugs only).
 - 4.4.4. Odometer (Six (6) digits, e.g., register to 99,999.9 miles).
 - 4.4.5. Oil Pressure Gauge and/or Warning Light.
 - 4.4.6. Speedometer.
 - 4.4.7. Vehicle manufacturer's standard Keyed Ignition Switch.
 - 4.4.8. Water Temperature Gauge and/or Warning Light.
- 4.5. **LAMPS:** Each bus shall be equipped with at least two (2) clear headlamps meeting the requirements of FMVSS No. 108 and a dimmer switch located at the far left of steering column. Adequate parking lamps operated by a switch in common with the headlamps shall be provided.
- 4.6. **TURN-SIGNAL AND VEHICULAR WARNING SIGNAL OPERATING UNITS AND FLASHERS:** The operating units and flashers for turn-signals and vehicular hazard warning signals shall meet the requirements of FMVSS No. 108 [See Paragraphs C.1.7 and C.1.11.].

¹⁶

If the intensity of the body-installed panel lamps is controlled, then the intensity control shall not be accomplished by the same rheostat that controls the chassis instrument lamps, unless the body company designs and installs the rheostat to accomplish both.

- 4.7. **WIRING:** The chassis manufacturer shall provide a readily accessible terminal strip or plug on the body side of the cowl, or at an accessible location within the engine compartment, with the following minimum terminals for the body connections:

- 4.7.1. Backup lamps.
- 4.7.2. Instrument panel lights (rheostat controlled by head lamp switch).
- 4.7.3. Left turn signals.
- 4.7.4. Right turn signals.
- 4.7.5. Stop lamps.
- 4.7.6. Tail lamps.

D.5. ENGINE AND RELATED COMPONENTS:

- 5.1. **AIR CLEANER:** Each chassis shall be equipped with a factory-installed maximum capacity, replaceable dry element type air cleaner. The intake air system for diesel engines shall have an air cleaner restriction indicator properly installed by the chassis manufacturer to meet manufacturer's engine specifications.
- 5.2. **COOLING SYSTEM:** The cooling system shall have the manufacturer's largest heavy-duty radiator available for the series and shall be of sufficient capacity to cool the engine at all speeds in all gears. The cooling system fan shall be the heavy-duty reinforced type.
- 5.3. **ENGINES:** Approved engines listed in each table for the various size buses are the engines for which the vendor has requested approval and are usually the smallest engine in terms of performance that will meet the requirements listed below. Other approved engines which the vendor may provide with a given chassis will be listed also in an Approved Products List (APL). The APL will be updated as new engines or additional versions of current engines are approved. Please note that only those engines approved as specified below and listed either in the Texas School Bus Specification or in the Class 070-SB-APL will be acceptable for school buses.
 - 5.3.1. **Diesel Engines:** When so specified in the Invitation for Bid [See Option No. 8], the 15-, 16-, 18-, 19-, or 20-passenger school bus chassis shall be furnished with a 4-cycle diesel engine.
 - 5.3.2. **Gasoline Engines:** Engines for the 15- through 20-passenger buses shall be of the gasoline type unless otherwise specified in the Invitation for Bid. Approved engines are listed in Tables No.'s Three through Seven (3 -- 7) and in the Class 070-SB-APL.
 - 5.3.3. **Power Requirements:** Each bus shall be furnished with an engine that meets or exceeds the following minimum criteria [See Paragraph D.5.3.4.7.], when tested at or above the gross vehicle weight rating (GVWR) required for a given bus capacity and with all accessories except air conditioning compressor on and operating:
 - 5.3.3.1. Acceleration from zero to fifty miles per hour (0--50 mph) in sixty (60) seconds or less.

5.3.3.2. Gradeability of one-and-one-half percent (1.5%) minimum at fifty miles per hour (50 mph).

5.3.3.3. Gradeability of five percent (5.0%) minimum at twenty-five miles per hour (25 mph).

5.3.3.4. Startability of twenty percent (20%) minimum.

5.3.3.5. Top speed of fifty-five miles per hour (55 mph) minimum at the manufacturer's rated rpm for the governed engine.

5.4. EXHAUST SYSTEM:

5.4.1 Component Placement: The exhaust pipe, muffler, and tailpipe shall be mounted under the bus and attached to the chassis frame.

5.4.2 Noise Level: The noise level shall neither exceed EPA "Noise Emission Standards" nor eighty-five (85) decibels at the ear of the occupant in the bus nearest the noise source.

5.4.3 Tailpipe Exit: The tailpipe of a gasoline-powered bus shall not exit the side of the bus anywhere within twelve inches (12") of a vertical plane through the center of the fuel filler opening and perpendicular to the side of the bus, unless protected with a metal shield to divert spilled fuel away from tailpipe.

5.5. OIL FILTER: Each chassis shall be equipped with a factory-installed, minimum one (1) quart capacity oil filter with a replaceable filter element.

5.6. TACHOGRAPH: When so specified in the Invitation for Bid [See Option No. 27], a tachograph containing a combination clock/speedometer/recorder shall be installed on the dashboard. The tachograph shall be Argo Model (s) 1310-6, Veeder-Root Model 1407, or approved equal.

5.7. THROTTLE: The force required to operate the throttle shall not exceed sixteen pounds (16 lbs.) throughout the full range of accelerator pedal travel.

D.6. APPROVAL OF NEW ENGINES: Procedures for approving a new bus engine for 15- through 20-passenger school buses shall be as follows in the order indicated:

6.1. SUBMISSION OF REQUEST: Submit a written request that the engine be approved along with the following:

6.1.1. Letter: Letter stating that the meets or exceeds each and every applicable requirement in Texas Specification No. 070-SB-98.

6.1.2. Literature and applicable power curves showing horsepower and torque:

- 6.2. REVIEW OF REQUEST:** The Commission will review the literature and performance charts and advise the vendor or manufacturer by letter of the results of this review. A copy of this letter will be furnished to the School Bus Committee. If this review verifies that the bus engine meets or exceeds the requirements of this specification, the vendor or manufacturer shall arrange for the school bus to be brought to Austin, Texas for inspection and evaluation by the Commission and the Texas School Bus Committee if requested.

D.7. TRANSMISSION AND RELATED COMPONENTS:

- 7.1. AUTOMATIC TRANSMISSION, STANDARD:** The standard automatic transmission shall be the three- or four-forward (3- or 4-) speed automatic type. An electronic control or similar device may be installed to ensure that automatic transmissions cannot accidentally be moved out of the neutral or park gear position while the driver is not in the driver's seat, and shall be one of the following:

7.1.1. Chrysler Motor Corporation's "A727 LoadFlite" ;

7.1.2. Ford Motor Company's Standard automatic, or;

7.1.3. General Motors Corporation's "Turbo Hydramatic" .

- 7.2. DRIVE SHAFT GUARD:** Each drive shaft section shall be equipped with protective metal guard or guards to prevent the shaft from whipping through the floor or dropping to the ground when broken.

D.7. CHASSIS TYPES: Figure No. One (1) shows the types of chassis available for small school buses.

FIGURE No. ONE (1)

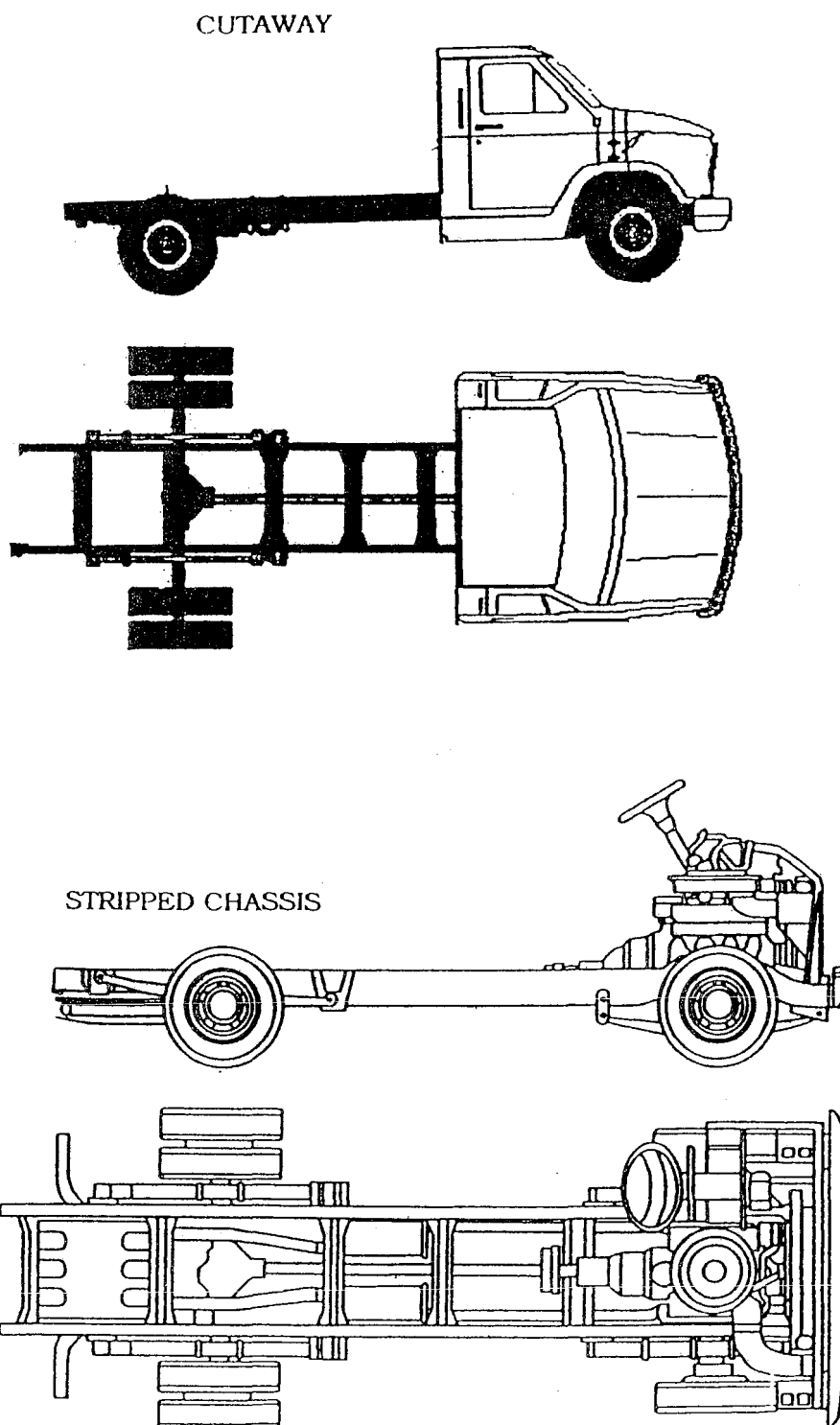


TABLE NO. THREE (3)
15-Passenger Bus Chassis
[SEE PARAGRAPH B.1.2.: REDUCED PASSENGER CAPACITY]
Refer to General Requirements, Page 7

15-Passenger ITEM	1998 Min. Rqmts.	Chevrolet/GMC G31305	Chevrolet/GMC G31705	Ford Van E350* ¹	Ford Cutaway E350* ¹
GVWR, lbs.	9500	9500/10000D	9500	9500	9600
GAWR, lbs. Front	4050	4100/4100D	4300	4200	4050
GAWR, lbs. Rear	6084	6084/7500D	6084	6084	6084
Axle Capacity, lbs. Front	4300	4300/4300	4300	4600	4600
Axle Capacity, lbs. Rear	6084	6084/7500D	6084	6340	6340
Wheelbase, in.	135	135	155	138	158
Chassis Length, in.	As Required	241	239	212	237.4
Track, in. Front	68.4	N/A	N/A	69.4	68.4
Track, in. Rear	67.0	N/A	N/A	67.0	71.6
Gasoline Engine, L.	**2	5.7L-V8	5.7L-V8	* ¹	* ¹
SAE Gross Horsepower	**2	250	250	* ¹	* ¹
SAE Gross Torque, lb-ft.	**2	330	330	* ¹	* ¹
Transmission: Automatic	A3	A4OD	A4OD	E4OD	E4OD
Tires, Steel Belted Radial	As Shown	LT245/75R16E	LT245/75R16E	LT245/75R16E	LT245/75R16E
Size & Load Range	As Shown				
Wheels: Rear	As Shown	Dual	Single	Single	Single
Alternator, amperes	100	124	100	95	130
¹ *Furnished with diesel engine only [See Option No. 8].					
² **See minimum power requirements in Paragraph D.5.3.4.					

DIESEL ENGINE [Option No. 8]

15-Passenger ITEM	1998 Min. Rqmts.	Chevrolet/GMC G31305/G31303/G31605	Ford E 350
Engine Displacement, L.	* ¹	6.5L-V8	7.3L-V8
SAE Gross Horsepower	* ¹	190	215
SAE Gross Torque, lb-ft.	* ¹	385	425
Alternator, amperes	100	100	130
¹ *See minimum power requirements in Paragraph D.5.3.4.			

Engines listed on this page are approved to meet or exceed power requirements under normal operating conditions. Other engines must be submitted for approval by the School Bus Committee [See Paragraph D.5.3.4.].

15-Passenger Bodies

15-Passenger ITEM S.W.	1998 Min. Rqmts.	Blue Bird Mircor-Bird	Collins Bantam	Van-Con Bus	MidBus Guide SW/DW	Thomas Minotaur	AmTram Vanguard	Carpenter Classmate SW	US Bus Universe
Interior Headroom, in.	65	74	65 75	65	72	73	74	68	75
Interior Width: Floor Line, in.	72	90.5	78	72	79	84	91	76	82
Interior Width: Shoulder Line, in.	70	91	78	70	77	84	91	76	81
Service Door Type	As Shown	Tall	Tall	Sedan	Tall	Tall	Tall	Tall	Tall
Rear Wheels	As Shown	Dual/Single	Single	Single	Single	Dual	Dual	Single	Single
Chassis Type	As Shown	Cutaway	Cutaway	Cutaway	Cutaway	Cutaway	Cutaway	Cutaway	Cutaway

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TABLE NO. FOUR (4)
16-Passenger Bus Chassis
[SEE PARAGRAPH B.1.2.: REDUCED PASSENGER CAPACITY]
Refer to General Requirements, Page 7

16-Passenger ITEM	1998 Min. Rqmts.	Chevrolet/GMC G31503	Chevrolet/GMC P30862	Ford E350Cutaway *
GVWR, lbs.	10000	10000	14500	10000
GAWR, lbs. Front	4050	4100	5000	3800
GAWR, lbs. Rear	7200	7500	11000	7500
Axle Capacity, lbs, Front	4300	4300	5000	4600
Axle Capacity, lbs, Rear	7500	7500	11000	78000
Wheelbase, in.	125	135	125	138
Chassis Length, in.	As Required	241	221	257.4
Track, in. Front	65.2	N/A	65.2	69.4
Track, in. Rear	66.7	N/A	66.7	73.2
Gasoline Engine, L.	**1	5.7L-V8	5.7L-V8	*1
SAE Gross Horsepower	**2	250	180	*1
SAE Gross Torque, lb-ft.	**2	330	295	*1
Transmission: Automatic	A4	A4 OD	4L80-E	E4 OD
Tires, Steel Belted Radial	Tubeless	LT225/75R16D	8.00R19.5D	LT225/75R16D
Size & Load Range	As Shown			
Wheels, Rear	Dual	Dual	Dual	Dual
Alternator, amperes	100	100	105	95
***See minimum power requirements in Paragraph D.5.3.4.				

