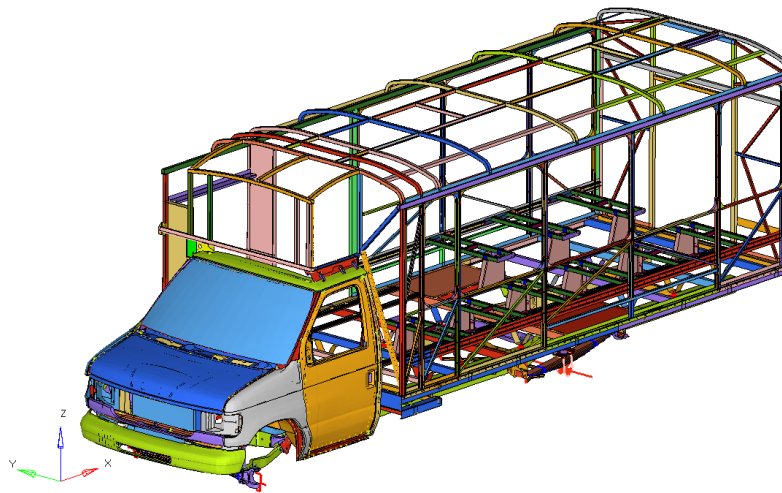




WORLD TRANS

REV GROUP



Bus Technical Specifications

T21

T23

E/G22

E/G24

E/G26

E/G28

Revision 2017-11-15



1. Scope

These specifications define requirements for medium-duty cutaway buses. Buses shall have a minimum expected life of seven (7) years or 200,000 miles, and are intended for the widest possible spectrum of passengers, including children, adults, the elderly and people with disabilities. Buses shall be certified for the seven year 200,000 mile durability through the Altoona test track per the FTA bus test regulations set forth in 49 CFR Part 665.

2. Legal Requirements

The Contractor shall comply with all applicable federal and state regulations. These shall include but not be limited to ADA, as well as state safety requirements. Buses shall meet all applicable FMVSS regulations in effect at the date of manufacture.

3. Manufacturer Certifications

The body manufacturer must be an ISO 9001:2008 certified company and have a “Fully Meets” rating in the Ford Quality Vehicle Manufacturer Program. Proof of compliance must be submitted with the bid.

4. Overall Vehicle Dimensions and Capacities

Model	T21	T23	E/G22	E/G24	E/G26	E28	E/G22N
Max Passengers (Fixed Seating)*	14+ Driver	17+ Driver	19+ Driver	21+ Driver	25+ Driver	29+ Driver	13+ Driver
Max Seating Rows	4	5	5	5	6	7	5
Interior Height at Center Aisle	80"	80"	80"	80"	80"	80"	80"
Interior Height 6" from Side Wall	75"	75"	75"	75"	75"	75"	75"
Interior Width	82"	82"	90"	90"	90"	90"	82"
Entrance Door Width	32"/40"	32"/40"	30"/40"	30"/40"	30"/40"	30"	30"/40"
Entrance Door Height	86"	86"	86"	86"	86"	86"	86"
Overall Height (Wheelwell Floor)	114"	114"	114"	114"	114"	114"	114"
Overall Height (Flat Floor)	N/A	N/A	119"	119"	119"	N/A	N/A
Overall Length with Bumpers	21'	23'4"	22' 2"(E) 22' 8"(G)	24'(E) 24' 6"(G)	26' 2"(E) 26' 8"(G)	27' 10"(E) N/A(G)	22' 2"(E) 22' 8"(G)
Overall Width with No Mirrors	88"	88"	96"	96"	96"	96"	88"
Wheelbase (Ford)	156"	156"	138"/158"	158"	176"/190"	212"	138"/158"
Wheelbase (GM)	N/A	N/A	139"/159"	159"	177"	N/A	139"/159"
GVWR (lbs) (Ford)	10,360	10,360	11,500 12,500 14,000 14,500	11,500 12,500 14,000 14,500	14,500	14,500	11,500 12,500 14,000 14,500
GVWR (lbs) (GM)	N/A	N/A	12,300 14,200	12,300 14,200	14,200	N/A	12,300 14,200

* Maximum passenger capacity subject to weight calculation of specific vehicle configuration.