DIESEL ENGINE [Option No. 8]

16-Passenger ITEM	1998 Min. Rqmts.	Ford E350	Chevrolet/GMC
Engine Displacement, L.	*1	7.3L-V8	6.5L-V8
SAE Gross Horsepower	*1	215	190
SAE Gross Torque, lb-ft	*1	425	385
Alternator, amperes	100	130	100
*1See minimum power requirements in Paragraph D.5.3.4.			

Engines listed on this page are approved to meet or exceed power requirements under normal operating conditions. Other engines must be submitted for approval by the School Bus Committee [See Paragraph D.5.3.4.].

16-PASSENGER BODIES

[Wide Body, Straight side, "Style II" Service Door]

The following bodies are available on commercial cutaway chassis in this configuration:

16-Passenger ITEM	1998 Min. Rqmts.	AmTran	Blue-Bird Micro-Bird	Carpenter Classmate	Collins Spr.	Collins Grnd.	MidBus Guide/DW	Thomas Minotaur	US Bus SturdiBus
Interior Headroom, in.	73	74	74/77	74	75	75	73	73	75
Interior Width, in.	90	90	90.5	90	90.5	90.5	90	90	90

TABLE NO. FIVE (5)
18-Passenger Bus Chassis
[SEE PARAGRAPH B.1.2.: REDUCED PASSENGER CAPACITY]
Refer to General Requirements, Page 7

18-Passenger ITEM	1998 Min. Rqmts.	Ford E 350 Cutaway	Chevrolet/GMC G31503 Cutaway
GVWR, lbs.	9500	9600	9500
GAWR, lbs. Front	4050	4050	4100
GAWR, lbs. Rear	6084	6084	6084
Axle Capacity, lbs, Front	4100	4600	4100
Axle Capacity, lbs, Rear	6084	7800	6084
Wheelbase, in.	138	138	155
Chassis Length, in.	--	237	241
Gasoline Engine, L.	*1	**2	5.7L-V8
SAE Gross Horsepower	*1	**2	250
SAE Gross Torque, lb-ft.	*1	**2	330
Transmission: Automatic	A4	E4OD	A4OD
Tires, Steel Belted Radial	Tubeless	LT245/75R16E	LT245/75R16E
Size & Load Range	As Shown		
Wheels, Rear	Single	Single	Single
Alternator, amperes	100	95	124
¹ See minimum power requirements in Paragraph D.53.4.			
² **Furnished with diesel engine only [See Option No. 8].			

DIESEL ENGINE [Option No. 8]

18-Passenger ITEM	1998 Min. Rqmts.	Ford E350	Chevrolet/GMC G31303
Engine Displacement, L.	*1	7.3L-V8	6.5L-V8
SAE Gross Horsepower	*1	215	190
SAE Gross Torque, lb-ft	*1	425	385
Alternator, amperes	100	130	100
¹ See minimum power requirements in Paragraph D.5.3.4.			

Engines listed on this page are approved to meet or exceed power requirements under normal operating conditions. Other engines must be submitted for approval by the School Bus Committee [See Paragraph D.5.3.4.].

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18-PASSENGER BODIES (With Dual (or Single) Rear Emergency Door)

The following bodies are available on van conversion chassis:

18-Passenger ITEM	1998 Min. Rqmts.	Collins Bantam	MidBus Guide SW or DW	Van-Con 18 Passenger	Carpenter Classmate SW	US Bus Sturdi Bus	Thomas Minotour
Overall Length	220	220/246.8	228.0	236/220	243.0	225.0	236
Interior Height	65	65/75	72.0	65.0	68.0	68.0	73
Interior Width	72	78	79	72	76	74	84
Entrance Door Height ¹	64	70/80	72	72	70	64	70
Passenger Seats (26"-39" Benches:							
Left Side, rows	4 or 5	4	4	4/5	5		4
Curb Side, rows	4 or 5	4	4	5	5		4
Knee Space, in.	24	24	25	24	24		24
Aisle Width, in.	12	13	12	15	13.25		12
¹ *Option 11 allows automotive type ("Style I") service doors.							

TABLE NO. SIX (6)
19-Passenger Bus Chassis
[SEE PARAGRAPH B.1.2.: REDUCED PASSENGER CAPACITY]
Refer to General Requirements, Page 7

19-Passenger ITEM	1998 Min. Rqmts.	Chevrolet/GMC	Chevrolet/GMC P30862	Ford E 350 Cutaway
GVWR, lbs.	10000	10000	14500	10700
GAWR, lbs. Front	4050	4100	5000	4050
GAWR, lbs. Rear	7500	7500	11000	7500
Axle Capacity, lbs, Front	4300	4300	5000	4600
Axle Capacity, lbs, Rear	7500	7500	11000	7800
Wheelbase, in.	125	155	125	138
Chassis Length, in.	As Required	241	221	257
Track, Front, in.	65.2	N/A	65.2	69.4
Track, Rear, in.	66.7	N/A	66.7	73.2
Gasoline Engine, L.	*1	5.7L-V8	5.7L-V8	**2
SAE Gross Horsepower	*	250	180	**2
SAE Gross Torque, lb-ft.	*	330	295	**2
Transmission: Automatic	A4	A4OD	4L80-E	E4OD
Tires, Steel Belted Radial	Tubeless	LT225/75R16D	8.00R19.5D	LT225/75R16D
Size & Load Range	As Shown			
Wheels, Rear	Dual	Dual	Dual	Dual
Alternator, amperes	100	100	105	95
¹ See minimum power requirements in Paragraph D.5.3.4.				
² **Furnished with diesel engine only [See Option No. 8].				

DIESEL ENGINE [Option No. 8]

19-Passenger ITEM	1998 Min. Rqmts.	Ford E350	Chevrolet/GMC G31303
Engine Displacement, L.	*1	7.3L-V8	6.5L-V8
SAE Gross Horsepower	*1	215	190
SAE Gross Torque, lb-ft	*1	425	385
Alternator, amperes	100	130	100
¹ See minimum power requirements in Paragraph D.5.3.4.			

19-PASSENGER BUS BODIES

The following bodies are available on commercial cutaway chassis in this configuration:

19-Passenger ITEM	1998 Min. Rqmts.	AmTran Vanguard VSS19	Blue Bird Micro-Bird MB-20	Carpenter Classmate	Collins Spr. Bantam	Collins Grand. Bantam	Thomas Minotaur	MidBus Guide DW	US Bus Super Sturdi
Interior Headroom, in.	73	74	74/77	74	75	75	73	73/79	75
Interior Width, in.	90	90.5	90.5	90	90.5	90.5	90	90	91
Service Door ¹	As Shown	Tall	Tall	Tall	Tall	Tall	Tall	Sedan/ Tall	Tall
¹ Available only with Option 11, Sedan-type Service Door.									

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TABLE NO. SEVEN (7)
20-Passenger Bus Chassis
[SEE PARAGRAPH B.1.2.: REDUCED PASSENGER CAPACITY]
Refer to General Requirements, Page 7

20-Passenger ITEM	1998 Min. Rqmts.	Chevrolet/GMC P30842	Chevrolet/GMC P30862	Ford Super Duty Cutaway
GVWR, lbs.	11500	11500	11500	14050
GAWR, lbs. Front	4400	4400	5000	4600
GAWR, lbs. Rear	7900	7900	7900	9450
Axle Capacity, lbs, Front	5000	5000	5000	4600
Axle Capacity, lbs, Rear	7900	7900	7900	9450
Wheelbase, in.	125	125	125	158
Chassis Length, in.	As Required	214.8	222.1	257.4
Track, Front, in.	65.2	65.2	65.2	69.4
Track, Rear, in.	66.7	66.7	66.7	77.7
Gasoline Engine, L.	*1	5.7L-V8	5.7L-V8	**2
SAE Gross Horsepower	*1	180	180	**
SAE Gross Torque, lb-ft.	*1	295	295	**
Transmission: Automatic	A4OD	4L80-E/A4OD	A4OD	E4OD
Tires, Steel Belted Radial	Tubeless	8.00R19.5E/D	8.00R19.5E	LT225/75R16E
Size & Load Range	As Shown			
Wheels, Rear	Dual	Dual	Dual	Dual
Alternator, amperes	100	105	105	95
¹ See minimum power requirements in Paragraph D5.3.4.				
² **Furnished with diesel engine only [See Option No. 8].				

DIESEL ENGINE [Option No. 8]

20-Passenger ITEM	1998 Min. Rqmts.	Ford Super Duty	Chevrolet/GMC G31303
Engine Displacement, L.	*1	7.3L-V8	6.5L-V8
SAE Gross Horsepower	*1	215	190
SAE Gross Torque, lb-ft	*1	425	385
Alternator, amperes	100	130	100
¹ See minimum power requirements in Paragraph D.5.3.4.			

Engines listed on this page are approved to meet or exceed power requirements under normal operating conditions. Other engines must be submitted for approval by the School Bus Committee [See Paragraph D.5.3.4.).

The following bodies are available on stripped chassis:

20-PASSENGER BUS BODIES (Straight Side, "Style II" Service Door)

20-Passenger ITEM	1998 Min. Rqmts.	Blue Bird Mini-Bird MB-20	Carpenter Cadet	Collins Grand Bantam ¹	Thomas Minotour
Interior Headroom, in.	75	74/77	77	75	73
Interior Width, in.	90	90.5	90	90	90
Service Door ²	As Shown	Tall	Tall	Tall	Tall
¹ Body available on cutaway chassis.					
² Conventional bus door -- Minimum 68" tall and 24" wide, folds or separates in the middle to open.					

E. 24 THROUGH 83 PASSENGER BODY SPECIFICATIONS:**E.1. GENERAL REQUIREMENTS:**

- 1.1. **BODY PHYSICAL REQUIREMENTS:** Physical requirements for the 24- through 83-passenger school buses shall conform to the following table [See Option No. 15 and Paragraph A.1.3]:

TABLE NO. EIGHT (8)
PHYSICAL REQUIREMENTS

(1)	(2)	(3)	(4) ¹	(5) ²	(5)	(6) ³	(7)
Minimum Size Number of Passengers:	Overall Body Width Inches, Max.	Rows Of Seats Each	Knee Spacing Inches, Min.	Seat Width Left Inches, Min.	Seat Width Right Inches, Min.	Center Aisle Width Inches, Min.	Floor-to-Ceiling Height Inches, Min.
24	96	5	24	39*	26	12	72
35	102	6	25	39*	39	12	72
47	102	8	25	39*	39	12	72
53	102	9	25	39*	39	12	72
59	102	10	25	39*	39	12	72
65	102	11	25	39*	39	12	72
71-S	102	12	24-3/4	39*	39	12	72
71-L	102	12	25	39*	39	12	72
77	102	13	25	39*	39	12	72
83	102	14	24-3/4	39*	39	12	72
¹ Column (4): Knee space is defined as the horizontal distance from the front center of a seat back to the rear center of the seat back or barrier immediately ahead, measured at approximately 4 inches above the seat cushion. Knee space may be reduced to minimum 24-3/8 inches, only on buses when high back seats are ordered, where it is impossible to achieve 24-3/4 inch space.							
² Column (5): <u>Left</u> rear seat shall have minimum width of 26 inches.							
³ Column (6): Floor-to-ceiling height shall be measured in the center of the body between the Number Two (2) pillar and the last side body pillar ahead of the rear roof slope.							

- 1.1.1. **Overall Length:** The overall length of a complete school bus shall not exceed forty (40) feet.

- 1.2. **BUMPER, REAR:** The rear bumper shall be furnished by the body manufacturer. It shall be secured to rear chassis frame and it shall be designed so as to prevent "hitching of rides" by obtaining a toehold thereon. The bumper shall not be permanently attached to the bus body, but shall wrap around the body, extending forward for at least twelve inches (12") on each side. The bumper shall be of pressed steel channel at least three-sixteenths inch (3/16") thick by eight inches (8") high. It must be bolted to the chassis frame and braced with material of at least equal impact ratio as the material in the bumper.

- 1.3. **CEILING:** The ceiling shall be free of all projections likely to cause injury to passengers. [See Table One (1) and Paragraph E.2.9.].

- 1.4. **COLORS and LETTERING:** A first quality black enamel (Color No. 17038 of Federal Standard No. 595a) or decals shall be used for lettering and trim. The properties of the black enamel shall be equal to those of the finish coat enamel. Pressure-sensitive tape or decals are acceptable for trim or lettering (e.g., EMERGENCY DOOR, EMERGENCY EXIT, etc. signs), provided they are made from FAISON R 200, 3M Series 180, or approved equal material. Exit signs and lettering shall be in compliance with FMVSS No. 217.
- 1.4.1. **Body Exterior:** The exterior of the complete bus except for bumpers, rub rails, and wheels shall be finished in school bus yellow (Color No. 13432 of Federal Standard No. 595a). The hood may be coated with non-reflective school bus yellow paint. When so specified in the Invitation for Bid [See Option No. 38], the school bus roof shall be painted white. The paint on the roof shall extend from the back of the front cap to the front of the rear cap and from a point on each side of the bus which is no lower than the top of the windows and no higher than the start of the roof curvature. The paint shall be the same quality as the paint on the remainder of the school bus.
 - 1.4.2. **Body Interior:** Unless otherwise specified in the Invitation for Bid, the interior of the complete bus body shall be finished in the manufacturer's standard color except where clear-coat galvanized steel is required [See Paragraph E.2.9].
 - 1.4.3. **Chassis Components:** Unless otherwise specified in the Invitation for Bid, chassis components such as grilles, frame rails, and wheel covers shall be painted the chassis manufacturer's standard color.
 - 1.4.4. **Emergency Exit Lettering:** The emergency exits shall be marked "EMERGENCY DOOR" or "EMERGENCY EXIT," both on the outside and/or on the inside in compliance with FMVSS No. 217.
 - 1.4.5. **Exterior Mirror Backs and Brackets:** The metal backs of all exterior mirrors, if painted, and all exterior mirror brackets shall be finished in lusterless black (Color No. 37038). [See Paragraphs E.3.8.2 and E.3.8.4.].
 - 1.4.6. **Logos:** No logo, trademark, insignia, or letters shall be placed on bumpers or mud flaps. A small metal or plastic plate designating body manufacturer's name may be attached to the bus body. A logo of reasonable size, which has been approved by the Commission, may be placed on the exterior bus body.
 - 1.4.7. **Rub Rails:** All rub rails, except the pressed-in type window level rub rails, shall be painted black (Color No. 17038). The pressed-in type rub rails shall be painted either black (Color No. 17038) or school bus yellow (Color No. 13432) at the option of the manufacturer.
 - 1.4.8. **School Bus Lettering:** The bus body shall have the words "SCHOOL BUS" on the front roof cap, the rear roof cap, and on both sides of the bus body applied with black paint (Color No. 17038 of Federal Standard No. 595a). The letters shall be neat, clearly defined block style eight inches (8") high with one inch (1") wide strokes. The words "SCHOOL BUS" shall be at the same level on each side of the bus (i.e., same height above bottom of skirt). Lettering shall be placed as high as possible without impairment of its visibility.

"SCHOOL BUS" lettering shall have a reflective background. This is not optional. Option No. 19, Reflective Materials, applies only to: diagonal marking of front and/or rear bumpers; outlining the rear perimeter of the bus body; and striping the sides of the bus body.

Required lettering and numbering shall include:

District or company name or owner of the bus shall be displayed in the beltline.

Bus identification number shall be displayed on the front, the rear, and the sides of the bus body.

- 1.4.9. School Name Lettering: When so specified in the Invitation for Bid (See Option No. 20), the school district name shall be provided in black letters on both sides of the bus near the belt line. Lettering shall be minimum five inches (5") high with minimum five-eighths inch (5/8") block strokes. Paint, if used, shall be equal in quality to that of the bus body paint; decals shall meet or exceed the requirements in Paragraph E.1.4. Maximum number of characters in one (1) line of the name is limited to the bus length. The school district should list in the space provided on the School Bus Requisition Form (*See sample form on page 168*), the name to be placed on the bus. Characters should be typed or printed plainly on this form to ensure accurate spelling.
- 1.4.10. Wheels: The wheels shall be painted the chassis manufacturer's standard color.
- 1.5. INSULATION, NOISE: Each school bus shall be constructed so that the noise level measured at the ear of the occupant nearest the primary vehicle noise source shall not exceed eighty-five (85) decibels, when tested in accordance with the procedure given in the Noise Test Procedure of NSSB. [See Option No. 24].
- 1.6. INSULATION, THERMAL: The ceilings and sidewalls shall be thermally insulated with a fire-resistant material approved by Underwriters Laboratories, Inc. to adequately reduce the noise level and to minimize vibrations. Buses shall have the equivalent of one-and-one-half inches (1-1/2") of fiberglass or other insulation in the ceilings and walls including the interior of hat-shaped bows. Any insulation used shall have a minimum R-factor value of 5.77.
- 1.7. LAMPS, SIGNALS, AND WARNING DEVICES: Each bus shall be furnished with the lamps listed below [See SMBI Standard No. 001]:
 - 1.7.1. Alternately Flashing Signal Lamps: Each school bus shall be equipped with eight (8) warning signal lamps, four (4) red and four (4) amber, working in an automatic non-sequential integrated system. The signal lamps shall conform to the design, installation location and operating requirements of Paragraph S4.1.4. of FMVSS No. 108:

"S4.1.4 Each school bus shall be equipped with a system of...":

"...(b) Four (4) red signal lamps designed to conform to SAE Standard J887, "School Bus Red Signal Lamps," July 1964, and four (4) amber signal lamps designed to conform to that standard, except for their color, and except that their candlepower shall be at least two-and-one-half (2-1/2) times that specified for red signal lamps. Both red and amber lamps shall be installed in accordance with SAE Standard J887, except that:

"(i) Each amber signal lamp shall be located near each red signal lamp at the same level, but closer to the vertical centerline of the bus; and

"(ii) The system shall be wired so that the amber signal lamps are activated only by manual or foot operation, and if activated, are automatically deactivated and the red signal lamps automatically activated when the bus entrance door is opened."

Note: The lamps shall be wired independently and not wired through the ignition switch. This will allow removal of the ignition key without affecting operation of the alternately flashing eight warning signal lamps.

1.7.1.1. Band: Each set of amber and red lamps shall have a minimum three inch (3") black band around the set and a three inch (3") band between the lamps in each set. The color of this band shall be black enamel (Color No. 17038, Black Enamel of Federal Standard 595a). If it is not possible to provide a three inch (3") band between the lamps in the set, the manufacturer will then provide a band as wide as possible. Any visor or hood used to shade the lights and improve visibility will not interfere with the intensity and photometric performance of the warning lights [See SMI Standard No. 001].

1.7.1.2. Mounting: If exterior panels are cut to provide an opening for installation of flush-mounted signal lamps, the lamps must have a closed cell sponge flange gasket with a minimum thickness of three-sixteenths inch (3/16"). The gasket shall be the full width of the flange on the lamp. Proper installation of the lamps shall be made in order to prevent seepage of moisture into the opening.

1.7.1.3. Operating Instructions: Complete instructions for the detailed operation of the warning signal lamp system shall be furnished with each school bus.

1.7.2. Backup Lamps: The color, requirements, and mounting of backup lamps shall be in accordance with FMVSS No. 108, except two (2) backup lamps are required by Texas Specifications.

1.7.3. Clearance, Identification and Side Marker Lamps: Each bus shall be furnished with the lamps listed below. The quantities, colors, requirements, and mountings shall be in accordance with FMVSS No. 108. Each identification, clearance, and side marker lamp installed to indicate school bus height and/or width shall be the armored flush mounting type for protection of lens from damage during normal operation. The armored protectors shall in no way interfere with the intended purpose of the lamps.

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The armored type protectors shall be Grote Manufacturing Company, Madison, Indiana 47250, Model No.'s 45012 and 45013, or K-D Lamp Company, 1910 Elm Street, Cincinnati, Ohio 45210, Model Nos. 38469-901 and 40268-301, or Weldon Model No. 5050, or approved equal. [See SBMI Standard No. 001 and FMVSS No. 108 Types and proper location of Lamps.]

Example of an approved equal: Peterson Model - PM122.

1.7.3.1. Clearance Lamps.

1.7.3.2. Identification Lamps.

1.7.3.3. Intermediate Side Marker Lamps (not required on buses less than 30 feet long).

1.7.3.4. Side Marker Lamps.

1.7.4. Interior and Stepwell Lamps: Interior lamps shall be installed to properly and adequately illuminate the entire aisle and emergency passageway. The stepwell shall be illuminated with a separate lamp activated by opening the service door. The fixtures shall have white or clear plastic lenses attached to metal receptacles. The stepwell lamp shall also have a metal bezel. The lamps shall be designated for a twelve (12) volt electrical system and shall have installed a minimum fifteen (15) candlepower lamp bulb. The fixtures shall be mounted so as to provide adequate illumination of the passenger and driver's compartment, spacing of the lamp fixtures shall be the option of the bus body manufacturer.

1.7.4.1. Quantity: The quantity of interior lamps required for each bus shall be as listed below:

SCHOOL BUS SIZE	INTERIOR CEILING LAMPS
(Number of Passengers)	(Minimum Required per Bus)
24 and 35	3
47 and 53	4
59 and 65	5
71, 77, and 83	6

1.7.4.2. Stepwell and interior lamps approved are as follows:

MANUFACTURER

CATALOG NUMBER

Arrow Safety Device Co.
Cardinal Mfg. Co.
Grote Mfg. Co.
K-D Lamp Co.
Weldon Inc.

Dome Lamps
043, 036
1271-G1
230 (61031)
KD530-12
8005

Stepwell Lamps
(Equivalent lamps
with metal bezels)

- 1.7.5. **License Plate Lamp:** The color, requirements, and mounting of the license plate lamp shall be in accordance with FMVSS No. 108.
- 1.7.6. **Reflex Reflectors and Intermediate Reflex Reflectors:** The quantities, colors, requirements, and mounting of reflex and intermediate reflex reflectors shall be in accordance with FMVSS No. 108, except one amber reflex reflector on the front, one (1) amber intermediate reflex reflector on the rear shall be mounted on each side of the bus body. The amber reflex reflectors mounted near the front and on each side of the chassis are required on Texas buses in addition to the reflectors required by FMVSS No. 108.
- 1.7.7. **Tail and Stop Lamps:** The quantities, colors, requirements, and mounting of tail and stop lamps shall be in accordance with FMVSS No. 108, except stop lamps shall be seven inches (7") in diameter and mounted at approximately the belt line level of the bus. A set of minimum four inch (4") tail/stop lamps shall be installed below the seven inch (7") set. Base of lamps shall be metal or durable plastic preferably with screw lens. Lenses shall be secured to lamps by a fastening method which requires a toll to remove the lens. The lamps shall be Grote 78002 or 78102 taillight, K-D Lamp Company Models 258-2601 or 258-2605, or approved equal.

Example of an approved equal: Truck-Lite Model 90-91.

- 1.7.8. **Turn-Signal/Hazard Warning Lamps:** The quantities, colors, requirements, and mountings of turn-signal/hazard warning lamps shall be in accordance with FMVSS No. 108, except rear turn-signal lamps shall be seven inches (7") in diameter. The front turn-signal lamps shall be the double-face pedestal type or they shall be of the "wrap-around type" (except single-faced type on forward control buses). They shall be mounted in such a manner so as to be capable of withstanding all normal vibrations. On double-faced pedestals, the front lens shall be amber; the rear lens shall be red or amber, or a shade between red and amber. The operating units and flasher for turn-signals and vehicular hazard warning signals shall meet the requirements of FMVSS No. 108.
 - 1.7.8.1. **Installation:** If exterior panels are cut to provide an opening for installation of flush-mounted turn-signal lamps, the lamps must have a closed cell sponge flange gasket with a minimum thickness of three-sixteenths inch (3/16"). The gasket shall be the full width of the flange on the lamp. Proper installation of the lamp shall be made in order to prevent seepage of moisture into the opening.
 - 1.7.8.2. **Wiring:** The exposed wiring to the signal lamps shall be enclosed in a one-piece (1-piece) waterproof loom, or equivalent, leading directly from the lamp body to the interior of the bus body. The wiring shall be supported at the lamp body and at intervals of not more than six inches (6") until it enters the bus body.
- 1.7.9. **Warning Devices:** Each school bus shall be equipped with three (3) triangular warning devices meeting the requirements of FMVSS No. 125. The devices shall be packed three (3) per metal or heavy-duty plastic box, or they may be individually packed in metal or heavy-duty plastic boxes with the three (3) boxes contained within a carrier.

Warning devices shall be securely mounted in the driver's compartment. Triangular warning devices furnished shall be approved by the Texas Department of Public Safety.

- 1.8. **LICENSE PLATE HOLDER:** A recessed license plate holder shall be mounted on the left rear of the bus body. The recess shall be minimum of three-eighths inch (3/8") deep at the top and shall be located so that the license plate will receive illumination from the clear lens on the underneath side of the tail light, or by a separate lamp.
- 1.9. **OPENINGS:** All openings in the floorboard or firewall between chassis and passenger-carrying compartment, such as for gearshift lever, steering column, and auxiliary brake lever, shall be sealed. All openings between chassis and passenger-carrying compartment made due to alterations by the body manufacturer must be sealed.
- 1.10. **PAINTING:**

1.10.1 **Preparation and Cleaning:**

1.10.1.1. **Surface Preparation:** The method used in the cleaning and preparation of all surfaces to be primed shall be equal to that specified by Federal Specification TT-C-490B for equivalent use. The final preparation for priming shall include a careful inspection to make certain that all surfaces to be primed will permit optimum adhesion of all paint films.

1.10.1.2. **Surface Cleaning:** All interior and exterior panels and rub rails to be painted or coated shall be thoroughly cleaned to remove all rust, grease, weld slag, and other foreign material prior to priming. Any welds on the components for the bus body or chassis shall be dressed, sanded, buffed, and thoroughly cleaned to remove any slag and to properly prepare the welds for priming. After proper cleaning, these components shall be thoroughly rinsed. Neither the cleaning process nor the rinses shall impair the zinc phosphate coating of the panels or rub rails.

1.10.2. **Primer Coat¹⁷:** After the components have been thoroughly cleaned and prepared as described above, they shall be totally primed and dried. These components may be primed and dried either prior to or after installation. All components such as rivet or bolt heads and damaged areas shall be thoroughly cleaned and primed.

1.10.3. **Finish Coat¹⁸:** After all interior and exterior panels and rub rails have been prepared, cleaned, and primed as specified above, they shall be finished

¹⁷ Components of the body frame system need not be primed, except for welds. All processes and methods used in the priming operation shall be in accordance with the best recognized industrial practices. Primers shall be those recommended by the paint manufacturer supplying the finish coat enamels. Primers may be any color. Clear-coated panels are required below the passenger windows and in the stepwell [See Paragraph E.2.9].

¹⁸ Alternate methods for preparing metal surfaces and painting procedures will be considered on an individual basis. Manufacturers shall submit their procedural data to the Commission for approval where methods are used that differ from those specified above.

with a first quality baking enamel, applied and baked according to the paint manufacturer's instructions. These enamels, when applied over the paint manufacturer's recommended primer, shall have properties equal to or better than those specified by Federal Specification TT-E-489F, Class B. Both interior and exterior enamel finish coats shall have a minimum dry film thickness of two (2) mils, when tested with a "dry film thickness gauge" (such as the "Elcometer Dry Film Thickness Gage," Gardner Laboratory, Inc., Bethesda, Maryland 20014) conforming to Federal Specification TT-C-490B. All processes and methods used in the enamel finish coat operation shall be in accordance with the best recognized industrial practices. In no instance shall the enamel finish coat be applied over an unprimed surface.

- 1.11. UNDERCOATING: Undercoating is required to provide for insulation, sound deadening, protection from road minerals, and rust prevention, as applicable, and shall meet the following:
 - 1.11.1. Application: The entire underside of the bus body, including floor members, wheelwells, side panels below the floor level, and all metal fenders or fenders with metal liners shall be coated with one-eighth inch (1/8") thick material as specified below. The undercoating shall be applied in accordance with the undercoating manufacturer's instructions. Do not cover up or obliterate the chassis identification plate [See Paragraph A.6.4.3].
 - 1.11.2. Material: Insulating and undercoating materials shall be an asphalt base underbody coating conforming to Federal Specification TT-C-520B, such as R-477-139, manufactured by Daubert Chemical Co., Chicago, Illinois 60638 or Lion Nokorode Emulsion 331 as manufactured by Lion Oil Company, El Dorado, Arkansas 71730, or an approved equal. An example of an approved equal is Tectyl MC121B, manufactured by Ashland Petroleum Company, Box 391, Ashland, Kentucky 41101, applied to a dry film thickness greater than twenty (20) mils.
- 1.12. WIRING: All wiring shall conform to the current standards of the SAE. All connections shall be made by soldering or by an industry-approved connector. All wires shall be insulated and shall be enclosed in a fibrous loom, or equal, for protection from external damage and short circuits. The wires shall be securely attached to the body and chassis at interval of twenty-four inches (24") or less.
 - 1.12.1. Accessory Wiring: Body-installed accessories shall be wired from the battery through a low voltage solenoid cut-off switch operated by the ignition key except for the eight (8) light warning system and hazard warning lights.

- 1.12.2. **Color and Number Coding:** A system of color and number coding shall be used and an appropriate identifying diagram shall be provided together with the wiring diagram provided by the chassis manufacturer.

The following body interconnecting circuits shall be color coded as noted:

FUNCTION	COLOR
Left Rear Directional Signal	Yellow
Right Rear Directional Signal	Dark Green
Stoplights	Red
Backup Lights	Blue
Taillights	Brown
Ground	White
Ignition Feed, Primary Feed	Black

The color of the cables shall conform to SAE J1128.

- 1.12.3. **Fusing:** Each circuit, except starting and ignition, shall be fused separately or shall have an adequate circuit breaker. Two (2) extra fuses for each size of fuse installed on the bus by the body manufacturers, shall be conveniently mounted on the bus body.

- 1.12.4. **Main Circuits:** The electrical system wiring shall have at least nine (9) main circuits:

- (1) Head, tail, stop (brake), and instrument panel lamps.
- (2) Clearance and stepwell lamps.
- (3) Dome lamps.
- (4) Starter motor.
- (5) Ignition and emergency door signal.
- (6) Turn-signal (directional).
- (7) Alternately flashing signal lamps.
- (8) Horn.
- (9) Heater and defroster.

E.2. CONSTRUCTION:

- 2.1. **GENERAL REQUIREMENTS:** Twenty-four passenger (24-) through 83-passenger school buses shall meet or exceed the bus body joint strength requirements of FMVSS No. 221. The bodies shall be reasonably dustproof and watertight. The main steel components are listed below and their requirements are listed in Table No. Nine (9). They shall be constructed of Type I steel except as noted there:

E: 24- Through 83-Passenger Body Specifications

Post-it® Fax Note 7671		Date	# of pages ▶ 1
To <i>Greg Mills</i>		From <i>L. Barker</i>	
Co./Dept.		Co.	
Phone #		Phone #	
Fax # <i>916-327-7195</i>		Fax # <i>512 463 3543</i>	

the body shall consist of:

ies, strainers, front and
and emergency door

ils, service doors,
emergency doors, skirts, roof panels, window jambs (post caps),
window sills, and front and rear panels including front cowl.

2.1.1.3. The Floor System: Floor panels, main cross members, auxiliary cross members, wheelhousing, steps, and stepwell bracing.

2.1.1.4. The Interior Paneling: Side and ceiling panels.

2.1.2. Body-Chassis Attachment: The body shall be attached to the chassis frame by means of U-bolts with seven-sixteenths inch (7/16") diameter threads and a minimum ten-thousand pounds (10,000 lbs.) tensile pull strength per arm, and the manufacturer's standard clips to prevent slippage between the chassis frame and the bus body. The U-bolts shall be fitted with lock washers and nuts and, after the nuts have been securely tightened, the threads of each U-bolt shall extend a minimum of one-half inch (1/2") past the nuts. Each bus shall be furnished with the following as indicated:

2.1.2.1. Body-Chassis Insulation: Anti-squeak material in continuous strips or rubber pads shall be permanently and firmly attached to the frame rails or cross members to insulate chassis from body.

2.1.2.2. Other Fastening Devices: All other main cross members (not attached by U-bolts) on all sizes of bodies shall be attached to the chassis with the manufacturer's standard fastening devices where possible. Shear bolts or other equally effective devices approved by the Commission, may be used in addition to U-bolts and standard clips to eliminate slippage.

2.1.2.3. U-Bolt: Bus bodies shall be attached to the chassis with U-bolts. The number used and their placement shall be as follows:

BUS SIZE	NO. OF U-BOLTS, Min.* ¹	PLACEMENT
24	4 (2 on each frame rail)	1/3 and 2/3 length of bus 1 at each end;
35, 47, & 53	6 (3 on each frame rail)	one in center 1 at each end;
59, 65, 71, 77, & 83	8 (4 on each frame rail)	one about one-third and one about two-thirds of length of bus body.
¹ School buses equipped with any combination of wheelchair lift positions and conventional seats shall have as a minimum, the number of U-bolts as if the bus were equipped with all conventional seating (e.g., a 71-passenger school bus body equipped with any combination of wheelchair positions and conventional seats shall have at least eight (8) U-bolts (four (4) installed on each frame rail).		

TABLE NO. NINE (9)
STEEL REQUIREMENTS
NOMINAL METAL THICKNESSES AND ZINC COATING DESIGNATIONS¹⁹

Item Number	Components	Thickness, In.	Metal Zinc Coating Designation
1	Bows, Frames	.0635	G 60
2	Bows, Roof	.0635	G 60
3	Cowl, Front	.0635	G 60
4	Doors, Emergency and Service:		G 60
4a	Exterior Panel	.0396	G 60
4b	Interior Panel	.0336	G 60
5	Door Posts:		
5a	Emergency Door	.0785	G 60
6	Floor Panels	.0785	G 60
7	Longitudinal Frame Members:		
7a	Floor Line	.0635	G 60
7b	Seat Line	.0635	G 60
7c	Belt Line	.0635	G 60
7d	Window Header Line	.0635	G 60
8	Panels, Exterior:		
8a	Front	.0396	G 60
8b	Rear	.0396	G 60
8c	Roof	.0396	G 60 or A 60
8d	Side	.0396	G 60 or A 60
8e	Skirts	.0396	G 60
9	Panels, Interior:		
9a	Headlining	.0336	G 60 or A 60
9b	Front Lap	.0336	G 60 or A 60
9c	Rear Lap	.0336	G 60 or A 60
9d	Lower (below windows)	.0336	G 60 or A 60* ¹
10	Posts, Side	.0635	G 60
11	Rub Rails:		
11a	Skirt Line	.0635	G 60
11b	Floor Line	.0635	G 60
11c	Seat Line	.0635	G 60
11d	Window Line	.0396	G 60
12	Wheel Housing	.0635	G 60
13	Window Sills	.0396	G 60**
¹ Lower interior embossed panels (Item No. 9d) and stepwell wall panels shall be clear-coated galvanized steel, ASTM designation A446-76, or Galvalume, aluminized steel, or aluminum over steel.			

¹⁹

It is mandatory that all components listed in Table No. Nine (9) be of the above types of steel, unless otherwise specified. Item No. 13 may be of aluminum alloy 6063-T6 having a minimum thickness of 0.062 inch. All other metal components not listed in Table No. Nine (9) may also be zinc-coated steel. **NOTE: OTHER BODY METAL OR MATERIAL USED IN CONSTRUCTION SHALL HAVE STRENGTH AT LEAST EQUIVALENT TO STEEL COMPONENTS SPECIFIED ABOVE.**

TYPE I (Regular): ASTM Specification A525, coating designation G60, as specified, mill zinc-coated steel. Coated steel, except components not to be primed and painted, shall have a smooth minimized spangle surface which has been zinc phosphate treated by the steel mill or by the bus body manufacturer.

TYPE II (Alloyed): ASTM Specification A525, coating designation A60, mill zinc-coated steel which has been zinc phosphate treated by the steel mill or by the bus manufacturer.

Standard ANCI tolerances allowed for metal thickness requirements.

- 2.1.3. **Body-Cowl Attachment:** Buses equipped with chassis manufacturer's cowl shall be furnished with the body securely attached to the rear face of the chassis cowl with a minimum of nine (9) bolts, nuts, and lock washers. On all such buses the junction between cowl and body shall be sealed to form a gastight and watertight seam. The sealant used shall be either the best grade of molded or extruded rubber weather stripping or a good quality, pressure applied, silicone elastomer sealant.
- 2.1.4. **Bus Body Length:** The bus body shall extend to, or farther than, the end of the chassis frame so that all main cross members and auxiliary cross members will rest upon the chassis frame. The distance from the end of the chassis frame and the rear of the body shall not exceed six inches (6").
- 2.1.5. **Caulking:** A flexible, tenacious, high quality caulking compound or adhesive shall be applied to the top of all rub rails, all unwelded metal joints, and to any place where moisture could enter through the exterior panels. This does not include the fresh air intake or heater or drain openings at the bottom of the rub rails. The compound shall be applied to the required areas in a neat and workmanlike manner without voids or skips.
- 2.1.6. **Chassis Frame Alterations:** The body manufacturer shall not in any manner alter the 24- through 83-passenger chassis frame except to cut off the rear portion of the frame where necessary to weld bumper braces, and to lengthen the frame in order to comply with the requirements of Paragraph F.3.1. None of the rivets in the chassis frame shall be cut flush with the frame or removed. The body manufacturer may alter the chassis frame to adapt standard chassis to forward control. Any change must have body manufacturer's warranty.
- 2.1.7. **Exhaust Pipe Extension:** The body manufacturer shall furnish and install an exhaust pipe extension when necessary in order to insure compliance with the chassis requirements of the exhaust system [See Paragraph F.5.5]. The tail pipe shall not extend beyond the rear bumper.
- 2.1.8. **Fasteners, Bolts and Rivets:** All bolts and rivets used in the manufacture of the school bus body shall be high strength metal. All bolts shall be equipped with lock washers or other acceptable devices to prevent loosening under vibration. All bolts, nuts, and washers except U-bolts, their nuts and washers, shall be parkerized, cadmium-plated, or otherwise rustproofed.

- 2.1.9. Fasteners, Other: Sheet metal screws or self-tapping bolts of any type shall not be used in the construction of bodies except:
 - 2.1.9.1. Alignment²⁰ of doors or in conjunction with rivets, welds, or bolts for compliance with FMVSS No. 221, as applicable, or;
 - 2.1.9.2. Attachment of exterior mirrors, [Paragraph E.3.8.5], or;
 - 2.1.9.3. Electrical wire moldings and light fixtures
 - 2.1.9.4. Installation of header pads over the doors, or;
 - 2.1.9.5. Installation of rub rails or emergency door handles and latches where it is impossible to use rivets or bolts, nuts, and lock washers and then only when these fasteners are used in conjunction with the manufacturer's standard metal adhesive which is used to meet joint strength requirements, or;
 - 2.1.9.6. Interior panels which must be removed to give accessibility to other interior or concealed components, or;
 - 2.1.9.7. Seat construction [See Paragraph E.2.13.5.2], or;
 - 2.1.9.8. Window frames when applied with the metal adhesive.
- 2.1.10. Front Body Section, Semi-forward Control Bodies: On semi-forward control 24- through 71-passenger buses, the front body section of the school bus from the windshield forward shall be of the bus body manufacturer's standard design and shall contain, but not be limited to, the following components:
 - 2.1.10.1 Fenders: Properly braced fenders with the total spread of the outer edges exceeding the total spread of the front tires when the front wheels are in the straight-ahead position.
 - 2.1.10.2 Grille: A sufficiently reinforced grille assembly.
 - 2.1.10.3 Hood: Hood cover with latching mechanism providing access to the forward part of the engine.
 - 2.1.10.4. Lamps: Headlamps and parking/turn-signal lamps as required by FMVSS No. 108.
- 2.1.11. Fuel Filler Opening: The body manufacturer will provide an opening in the body panel of sufficient size to allow easy access and entry of fuel nozzle to the fuel tank filler neck opening. This opening in the panel must be so positioned that the filler neck, when viewed at right angles from the side, is approximately centered in the cut-out. This opening shall be provided with a hinged cover so designed and constructed to remain open when fueling is in progress and remain in a totally closed position at all other times [See Paragraph E.2.10.3.1].

²⁰ When self-tapping bolts are used to align doors, they shall be tack-welded at the head or applied with the metal adhesive and shall not exceed the number of rivets, or bolts, nuts, and washers installed in the door hinges.

- 2.1.12. **Identification Plate:** Each body shall bear in a prominent place a permanently attached plate showing the name of the manufacturer and the body serial number [See Paragraph A.6.4.2].
- 2.1.13. **Steering Wheel Placement:** There shall be at least a two inch (2") clearance between the steering wheel and the cowl, instrument panel, or any other surface.
- 2.1.14. **Wood:** The use of wood shall be limited to the construction of passenger seats, seat backs, or header pads, and the bottom of any tool compartment or to insulate floors.
- 2.2. **ACCESS PANELS:** Any panel used for access to the engine radiator or radiator overflow container and installed in the passenger compartment shall have a keyed lock. This does not include the engine cover.
- 2.3. **BATTERY COMPARTMENT:** If the battery is mounted on the chassis frame, which is required on diesel-powered buses, the bus body manufacturer shall provide a battery compartment beneath the floor of the bus body. This compartment shall be a skirt type container, reinforced and equipped with a pullout receptacle and an outside access door. The battery compartment shall provide complete weather protection for the battery as well as total access for servicing [See Paragraph F.4.2.4]. Battery cables of sufficient length shall be provided to accommodate the mounting of the battery in this compartment, and the body manufacturer shall mount the battery in the compartment. This compartment is not available on rear engine buses.
- 2.4. **BODY FRAME:** The complete body frame shall be formed, welded, riveted, or lock bolted, assembled and constructed in accordance with recognized engineering practices within the bus body industry.
 - 2.4.1. **Design:** The frame shall have a formed shape with a minimum cross sectional depth of one-and-one-eighth inches (1-1/8"). Frame members, running from one side main cross member to the other side main cross member, may be continuous bow frames, or they may consist of side posts and roof bows. If side posts and roof bows are used, every pair of side posts must be connected by a roof bow to form the equivalent of a continuous bow frame. The side posts shall be set on not more than thirty inch (30") centers, except that one (1) side post and bow or one bow frame may be set on a maximum of thirty-eight-and-three-fourth inch (38-3/4") center, or three (3) bow frame sections not exceeding thirty-six-and-one-half inches (36-1/2") may be used in any one (1) body (up to four (4) thirty-eight-and-three-fourth inch (38-3/4") body frame sections may be used for Forward Control Rear Engine buses ONLY). Each of the side posts or bow frames shall be securely welded, riveted, or lock bolted to the floor system at each main cross member or to the longitudinal frame member which is located at the floor line. Each side post and/or bow frame must also be attached, as specified above, to the remaining longitudinal frame members.

- 2.4.2. **Front Frame Section:** The front frame shall be a unitized framework of formed sections designed with the necessary stress members required to withstand the torsional stresses set up by or in the chassis. The corner posts shall extend from the bottom of the body to the windshield header and shall not cause or produce a "blind spot" for the driver. The front assembly shall be securely attached to the floor system by lock bolting, welding, or riveting and shall be securely bolted to the chassis cowl in such a manner as to not to cause undue strain [See Paragraph E.2.4.1].
 - 2.4.3. **Longitudinal Frame Members:** The body frame shall have not less than four (4) individual side longitudinal frame members extending the full length of the body (except as interrupted by side posts or when cut for an opening for the wheelhousing). One (1) each shall be located at the floor line, the seat line, the belt line, and at the window header line. The belt line longitudinal member may be replaced by an exterior rub rail, i.e., an extra rub rail in the belt line area. This rub rail shall meet requirements specified under RUB RAILS, Paragraph E.2.10.
 - 2.4.4. **Material:** The body frame system [See Paragraph E.2.1.1] shall be of the type, grade, and thickness of steel specified in Table No. Nine (9) or approved equal, and shall meet the requirements of FMVSS No. 220.
 - 2.4.5. **Rear Frame Section:** The rear frame shall consist of a formed sill, two (2) posts (one (1) on either side of the emergency door, extending from the sill to the roof bow and intersected by a rear header at the proper point), and suitable strainers to form a rigid framework. framework shall be assembled and attached to the floor system by welding, riveting, or lock bolting.
- 2.5. **EMERGENCY EXITS:** Texas school buses shall be provided with emergency exits which comply with FMVSS No. 217 and those requirements as listed below:
- 2.5.1. **EMERGENCY DOORS:** The emergency door shall be of the type, grade, and thickness of steel specified in Table No. Nine (9) or approved equal. Emergency doors on buses furnished to this specification shall be equipped with doors meeting the requirements below. Emergency doors shall be furnished with upper glass panels, permanently closed, set in rubber or sealed against rubber. [See Paragraphs E.2.19.2. and E.1.4.4.] No seat or other object shall be placed in the body that restricts the passageway to the emergency door to less than twelve inches (12"). There shall be no steps leading to the emergency door.
 - 2.5.1.1. **Attachment:** The hinges for the emergency doors shall be attached with rivets or bolts, nuts, and lock washers. Metal screws or self-tapping bolts are not acceptable. Metal screws may be used for alignment of doors while installing rivets. Self-tapping bolts may be used for alignment if the bolt heads are tack-welded to the hinges [See Paragraph E.2.1.9.1.].

- 2.5.1.2. Design: The emergency door on all except rear-engine buses²¹ shall be located in the center of the rear of the body and shall have a minimum horizontal opening of thirty inches (30") and a minimum vertical opening of forty-eight inches (48") measured from the floor level. The door shall be hinged on the right side of the body (forward side for rear engine buses), shall open outward, and shall be designed to permit opening from both inside and outside of the bus. It shall be properly sealed against moisture and dust.
- 2.5.1.3. Door Holding Device: A means (device) shall be provided to hold the swing-out type door (s) in the fully opened position (ninety degree (90°) minimum).
- 2.5.1.4. Glass Panels: The glass in the emergency door shall have an area of not less than two-hundred-ninety-nine square inches (299 sq. in.) and shall be set solid in a waterproof manner [See Paragraph E.2.19.1.1.]. The installation of glass in the lower portion of the door is required and shall meet the same requirements (lower glass panels not required in the emergency doors of rear engine buses). The lower glass panels shall be the body manufacturer's standard size. These glass panels shall be installed securely to prevent removal by hand.
- 2.5.1.5. Header Board: The head impact area on the inside at the top of the emergency door shall be protected by an energy-absorbing, padded header board, three inches (3") wide and one inch (1") thick, extending the full width of the emergency door to prevent injury when accidentally impacted.
- 2.5.1.6. Latch: The emergency door shall be equipped with a slide bar rack and pinion (cam) operated latch. The slide bar shall be approximately one-and-one-fourth inches (1-1/4") wide and three-eighths inch (3/8") thick and shall have a minimum stroke of one-and-one-eighth inches (1-1/8"). The slide bar shall be spring loaded so as to retain the bar in the closed position and have a minimum of one inch (1") of horizontal bearing surface beyond the edge of the door frame when the door lock is in a latched position.
- 2.5.1.7. Latch Handle: The movement of the lock handle through its full arc of operation shall not be obstructed by, or extended into the area behind the rear seats at the emergency door. The handle, when in the closed position, shall meet the requirements of FMVSS No. 217. The design of the latch handle shall allow quick release, but shall offer protection against accidental release. Control of the fastening devices from the driver's seat shall not be permitted. A pull handle shall be installed on the inside of the emergency door so that the door can be securely closed for positive fastening. Provisions for opening from the outside shall consist of a handle (device) designed to prevent "hitching a ride" yet allowing the door to be opened when necessary. The outside handle, when in the closed position, shall extend vertically downward from its pivot center.

²¹ A left rear emergency door meeting the requirements of FMVSS No. 217, shall be provided on rear engine buses.

2.5.1.8. Switch: The emergency door latch shall be equipped with a heavy-duty electric plunger-type switch connected to a warning buzzer located in the driver's compartment. The switch shall be enclosed in an adequately protected case, and wires leading from the switch shall be concealed in the walls. The switch shall be mounted plumb, parallel, and perpendicular to the striker plate of the lock slide bar. The switch shall be installed so that the buzzer will sound before the door handle is turned far enough to permit the door to open. The switch shall be Cole-Hersee's No. 9118, having an upset end (knob) on the plunger head.

2.5.2. Emergency Exit Requirements:

"Type A", "Type B", "Type C", and "Type D" vehicles shall be equipped with a total number of emergency exits as follows for the indicated capacities of vehicles. Exits required by FMVSS No. 217 may be included to comprise the total number of exits specified:

Zero to 42 Passenger = One (1) emergency exit per side and one (1) roof hatch.

43 to 78 Passenger = Two (2) emergency exits per side and two (2) roof hatches.

79 to 90 Passenger = Three (3) emergency exits per side and two (2) roof hatches.

Each emergency exit above shall comply with FMVSS No. 217. These emergency exits are in addition to the rear emergency door or exit.

In addition to the audible warning required on emergency doors by FMVSS No. 217 additional emergency exits may also be equipped with an audible warning device.

2.6. FLOORS: The floor system [See Paragraph E.2.1.1.3.] shall be of the type, grade, and thickness of steel specified in Table No. Nine (9) or approved equal (See Paragraph. E.3.1.).

2.6.1. Construction and Installation: The floor panels shall run the full width of the floor and shall be supported on all outside edges by a longitudinal frame member. The floor panels shall be welded, riveted, or bolted to the main and auxiliary cross members and shall be joined so as to form a leakproof and dustproof floor. The main and auxiliary cross members shall extend the full interior width of the floor panels. The side posts or bow frames shall be securely welded, riveted, or bolted to the floor system and to the longitudinal frame members or gussets.

2.6.2. Cross Members: The cross members shall be spaced not more than ten inches (10") center-to-center. The floor panels and cross members shall be designed so as to completely and adequately support all fixed and changeable loads under all operating conditions without deformation of the underbody structure, strains to body, or fractures of member joints. The design and strength of the under structure shall be sufficient to eliminate the necessity of installing outriggers attached to the chassis except at the

front entrance. The undersurface of the entire floor structure, including wheelhousing and stepwell, shall be sprayed with material at least one-eighth inch (1/8") thick conforming to that specified in Paragraph E.1.11.

- 2.6.3. Insulation: When air conditioning is ordered [See Option No. One (1) and Paragraph H.1.2.] the floor shall be covered with five-eighths inch (5/8") nominal thickness A-C or B-B exterior grade plywood manufactured in accordance with U.S. Product Standard PS 1-83. CDX interior grade plywood with exterior glue is acceptable when all surfaces including the edges of the wood are covered or sealed against the exterior environment. [See Paragraph. C.2.5.1.].

2.7. FLOOR COVERING:

- 2.7.1. Aisle Material: Floor covering in the aisle shall be the aisle type, fire-resistant rubber or equivalent, and shall be nonskid, wear-resistant, and ribbed. Minimum overall thickness shall be three-sixteenths inches (3/16") when measured from tops of the ribs. Rubber aisle floor covering shall meet Federal Specification ZZ-M-71D.
- 2.7.2. Installation: Floor covering must be permanently bonded to floor and must not crack when subjected to sudden changes in temperature. Bonding or adhesive material shall be waterproof and shall be a type recommended by the manufacturer of floor-covering material. All seams must be sealed with waterproof sealer.
- 2.7.3. Trim: Seams shall be covered with extruded aluminum metal strips of a minimum three-sixteenths inches (3/16") high and one inch (1") wide that shall be installed on each side of the aisle, the full length of the aisle, so as to secure both the edges of the aisle covering and adjoining edges of the underseat covering. Each aisle strip shall consist of not more than three (3) pieces of the metal stripping. The strips shall be secured to the flooring with flush-mounted flat or low profile oval head screws; holes for the screws shall be countersunk. The screws shall be placed not more than nine inches (9") apart for the full length of the metal strips except that the ends of each piece of stripping shall have screws placed at not more than three-fourths inches (3/4") from each end. Screws may be placed nine-and-one-half inches (9-1/2") apart only to avoid interference with floor sill members.
- 2.7.4. Underseat Material: The floor in the underseat area (including wheelwells, and the areas under the driver's seat, wheelchairs, and toeboard except transmission inspection plate) shall be covered with fire-resistant rubber floor covering or equivalent having minimum overall thickness of one-eighth inches (1/8"). Floor covering on toeboard shall be held in place by trim strip or molding.

2.8. PANELS, EXTERIOR:

- 2.8.1. Attachment and installation: All exterior panels shall be attached to bow frames and strainers so as to act as an integral part of the structural frame. They shall be installed by lapping and riveting, lapping and bolting, or by flanging and bolting and in such a manner as to form watertight joints. The

exterior side panels shall be installed either vertically or longitudinally. Vertical panels shall be one-piece (1-piece) and shall extend from the window line to or below the floor line. Longitudinal panels shall be installed starting at or below the floor line and extending upward to the window line with each ascending panel overlapping the preceding panel. Rub rails shall not be considered as part of the paneling for covering the side except for pressed-in window rails.

- 2.8.2. Design: The front and rear exterior panels shall be formed into the desired contours to give a smooth, pleasing appearance to the bus. The front and rear exterior roof panels shall be of not more than three (3) pieces welded or riveted together to form a continuous piece over the front and rear frame.
- 2.8.3. Joints: Joints shall meet the requirements of FMVSS No. 221.
- 2.8.4. Material: All exterior panels [See Paragraph E.2.1.1.2.] shall be of the type, grade, and thickness of steel specified in Table No. Nine (9) or approved equal.
- 2.8.5. Undercoating: All exterior panels shall be completely sprayed on the inside of the main exposed surfaces, and shall feather edge to the edge of the attaching members, with one-sixteenth inch (1/16") thick material conforming to that specified in Paragraph E.1.11. The spraying shall be done after the panels are installed.
- 2.9. PANELS, INTERIOR: All interior wall and ceiling panels shall be steel and of the body manufacturer's standard design except the panels beneath the windows shall be clear-coated galvanized embossed steel meeting ASTM A 446. Also the stepwell and riser panels in the service door entryway shall be clear-coated galvanized steel (embossing not required). Galvalume, aluminized steel, and aluminum over steel panels are acceptable for use beneath the windows and in the entryway.
 - 2.9.1. Attachment: All interior panels shall be attached to the frame structure by bolts, rivets, or by any well-designed method utilizing self-locking panels, or locking panel strips. Regardless of the method used, the panels shall be attached so that vibration, rumbling, and popping will be at a minimum.
 - 2.9.2. Design: Front and rear panels shall be formed to present a smooth, pleasing appearance. If the ceiling is constructed so as to contain lapped joints, the forward panel shall be lapped by the rear panel and all exposed edges shall be beaded, hemmed, flanged, or otherwise treated to minimize sharp edges.
- 2.10. RUB RAILS: Four (4) separate, one-piece (1-piece), continuous rub rails of the type, grade, and thickness of steel specified in Table No. Nine (9) (or approved equal), shall be installed on the body as described below. The minimum finished width of all rub rails shall be four inches (4"):
 - 2.10.1. Construction: The rub rails shall be of ample strength to resist impact and to prevent crushing of the bus body and shall be a flanged-formed channel,

longitudinally fluted or corrugated rib surface. Ends shall be (1) smoothly closed, or (2) closed by a rounded end cap which shall be butt- or flash-welded to the rub rail, or (3) closed by a rounded end cap inserted with an approximate one inch (1") sleeve inside of the rub rail, riveted in position at the top and bottom of the rub rail flange, and sealed in the same manner as the top flange of the rub rails.

2.10.2. Drainage: The bottom edge of each rub rail (except the pressed-in-type which may be used near the window line) shall have provisions for drainage of accumulated moisture. One (1) of the following drainage methods shall be used:

2.10.2.1. Slots: The bottom flange of the rub rail shall have a minimum of one inch by 0.32 inch (1" x 0.32") formed slots spaced on not more than twelve inch (12") centers, or;

2.10.2.2. Slots or Holes: One (1), one-fourth inch (1/4") diameter slot or hole per foot in the lowest part of the rub rail drilled prior to the priming, painting, and installation of the rub rail shall be provided. Holes drilled after rub rail installation or after priming and painting are not acceptable. Formed slots are preferred over drilled or cut holes.

2.10.3. Installation: All rub rails shall be bolted or riveted on top and bottom to each side post and riveted on top and bottom to the exterior paneling between the side posts [See exception in Paragraph E.2.1.9.5.]. Provisions for one-piece (1-piece) rails may be accomplished by butt- or flash-welding. All welds, including those for the end caps, shall be dressed, sanded, and buffed. Rub rails shall be installed on both sides of bus body as follows:

2.10.3.1. Floor and Skirt Level: The floor and skirt level rub rails and the additional rub rail furnished in lieu of one longitudinal frame member shall be installed the full outside length of the body (except at wheel housings) on the right side from the service door to the rear corner radius and on the left side from the point of curvature near the outside cowl to the rear corner radius. One (1) of the floor level rails may be cut to provide an opening for the gas tank filler neck only if fuel tank furnished to meet FMVSS No. 301-75 requires the opening to be enlarged, or to meet the requirements in Paragraph E.2.1.11.

2.10.3.2. Seat Level: The seat level rub rail shall be installed from the service door completely around the bus body (except for emergency door and rear engine bus) to the point of curvature near the outside cowl on left side. The rails may be two-piece (2-piece) with the joint being near the rear side of the bus body. The rail extension shall be joined to the continuous side rail by one of the following: (1) butt welding; (2) jogged lapped by not less than one inch (1") and riveted, or; (3) butted with a sleeve riveted over the joint. When joining is by lapping or fastening with a sleeve, the joint must be made at the rearmost body side post or preferably, the second post from the rear.

2.10.3.3. Window Level: The window level rub rail shall be installed the full outside length of the body on the right side from the service door

to the rear corner radius and on the left side from the point of curvature near the outside cowl to the rear corner radius. The splice, shall be located at the body post behind the rear wheel house, by lapping the full width of the supporting part of the post.

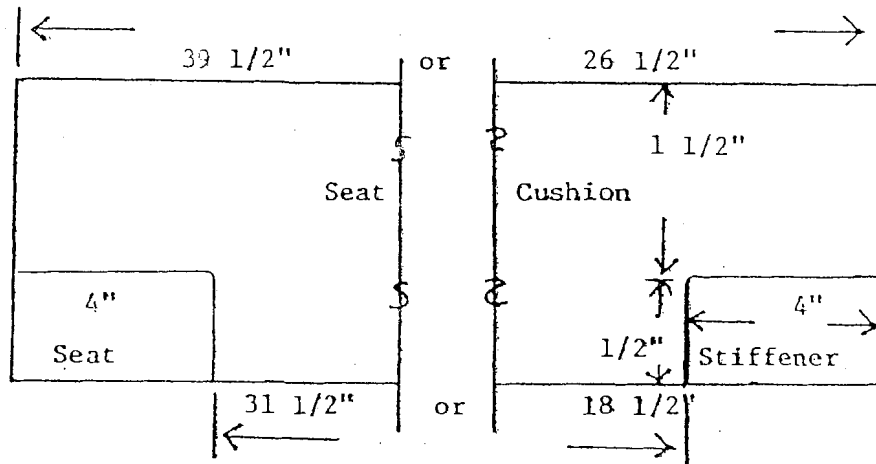
- 2.10.4. Location: One (1) rub rail shall be installed at the skirt level, one (1) at or near the floor, one (1) at or near the seat level, and one (1) near the window line. One (1) additional rub rail may be furnished in lieu of one longitudinal frame member [See Paragraph E.2.4.3.].
- 2.10.5. Sealing: The top joint of the rub rail shall be sealed with a caulking compound or adhesive as specified in Paragraph E.2.1.5.
- 2.11. SEAT BARRIERS: Seat barriers shall be furnished and installed in accordance with FMVSS No. 222. The front barriers shall not infringe upon the area required for safety and operating equipment.
 - 2.11.1. Handrail: A grab handle or handrail of sufficient length to assist entering and exiting passengers shall be installed on the forward side of the right barrier. The outside surface of this handle shall be stainless steel, polished aluminum, or chrome-plated steel. [See Paragraph C.2.14.4.].
 - 2.11.2. Knee Space: Knee space between these barriers and the front of each front passenger seat shall be at least twenty-four inches (24") for 24-passenger bus, at least twenty-four-and-three-fourths inches (24-3/4") for the 71S- and 83-passenger buses, and at least twenty-five inches (25") for all other 35-through 77-passenger buses when measured from the modesty panel to the front of the seat back at the center of the seat approximately four inches (4") above the seat cushion.
 - 2.11.3. Upholstery: Barriers shall be covered with upholstery meeting the requirements of Paragraph C.2.12.3.6.
- 2.12. SEATING REQUIREMENTS, DRIVER, HIGHBACK SUSPENSION:
 - 2.12.1. Design: The base of the driver's seat shall be of the adjustable pedestal type or the platform type having an adjustment range of approximately four inches (4") "Fore and Aft," and a separate minimum one inch (1") vertical adjustment. The back of the driver's seat shall be heavily padded and form-fitted. Driver's seat supplied by the body company shall be a high back suspension seat with a minimum seat back adjustment of fifteen degrees (15°), not requiring the use of tools, and with a head restraint to accommodate a 95th percentile adult male, as defined in FMVSS No. 208. The driver's seat shall be secured with nuts, bolts, and washers or flanged-headed nuts.
 - 2.12.2. Driver's Seat Access: There shall be unrestricted access to the driver's seated position from either the aisle or the right service door without the operator having to climb over the engine cover or any other object. The minimum space between the driver's seat (in the rearmost position) and the engine cover or other object (except seat belt anchorage) at the floor and at the seat level shall be not less than six inches (6").

- 2.12.3. **Installation:** The pedestal or platform shall be mounted with bolts, flat washers, lock washers, and nuts except where it is impossible to use bolts and nuts at certain floor points due to main cross members or floor sill interference. Thread-forming or cutting bolts and lock washers may be used at these points.
- 2.12.4. **Seat Belts and Seat Belt Assembly:** A three- point (3-point), "Type II" seat belt assembly conforming to FMVSS No. 209 shall be provided for the driver. The belt assembly shall be equipped with at least one reel-type emergency locking retractor (ELR) for the continuous belt assembly. The location of the seat belt anchorage shall conform to SAE Standard J383 with the driver's seat adjusted to its rearmost position. The anchored ends of the belt assembly shall be fitted with a minimum eight inch (8") semi-rigid plastic boot which will prevent that portion of the belt between the buckle and the retractor reel from contacting the floor and to keep the belt from hitting the feet of the passengers in the front seat directly behind the driver. The seat belt assembly shall be anchored in such a manner or guided at the seat frame so as to prevent the driver from sliding sideways from under the belt.
- 2.13. **SEATING REQUIREMENTS, PASSENGER:** The bus passenger seats shall meet or exceed the knee spacing and crash protection requirements of FMVSS No. 222 and shall conform to the following:
- 2.13.1. **Seat Back Heights:** When so specified in the Invitation for Bid [See Option No. 21²²], seat back heights shall be increased four inches (4") over the seat back heights required by FMVSS No. 222.
- 2.13.2. **Seat Belts, Passenger, Optional:** [See Paragraph E.3.13.].
- 2.13.3. **Seat Cushions:** All twenty-six inch (26") and all thirty-nine inch (39") seat cushions shall be designed to adequately support, respectively, two or three (2 or 3) passengers of one-hundred-twenty pounds (120 lbs.) each. All seat cushion materials shall meet or exceed the requirements of FMVSS No. 302 and/or California Technical Bulletin 117. The seat cushion shall be either of one-piece (1-piece) construction or may be constructed of more than one-piece (1-piece) at the manufacturer's option. The seat cushion unit shall consist of a base, a one- or two-piece (1- or 2-piece) polyurethane foam cushion, and uphoistery, meeting the following requirements:
- 2.13.3.1. **Base:** The base shall be nominal one-half inch (1/2") thick, interior grade, C-D plywood with exterior grade glue, identification index 32/16, manufactured in conformance with U.S. Product Standard PS 1-83 and identified as to veneer grade and glue bond type by the trademarks of an approved testing agency. Plywood with blue stain in sapwood is not acceptable.
- Alternatively, the base may be made of "Donnite" material, manufactured by the Donnite Corporation, Flora & Harrison, Plymouth, Indiana 45563, of equal or better strength and thickness.

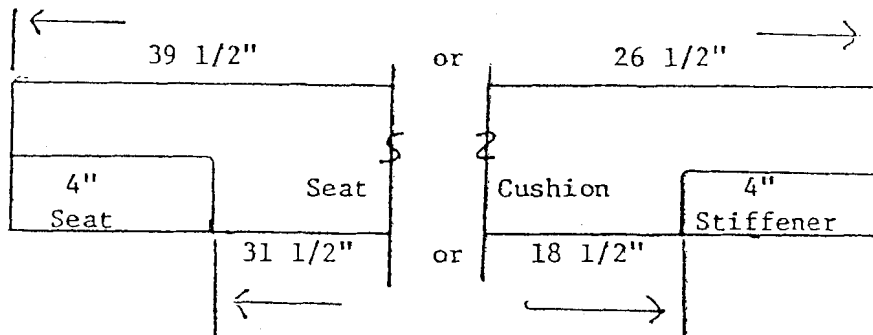
2.13.3.2. Foam Cushion Assembly, One-Piece Polyurethane Foam:

- (i) Construction:** The seat cushion dimensions shall be in accordance with the nominal dimensional requirements as shown in Figure No. Two (2).
- (ii) Design:** The one-piece (1-piece) foam cushion shall be solid polyurethane foam conforming to the physical requirements in Table No. Ten (10) (rebonded or molded polyurethane foams are not acceptable for seat cushion).

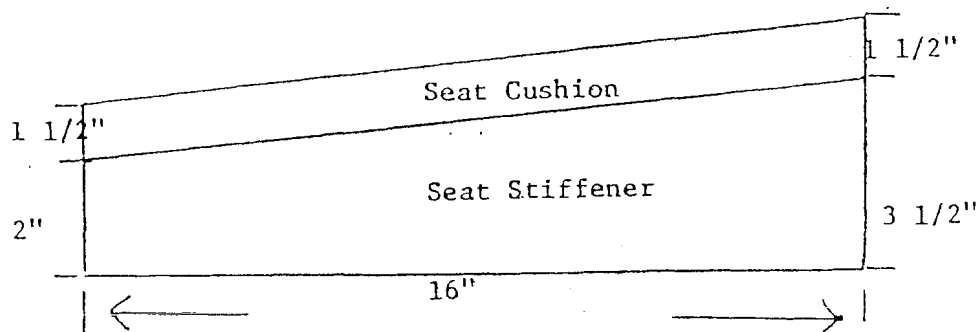
FIGURE 2
SEAT CUSHION ASSEMBLY



FRONT VIEW



REAR VIEW



SIDE VIEW

TABLE NO. TEN (10)
ONE-PIECE CUSHION
PHYSICAL PROPERTIES
(ASTM D 3574)

Item	One-Piece Seat Cushion
Density, lbs/cubic foot, Min.	1.8
Load Deflection, 4" thick @ 25% Indentation, Min.	90
Indentation Load, ratio, 65%/25%, Min.	2
Compression Set, 50% Deflection (22 hrs @ 158° F), Max.	2.0
Tensile Strength, lbs/square inch, Min.	10
Tensile Elongation, %, Min.	150
Tear Resistance, labs/inch, Min.	1.5

2.13.3.3. Foam Cushion Assembly, Two-piece Polyurethane:

- (i) **Construction:** The seat cushion assembly shall be fabricated in accordance with the nominal dimensional requirements as shown in Figure No. Two (2). In the two-piece (2-piece) assembly, the top one-and-one-half inches (1-1/2") of the cushion shall be of one (1) continuous foam piece. All parts of the seat cushion and the seat stiffeners shall be securely cemented or otherwise bonded together to form the seat cushion assembly shown in Figure No. Two (2).
- (ii) **Design:** The two-piece (2-piece) foam cushion assembly shall be constructed of unfilled polyurethane foam conforming to the physical requirements in Table No. Eleven (11) (rebonded polyurethane foams are not acceptable for seat cushion or seat stiffeners):

TABLE NO. ELEVEN (11)
TWO-PIECE CUSHION ASSEMBLY
PHYSICAL PROPERTIES
(ASTM D 3574)

Item	Seat Cushion	Seat Stiffeners
Density, lbs/cubic foot, Min.	1.8	2.4
Load Deflection, 4" thick @ 25% Indentation, Min.	52 ± 5	80
Indentation Load, ratio, 65%/25%, Min.	2	3
Compression Set, 50% Deflection (22 hrs @ 158° F), Max.	10	20
Tensile Strength, lbs/square inch, Min.	10	12
Tensile Elongation, %, Min.	150	75
Tear Resistance, labs/inch, Min.	2	2

2.13.4. Seat Frames:

2.13.4.1. **Design and Material:** The seat frames shall be constructed of steel of the type, size, and gauge necessary to meet the seat load deflection requirements of FMVSS No. 222. Flip seats meeting the requirements of FMVSS No. 217 may be utilized at a location to accommodate side emergency exits as required by FMVSS No. 217. Seat frames legs shall be two, four, or six (2, 4, or 6) pedestal type. The seat backs shall slope backward to provide a comfortable seating angle. Seat backs that are set in a vertical plane or tilt forward are not acceptable.

2.13.4.2. **Painting Requirements:** The entire seat frame, except that section of the back frame which is padded and upholstered, shall be thoroughly cleaned, primed, and painted. The paint shall have adhesive qualities which will not permit the removal of the paint by means of the thumbnail-scratch method without first chipping a starting place [See also Paragraph E.1.10.].

2.13.5. Seat Installation:

2.13.5.1. **Aisle Width:** The minimum aisle width between rows of seats shall be twelve inches (12") except a thirty inch (30") aisle is required if regular seating is provided between the rear emergency door and any wheelchair positions on wheelchair-equipped buses [See Paragraph G.1.7.3.].

2.13.5.2. **Attachment:** Each leg shall be attached to the floor with at least two (2) bolts, flat washers, lock washers, and nuts, or approved equal. Where it is impossible to use bolts and nuts at certain floor points due to main cross members or floor sill interference, thread-forming or cutting bolts and lock washers may be used.

2.13.5.3. **Knee Spacing:** Allowing for manufacturing tolerances, Texas requires the maximum allowable knee space on buses consistent with the overall standard body lengths [See Paragraph A.2.13. and Option No. 16]. These minimums are generally not less than the following [See Table No. Eight (8)]:

(i) Twenty-four inches (24") for the 24-passenger bus

(ii) Twenty-four-and-three-fourths inches (24 3/4") for the short wheelbase 71- and the 83-passenger buses.

(iii) Twenty-five inches (25") for all other 35- through 77-passenger buses.

2.13.5.4. **Track Seating:** Seats may be track mounted in conformance with FMVSS No. 222. If track seating is installed, the manufacturer shall supply minimum and maximum seating spacing dimensions applicable to the bus, which comply with FMVSS No. 222. This information shall be on a label permanently affixed to the bus.

2.13.6. **Upholstery:** The seat cushion and back units shall be covered on top and four (4) sides with a vinyl resin-coated upholstering material as follows:

- 2.13.6.1. **Material:** These materials shall be fire-resistant and shall meet or exceed the Boston Fire Block Test in the National School Bus Standards. They shall be artificial leather.
- 2.13.6.2. **Thread:** The upholstery material shall be securely sewn with a thread meeting the requirements of Federal Specification V-T-295d. The thread in the needle and the thread in the looper (bobbin) of double thread machines shall be size F, Type II (Twisted Bonded Multiple Cord), and size E, Type I (Twisted Soft Multiple Cord), respectively. The thread used in the needle and through the looper shall be Size F (Monofilament), Type III, for single thread machines.
- 2.13.6.3. **Welting:** There shall be welting on exposed seams of the seat back and cushion.

2.14. SERVICE ENTRYWAY:

- 2.14.1. **Design of Steps:** The entrance door steps shall be designed so that the first step shall be not less than ten inches (10") and not more than fourteen inches (14") for "Type A", "Type B", and "Type C" buses and a range between eleven inches (11") and not more than sixteen inches (16") for "Type D" buses, from the ground when the bus is unloaded. Service door entrance may be equipped with two- or three-step (2- or 3-step) entrance. Risers in each case shall not exceed a height of ten inches (10"). When plywood is used on a steel floor or step, the riser height may be increased by the thickness of the plywood. [See Paragraph E.2.6.3.]. The stepwell shall not protrude beyond the side body line and shall be fully enclosed to prevent accumulation of ice, snow, and dust. A suitable device (or devices) shall be designed and installed to prevent injury or fatality of passengers from being dragged. At least one (1) such device shall assist passengers during entry or egress, and be designed to eliminate entanglement.
- 2.14.2. **Entryway Access:** There shall be a minimum of twelve inches (12") of unrestricted access from the service door to the center aisle.
- 2.14.3. **Floor Material:** All steps and the floor line platform area shall be covered with three-sixteenths inches (3/16") rubber metal-backed treads with at least one-and-one-half inch (1-1/2") white nosing as an integral piece without any joint. A three inch (3") white rubber step edge with metal back may be substituted in the floor line platform area. Step tread minimum overall thickness shall be three-sixteenths inch (3/16") ribbed design similar to the ribbed design of the aisle rubber. Metal back of tread, minimum twenty-four (24) gauge cold rolled steel, shall be permanently bonded to ribbed rubber. Grooved design shall be such that said grooves run at ninety degree (90°) angle to long dimension of step tread. The rubber portion of the step trends shall have the following characteristics:
 - 2.14.3.1. Show a Durometer or equivalent hardness of eighty-five to ninety-five (85 to 95).
 - 2.14.3.2. Special compounding for good abrasion resistance and high coefficient of friction.

- 2.14.3.3. Sufficient flexibility so that it can be bent around a one-half inch (1/2") mandrel both at one-hundred-thirty degrees (130°F) and twenty degrees (20°F) without breaking, cracking, or crazing.
- 2.14.4. Handrails: A grab handle not less than twenty inches (20") in length shall be provided and placed in an unobstructed location inside the doorway. The outside surface of this handle shall be stainless steel, polished aluminum, or chrome-plated steel [See Paragraph C.2.11.1.]. The design shall provide a smooth installation which would eliminate the possibility of clothing or other articles becoming caught upon ingress or egress from the vehicle.
- 2.15. SERVICE or ENTRANCE DOORS: The service door shall be of the type, grade, and thickness of steel specified in Table No. Nine (9) or approved equal:
- 2.15.1. Attachment: The hinges for the service or entrance doors shall be attached with rivets or bolts, nuts, and lock washers. Metal screws or self-tapping bolts are not acceptable. Metal screws may be used for alignment of doors while installing rivets. Self-tapping bolts may be used for alignment if the bolts heads are tack-welded to the hinges [See Paragraph E.2.1.9.1.].
- 2.15.2. Design: The service doors may be the two-piece (2-piece) type (i.e., open in the middle) or the folding (or jackknife) type. These doors shall have a minimum horizontal opening of approximately twenty-four inches (24") and a minimum vertical opening of about sixty-eight inches (68"). The service door shall have upper and lower glass panels [See Paragraph E.2.15.3.] to permit the driver to see entering passengers as well as the passenger landing area. These glass panels shall be set in rubber. Vertical closing edge or edges of these doors shall be equipped with rubber or rubberized material to protect passengers' fingers. There shall be no door on the left of the driver. This door shall have a positive latching mechanism to eliminate the possibility of an inadvertent door opening during a frontal collision or roll-over.
- 2.15.3. Glass Panels: Service or entrance doors shall have glass panels of approved safety glass [See Paragraph E.2.19.2.]. Bottom of each lower glass panel shall be not more than ten inches (10") from the top surface of the bottom step. The top of each upper glass panel shall be not more than six inches (6") from the top of the door.
- 2.15.4. Header Board: The head impact area on the inside top of the service or entrance door shall be protected by an energy-absorbing, padded header board, three inches (3") high and one inch (1") thick, extending the full width of the opening, to prevent injury when accidentally impacted.
- 2.15.5. Location and Operation:
- 2.15.5.1. Conventional Bus Doors: The entrance doors for conventional buses shall be operated manually, or when so specified in the Invitation for Bid [See Option No. 10], actuated electrically, or by air pressure or vacuum and shall allow manual opening in case of an emergency. The door control shall be the hand lever type, driver-operated, and shall be designed to afford easy release

and to prevent accidental opening. The two-piece (2-piece) or folding type service door shall be located on the right side near the front of the bus in direct view of the driver.

2.15.5.2. **Forward Control Bus Doors:** The doors on forward control buses shall be operated either manually or actuated electrically or by air pressure or vacuum, and shall allow manual opening in case of an emergency. If manually operated, the door control shall be the hand lever type, driver-operated, and shall be designed to afford easy release and to prevent accidental opening. The service door shall be located on the right side near the front of the bus. At least two-thirds (2/3) of its opening width shall be ahead of the point opposite the back of the driver's seat. When so specified in the Invitation for Bid [See Option 10], doors shall be operated by means of electric, air pressure or vacuum, at the manufacturer's option.

2.15.5.3. **Semi-forward Control Bus Doors²³:** On semi-forward control buses, the entrance doors shall be operated from controls at or near the bus driver's seated position. The doors shall be operated manually, or actuated electrically or by air pressure or vacuum and shall allow manual opening in case of an emergency. To prevent accidental opening while the bus is in motion, the system shall require at least a one-hundred-twenty-five pound (125 lb.) force applied to its center in order to manually open the door. When so specified in the Invitation for Bid [See Option No. 10], doors shall be operated by means of electric, air pressure or vacuum, at the manufacturer's option.

2.16. **SKIRT REINFORCEMENTS:** Side skirts shall be gusseted or braced on not more than thirty inch (30") centers and wherever required for rigidity and to prevent vibration. If the body sections are authorized to be longer than thirty inches (30"), no more than three sections of skirt reinforcement shall be on centers up to a maximum of thirty-six inches (36"), or no more than one (1) section shall be on centers up to a maximum of thirty-eight-and-three-fourth inches (38-3/4").

2.17. **VENTILATION:** The bus body shall be equipped with a suitable, controlled ventilation system of sufficient capacity to maintain a satisfactory ratio of outside to inside air under normal operating conditions without opening windows except in warm weather. A static-type, non-closeable exhaust ventilator shall be installed in the low-pressure area of roof.

2.18. **WHEELHOUSING:** The wheelhousing shall be of the type, grade, and thickness of steel specified in Table No. Nine (9) or approved equal. The wheelhousing shall be constructed of a maximum of three pieces and of arched design and shall be attached in such a manner so as to form a waterproof and dustproof seam. The size of the wheelhousing shall be such that tire chains will have proper clearance. The edges inside the bus shall be rounded to prevent injury to the passengers.

²³ Powered Service Doors shall be clearly and concisely marked with operating instructions in case of a power failure.

The wheelhousing shall be such that when attached to the body, the strength of the resulting structure shall be equivalent to or greater than that section of body that has been removed to receive the wheelhousing. [See Paragraph E.1.11.].

2.19. WINDSHIELD AND WINDOWS:

2.19.1. General Design:

2.19.1.1. Emergency Door Windows: The emergency door shall be furnished with an upper and lower glass panels [See Paragraph E.2.5.1.4.] permanently closed, and set in rubber or sealed against rubber.

2.19.1.2. Rear Window: Rear windows (not emergency door windows)²⁴ shall be installed on each side of the rear emergency door. Each rear window glass shall have a minimum area of one-hundred-forty square inches (140" sq.) and shall be set solid in a waterproof manner. These windows shall be installed securely to prevent removal by hand.

2.19.1.3. Side Window, Driver's: The driver's window shall be a two-piece (2-piece) window of either of the following types:

- (i) Two-piece (2-piece) sliding-sash type: This type will be acceptable only when the bus is equipped with an adequate air scoop to draw outside air into the driver's compartment. When the driver's ventilation is drawn through the heater system, this air shall be shielded from the heat sources and a hot water cut-off valve shall be provided in the driver's compartment.
- (ii) Other Type: This type of window shall have the front part opening either in or out and rear part lowering and raising by use of a regulating handle.

2.19.1.4. Side Windows, Passenger, Standard²⁵: There shall be either a standard or a push-out type window for each passenger seat except where it is not possible because of the installation of side emergency exits [See Paragraphs E.2.5.2. and E.2.19.1.5.]. Standard side windows shall open from the top only and shall operate freely. All side windows except the driver's and the service door window, shall be the split sash type with positive latch. Side windows that can be latched in an uneven position are not acceptable.

²⁴ A rear "push-out" window, meeting the requirements of FMVSS No. 217, shall be provided on the rearward window on rear engine buses.

²⁵ Seventy-seven-passenger (77-) and 83-passenger rear-engine buses may have one less set of passenger windows than rows of seats.

They shall be furnished with a latching mechanism which will allow each window to be latched in a position not more than six inches (6") from the top. The passenger side windows shall provide an unobstructed opening twenty-two inches (22") wide and between nine and ten inches (9" and 10") high. These windows shall include a metal stop pin, bar, or similar device to ensure that the windows can be lowered only within the mandatory limit. These latches and related mechanism (excluding the thumb regulator) shall be manufactured of metal. When in a closed position, all windows shall be weather-tight.

2.19.1.5. Side Windows, Passenger, Push-out Type²⁶: At the manufacturer's option, 24-passenger buses may be provided with one push-out side window in lieu of an emergency exit on each side and 35- through 83-passenger buses may be provided with two push-out side windows in lieu of two (2) emergency exits on each side [See Paragraphs E.2.5.1. and E.2.5.2. and Option No. 39]. These windows shall be hinged at the top and shall be positioned for ease of egress. These push-out windows shall be the body manufacturer's standard push-out passenger windows meeting or exceeding Federal Standards.

2.19.1.6. Windshield: The maximum width of the windshield center post shall not exceed two-and-one-half inches (2-1/2"). There shall be at least two inches (2") of clearance between the steering wheel and the windshield, cowl, instrument panel, or any other surface.

2.19.2. Glazing: Glass shall be installed in rubber channel gasket material or approved equivalent material. The glass shall be mounted so that the permanent identification mark is visible from either inside or outside of the bus. All safety glazing materials shall be approved by the Department of Public Safety. All exposed edges of glass shall be banded. The glass shall be as follows:

2.19.2.1. Rear and Other Windows: The glass in all other window including the driver's side windows, emergency door windows, and rear (side) windows shall be a minimum of one-eighth inch (1/8") safety plate glass and shall be AS-2 grade or better as specified in ANSI Safety Code Z26.1.

2.19.2.2. Safety Plate Glass: When so specified in the Invitation for Bid [See Option No. 16], all windows shall have AS-2 grade or better grade laminated safety plate glass.

²⁶ Push-out windows shall be equipped with an electrical switch connected to an audible signal automatically operated and located in the driver's compartment which shall indicate when the window is pushed out in excess of one-half inch (1/2"). The switch shall be enclosed to prevent tampering. Wires leading from the switch shall be concealed in the walls. No cut-off switch shall be installed in the circuit.

2.19.2.3. Side Windows, Passenger: The glass in all passenger side windows, including push-out type emergency exit windows, shall be a minimum of one-eighth inch (1/8") safety plate glass and shall be AS-2 grade or better, as specified in ANSI Safety Code Z26.1.

2.19.2.4. Windshield: The windshield shall be minimum seven-thirty-seconds inch (7/32") thick safety plate glass and shall be heat-absorbent, laminated AS-1 safety glass meeting ANSI Standard Z26.1, as amended.

2.19.3. Tinting²⁷:

2.19.3.1. Side Windows, Passenger: When so specified in the Invitation for Bid [See Option No. 13], passenger side windows and push-out type emergency windows only shall be tinted to minimum light transmittance of thirty percent (30%), and a maximum light transmittance of forty percent (40%) using AS-3 grade glass. This is defined as "dark tinting" and is not permitted on the windshield or any window used for driving purposes.

2.19.3.2. Windshield: The windshield shall have a horizontal gradient band (tinted) starting slightly above the driver's line of vision with approximately ninety percent (90%) light transmittance and gradually decreasing to a minimum of seventy percent (70%) light transmittance at the top of the windshield, or the entire windshield shall be tinted to meet the requirements of FMVSS No. 205.

E.3. ACCESSORIES, REQUIRED AND OPTIONAL:

- 3.1. ACCESS PORT: An access port with cover plate shall be installed above the fuel sending unit. It shall be of sufficient size to service fuel sending units and fuel pumps installed in the fuel tank. An access port is not required on the 24-passenger bus or on buses with front-mounted wheelchair lifts [See Paragraph G.1.7.3.].
- 3.2. BACKUP ALARM: An automatic, audible backup warning alarm meeting the requirements of Type C, 97 decibels, SAE J994b (except for 12-volt system) shall be installed behind the rear axle.
- 3.3. DEFROSTERS: Defrosting equipment shall keep the windshield, the window to the left of the driver, and the glass in the service door clear of fog, frost, and snow, using heat from the heater and circulation from fans. All defrosting equipment shall meet the requirements of FMVSS No. 103. Any circulating fan used in defogging and installed on the curb side of the bus front shall be mounted on the windshield header so as to protect the fingers, hair, and clothing of entering and departing passengers.
- 3.4. EMERGENCY EQUIPMENT: Twenty-four-passenger (24-) through 83-passenger school buses shall be equipped with the following emergency equipment:

²⁷ All safety glazing materials shall be approved by the Department of Public Safety.

- 3.4.1. **Body Fluid Cleanup Kit:** Each bus shall be provided with a removable and moisture-proof body fluid cleanup kit. It shall be properly mounted and identified as a Body Fluid Cleanup Kit. This kit shall contain as a minimum, the following items mounted in a removable metal or hard plastic kit:

- 1 -- 15 oz. chlorine-type absorbent deodorant material (or equal)
- 1 -- 12 oz. germicidal spray disinfectant
- 2 -- pair disposable latex gloves
- 4 -- 18" x 18" absorbent towels
- 1 -- plastic pick-up spatula
- 1 -- plastic hand broom
- 1 -- plastic dust pan
- 2 -- 14" x 19" disposal bags and ties (waterproof)
- 2 -- adhesive "BIO-HAZARD" labels
- 1 -- 12 oz. deodorant spray
- 4 -- individually wrapped, cold sterilization wipes in foil-lined pouches
- 2 -- paper respiratory masks
- 1 -- metal or hard plastic container identified as "BIO-HAZARD" with black symbol and lettering on orange mountable case

- 3.4.2. **Fire Extinguishers:** School buses shall be equipped with a fire extinguisher, as listed below:

3.4.2.1. **Standard Fire Extinguishers:** Each bus shall be equipped with at least one refillable stored pressure Multipurpose Dry Chemical type (or approved equal) fire extinguisher of minimum five pound (5 lb.) capacity, mounted in an extinguisher manufacturer's automotive type bracket, and located in the driver's compartment in full view of and readily accessible to the driver. The fire extinguisher shall bear the Underwriters Laboratory Listing Mark of not less than 2A 20-B:C rating. Extinguishers shall be furnished with a hose, pressure gauge, and metal head.

3.4.3 **First Aid Kit:** Buses shall have a removable metal first aid kit container mounted in an accessible place within the driver's compartment. The compartment shall be marked to indicate the location of the kit. Number of units and contents for each kit shall be as follows:

- 2 -- 1 in x 2 1/2 yds. adhesive tape rolls
- 24 -- sterile gauze pads 3 in x 3 in
- 100 -- 3/4 in x 3 in adhesive bandages
- 8 -- 2 in bandage compress
- 10 -- 3 in bandage compress
- 2 -- 2 in x 6 yds. sterile gauze roller bandages
- 2 -- nonsterile triangular bandage approx. 40 in x 54 in, 2 safety pins
- 3 -- sterile gauze pads 36 in x 36 in
- 3 -- sterile eye pads
- 1 -- rounded end scissors
- 1 -- pair latex gloves
- 1 -- mouth-to-mouth airway

3.5. HEATERS AND RELATED COMPONENTS:

- 3.5.1. Bleeder Valves:** Any heater (s) installed by the body manufacturer shall have accessible air bleeder valves installed in the return lines.
- 3.5.2. Heater, Standard:** Each bus shall be equipped with a heavy-duty combination fresh air and recirculating air heater (s). The heater (s) shall be a hot water type. The Btu/hr. rating shall be in accordance with Standard SBMI No. 001. These standard heaters shall have minimum free flow output ratings as follows:
 - 3.5.2.1. Twenty-four-passenger (24-) and 35-passenger Buses:** 45,000 Btu/hr.
 - 3.5.2.2. Forty-seven-passenger (47-) and Larger Buses:** 80,000 Btu/hr.
- 3.5.3. Heater, Auxiliary²⁸:** When so specified in the Invitation for Bid [See Option No. 14], a second recirculating heater shall be furnished. It shall be mounted near the rear of the bus and in such a manner so as not to interfere with the securing of seats to the floor, as specified in Paragraph E.2.13.5.2. The Btu/hr. rating shall be in accordance with SBMI Standard No. 001. Heated conduits inside the buses shall be insulated or shielded to prevent injury to the driver or passengers. The heater shall have a minimum output rating (recirculating air rating - not fresh air intake rating) as follows:
 - 3.5.3.1. Twenty-four-passenger (24-) and 35-passenger Buses:** 40,000 Btu/hr.
 - 3.5.3.2. Forty-seven-passenger (47-) and Larger Buses:** 60,000 Btu/hr.
- 3.5.4. Installation:** The standard heater shall be installed near the front of the bus body with the controls readily accessible to the driver; the auxiliary heater shall be installed near the rear of the bus. Heater hose connections shall be installed above the floor of the bus body and through the firewall to the engine compartment. Heated conduits inside the bus shall be insulated or shielded to prevent injury to the driver or passengers. The length of the hot water hoses shall be as short as possible consistent with good installation practices; however, the hoses shall not be installed in such a manner so as to interfere with normal engine maintenance operations, such as the removal of the engine air cleaner. The hoses shall not dangle or rub against the chassis or sharp edges and shall not interfere with or restrict the operation of any motor function, such as the spark advance of an automatic distributor. Heater hose shall conform to SAE 20R3, Class C, as defined in SAE Standard J20e. Each heater installation shall include two (2) all brass shutoff valves or cocks. Installation of the shutoff valves or cocks shall be as close as possible to the water pump and motor block outlets. The hoses shall be adequately supported to guard against excessive wear due to vibration. These cutoff valves or cocks shall be installed as follows:

²⁸

Auxiliary heaters on diesel-powered buses shall be furnished with a water circulating pump.

- 3.5.4.1. One (1) between the heater hose connection and the water pump outlet, and,
 - 3.5.4.2. One (1) between the heater hose connection and the engine block.
- 3.5.5. Service Accessibility: Heater motors, cores, and fans shall be readily accessible for service. Access panels (removable without removing driver's seat) shall be provided as required for maintenance.
- 3.6. MUD FLAPS: When so specified in the Invitation for Bid [See Option No. 18], mud flaps of durable, heavy-duty rubberized construction, complete with brackets, shall be installed behind each set of rear wheels. The mud flaps shall be comparable in size to the width of rear wheelhousing and shall reach within approximately eight inches (8") of the ground when the bus is empty. They shall be mounted at a distance from the wheels that will permit free access to spring hangers for lubrication, and to prevent their being pulled off when the bus is moving in reverse. There shall be no advertisement on the mud flaps.
- 3.7. MIRRORS, EXTERIOR: Exterior mirrors shall conform to the requirements of FMVSS No. 111. Each school bus shall be provided with exterior mirrors and brackets as described below:
 - 3.7.1. Mirror System, Crossover: The crossview mirror system shall provide the driver with indirect vision of an area at ground level from the front bumper forward and the entire width of the bus to a point where the driver can see by direct vision. The crossview system shall also provide the driver with indirect vision of the area at ground level around the left and right front corners of the bus to include the tires and service entrance on all types of buses to a point where it overlaps with the rear vision mirror system.
 - 3.7.2. Mounting and Mounting Brackets, Standard: Mirror mounting and backing shall be of steel or a high-impact plastic such as a polycarbonate/polyethylene terephthalate blend, or approved equal. Mounting of all exterior mirrors to the bus body shall be by means of bolts, nuts, and lock washers, where possible; otherwise No. 10 hexagon head sheet metal bolts with star lock washers or No. 10 hexagon head sheet metal screws with serrated surface shall be used. This system of mirrors shall be easily adjustable but be rigidly braced so as to reduce vibration.
 - 3.7.3. Mirror Backing and Mounting, Stainless Steel, Optional: When so specified in the Invitation for Bid, exterior rearview mirror backs and mounting brackets shall meet or exceed all of the applicable requirements of Paragraph E.3.8.2 above except the mirror backing and mounting shall be made of stainless steel.
 - 3.7.4. Painting: Brackets and assemblies of all exterior rearview and crossover mirrors shall be cleaned and prepared for painting in accordance with Federal Specification TT-C-490B, Type I or Type II. The metal backs of stainless steel, aluminum, and chrome-plated exterior and crossover mirrors, if painted, and the backs of all other metal-backed exterior and crossover mirrors shall be finished in black (Color No. 37038 of Federal Standard No. 595a).

- 3.7.5. **Rearview Mirror System:** The rearview mirror system shall be capable of providing a view along the left and right sides of the bus which will provide the driver with a view of the rear tires at ground level, a minimum of two-hundred feet (200') to the rear of the bus and at least twelve feet (12') perpendicular to the side of the bus at a distance of thirty-two feet (32') back from the front bumper.
- 3.8. **MIRRORS, INTERIOR:** A clear-vision, interior rearview mirror conforming to FMVSS No. 111, with at least six inches by thirty inches (6" x 30") size vision area, affording a good view of the road to the rear as well as of the passengers, shall be furnished and installed. The mirror shall be made of safety glass and have rounded corners and protected edges.
- 3.9. **REFLECTIVE MATERIAL²⁹:** When so specified in the Invitation for Bid [See Option No. 19], buses shall be equipped with reflective material meeting the following requirements. The material shall be automotive engineering grade or better, shall meet the initial reflectance values in DOT FHWA FP-85 and shall retain at least fifty percent (50%) of those values for a minimum of six (6) years. Reflective materials and markings shall be installed in the following locations:
- 3.9.1. Front and/or rear bumper may be marked diagonally forty-five degrees (45°) down to centerline of pavement with two inch (2") plus or minus one-fourth inch ($\pm 1/4$ ") wide strips of non-contrasting reflective material.
- 3.9.2. Rear of bus body shall be marked with strips of reflective National School Bus Yellow (NSBY) material to outline the perimeter of the back of the bus using material which conforms with the requirements of FMVSS 571.131 Table One (1). The perimeter marking of rear emergency exits per FMVSS No. 217 and/or the use of reflective "school bus" signs per Paragraph 3.9.3 below partially accomplish the objective of this requirement. To complete the perimeter marking of the back of the bus, strips of at least one-and-three-fourths inch (1-3/4") reflective NSBY material shall be applied horizontally above the rear windows and above the rear bumper extending from the rear emergency exit perimeter marking outward to the left and right rear corners of the bus; and vertical strips shall be applied at the corners connecting these horizontal strips.
- 3.9.3. Side of bus body shall be marked with reflective National School Bus Yellow Material at least one-and-three-fourths inches (1-3/4") in width, extending the length of the bus body and located (vertically) between the floor line and the beltline.
- 3.10. **STROBE LIGHT, Flashing:** When so specified on Invitation for Bid [See Option No. 26], an optional white flashing strobe light meeting the following requirements shall be provided:
- 3.10.1. **Design:** The lamp shall have a single clear lens emitting light revolving three-hundred-sixty degrees (360°) around a vertical axis. The light source shall be minimum of fifty (50) candlepower and flash eighty to one-hundred-and-twenty (80-120) times per minute.

²⁹ Reflectivity of the stop signal arm is addressed under the Stop Signal Arm Section. If used, signs placed on the rear of the bus relating to school bus flashing signal lamps or railroad stop procedure may be reflective material as specified.

The base of the lamp shall be metal or approved equal and installed by a method which seals out dust and moisture. A manual switch is required for operation and a pilot light to indicate when the light is in operation shall be included. Wiring shall be installed inside the bus walls.

- 3.10.2. Mounting: The strobe light shall be permanently installed near the centerline on the school bus roof not more than one-third (1/3) of the body length forward from the rear edge of the bus roof. It shall not extend above the roof more than approximately six-and-one-half inches (6-1/2").
- 3.11. SEAT BELTS, PASSENGER: When so specified in the Invitation for Bid [See Option No. 22], seat belts conforming to FMVSS No.'s 209 and 210 shall be provided for each passenger position. The seat belts shall meet the following requirements:
- 3.11.1. Colors: The belt assemblies shall be alternately color coded with contrasting colors. All aisle seats on the same side of the bus shall have belts with the same color. Two (2) position seats shall use two (2) colors; three (3) position seats may use two or three (2 or 3) colors.
- 3.11.2. Design: Seat belts shall have a buckle end and an attaching end which are adjustable to fit passenger sizes as required by FMVSS No.s' 208 and 209 (except lights and buzzers are not required). Buckles shall be of the plastic-covered push button design. Long and short ends shall be mounted alternately with the short end on the aisle. If possible, the design shall prevent fastening the belts across the aisle.
- 3.12. STIRRUP STEPS: There shall be one stirrup step and a suitably located handle on each side of the bus body front for easy accessibility in cleaning the windshield and lamps. The stirrup step on forward-control buses shall be on or in the bumper. Stirrup steps are not required on the 24-passenger bus unless necessary to clean windshield and windows.
- 3.13. STOP ARM: A school bus stop arm meeting SAE J1133 and the following requirements shall be provided:
- 3.13.1. Design: The sign shall be octagon-shaped, constructed of zinc-coated steel or aluminum. It shall have a minimum one-half inch (1/2") wide white border and the word "STOP" in white letters at least six inches (6") high against a red background on both sides. The letters, border and background shall be of reflective materials meeting DOT FHWA FP-85. Double-faced red, alternately flashing lamps, or LED Stop Sign, flashing both sides, one (1) each at the top and bottom (visible from each side of the structure) shall be connected to, and flash with the required school bus red flashing signal lamp circuit when the arm is extended. The arm mechanism may be activated by air pressure, electricity, or by vacuum.
- 3.13.2. Mounting: The stop arm shall be installed on the left side of the school bus near the front cowl section.

- 3.14. **STUDENT SAFETY CROSSING ARM:** When so specified in the Invitation for Bid (See Option No. 25), each bus shall be equipped with a student safety crossing arm which shall meet or exceed SAE Standard J 1133. It shall be extended and retracted simultaneously with stop arm by means of the stop arm control. It shall be mounted to the right side of the front bumper by means of a four-point (4-point) mounting assembly. All components and connections shall be weatherproofed. The unit shall be easily removable for the purpose of towing of the bus. The unit shall be constructed of nonferrous material or treated as per the body sheet metal standard and shall contain no sharp edges or projections that could cause hazard or injury to students. The crossing arm shall extend seventy-two inches (72") from the front bumper and shall not open more than ninety degrees (90°) when in the "extended" position. The mechanism may be activated by air pressure, electricity, or be vacuum.
- 3.15. **SUN VISOR:** A two-post (2-post), adjustable sun visor with a minimum size of six inches by thirty inches (6" x 30") and a minimum thickness of one-eighth inch (1/8") and constructed of tinted Plexiglas shall be furnished on each bus. Means shall be provided for tension adjustment. It shall be installed above the interior windshield on the driver's side or it may be mounted to the inside rearview mirror at each end using lock type nuts. If this type of mounting is used, the mirror shall have an adjustable reinforcing bracket at each end to reduce any vibration distortion caused by the weight of the sun visor.
- 3.16. **TOOL COMPARTMENT:** When so specified in the Invitation for Bid [See Option No. 30], a metal container of adequate strength and capacity shall be provided for storage of tire chains, tow chains, and such tools as may be necessary for minor emergency repairs. This storage container shall be located either inside or outside the passenger compartment and shall be capable of being securely latched. However, if it is located inside the passenger compartment, it shall be provided with a separate cover, and shall be fastened to the floor in the right front or the right rear of the bus. A seat cushion shall not be used as this cover.
- 3.17. **WINDSHIELD WASHERS AND WIPERS:**
- 3.17.1. **Washers:** A vacuum-, electric-, or air-operated windshield washer shall be furnished and installed. The washer shall have a minimum reservoir capacity of one quart (1 qt.) of liquid and shall direct a stream of water into the path of travel of each windshield wiper blade each time the actuating button is operated.
- 3.17.2. **Wipers:** A windshield wiping system, two (2) speed or variable speed, with an intermittent feature, shall be provided.
- The wipers shall be operated by one (1) or more air or electric motors of sufficient power to operate wipers. If one (1) motor is used, the wipers shall work in tandem to give full sweep of windshield.

E.4. APPROVAL OF NEW BUS BODIES: Procedures for approving a new bus body for 24-through 83-passenger school buses shall be as follows in the order indicated:

- 4.1. **SUBMISSION OF REQUEST:** Submit a written request that the body be approved along with the following:

4.1.1 Letter: Letter stating that the body meets or exceeds each and every applicable requirement in Texas specification No. 070-SB-98.

4.1.2. Literature and drawings: See Paragraph A.6.5.

4.2. REVIEW OF REQUEST: The Commission will review the literature and drawings and advise the vendor or manufacturer by letter of the results of this review. A copy of this letter will be furnished to the School Bus Committee. If this review verifies that the bus body meets or exceeds the requirements of this specification, the vendor or manufacturer will be notified in writing. The commission reserves the right to require the school bus to be brought to Austin, Texas for inspection and evaluation by the Commission and the Texas School Bus Committee.

4.3. INSPECTION AND EVALUATION:

4.3.1. The bus body shall be inspected using the current School Bus Inspection Check List.

4.3.2. The bus body will be evaluated and if found suitable for the intended purpose, the Commission will issue a letter to the manufacturer listing the model as approved for the capacities requested³⁰. If found not suitable, the Commission will issue a letter to the vendor or manufacturer giving the reason (s) for disapproval.

³⁰

Once a bus body is approved for one passenger capacity, other capacities of this same body differing only in length and capacity need not be inspected and evaluated prior to approval. The vendor or manufacturer shall request by letter that these other body lengths/models be approved.