5. Chassis

- a. Front Axle: 4,600 or 5,000 lb (Ford E-Series). 4,300 or 4,600 lb (GM G-Series). 4,130 lb (Ford T-Series). Appropriate for GVWR and weight distribution.
- b. Rear Axle: 7,800, 8,500 or 9,600 (Ford E-Series), 8,600 or 9,600 lb (GM G-Series). 7,275 lb (Ford T-Series). Appropriate for GVWR and weight distribution.
- c. Engine: 6.2L or 6.8L gasoline (Ford E-Series), 6.0L gasoline (GM G-Series), 3.7L gasoline or 3.2L diesel (Ford T-Series)
- d. Transmission: 6-speed automatic (Ford E-Series), 6-speed automatic (GM G-Series), 6-speed automatic (Ford T-Series)
- e. Brake system: Power, self-adjusting, four wheel disc with four wheel anti-lock
- f. Fuel Tank: 40gal or 55gal rear-mount (Ford E-Series), 37gal mid-ship mount or 57gal rear-mount (GM G-Series), 25gal mid-ship mount (Ford T-Series), appropriate for required fuel range and weight distribution. The vehicle fuel tank must be installed by the chassis manufacturer; fully compliant with California Air Resources Board (CARB) standards and must not be modified in any way.
- g. Exhaust: Exhaust system to be aluminized exhaust pipes and muffler properly installed with heat shield and baffles.
- h. Standard alternator output: 225A Ford E-Series, 220A Chevrolet G-Series, 230A Ford T-Series Gas, 210A Ford T-Series Diesel.
- i. Batteries: Standard is one OEM under hood with an option for additional frame mounted battery, or option for two new batteries mounted in battery box on both E-Series Ford and G-Series Chevy. T-Series standard is two OEM mounted under the Driver's seat.

6. Body Structure

The body shall be a steel cage construction. All structural members in the floor, side walls, rear wall, and roof shall be G40 galvanized steel material for corrosion resistance. A full FEA analysis of the body cage has been performed to show compliance to minimum requirements.

The body cage structure, at a minimum, to have been tested to the following:

1. All applicable FMVSS regulations

2. Buses shall be certified for the seven year 200,000 mile durability through the Altoona test track per the FTA bus test regulations set forth in 49 CFR Part 665 (up to 26' bus length)
3. FMVSS 220, School Bus Rollover Protection
4. FMVSS 214 Type, Side Impact Protection

Prior to installation on the chassis, the body cage structure shall be assembled using leveling and squaring fixtures to ensure consistency and a plumb, square and level structure. Specific body cage construction elements shall include:

- a. Floor: The floor frame shall be constructed of 11 gauge, G40 galvanized tubular crossmembers at least 2" wide X 2" high with a minimum strength of 50,000 psi. The tubular crossmembers shall be MIG welded to a G40 galvanized C-channel forming the perimeter of the floor structure. Crossmembers shall be placed at body mount isolator locations as provided by the chassis manufacturer. The floor frame shall be secured to the chassis frame in accordance with the chassis manufacturer's recommended practices.
- b. Side Walls: Side walls shall be constructed of 16 gauge G40 galvanized 45,000 psi steel modular sections. Each modular section shall include vertical C-channels along its forward and rearward boundary, a horizontal C-channel along its upper boundary, and a Z-shaped section at its lower boundary. Each modular section shall include a diagonal channel to form a strong truss. Modular wall sections shall be welded to adjacent fore and aft sections to form a structural I-beam at each window section. Modular wall sections shall be welded at their upper C-channel to a continuous 14 gauge, 1-1/2" x 2" tubular longitudinal member to form the top of the side wall. Modular wall sections shall be welded along their lower boundary to the C-section of the floor perimeter. A G40 galvanized seat track shall be spot welded to a continuous HSLA Grade 60 G40 galvanized roll formed stringer supporting the seat track on three sides, and the stringer shall be welded to the adjacent structural members of the wall cage.
- c. Roof: The roof consists of 1.5" x 1.5" 16 gauge G40 galvanized tubular steel roof bows installed on maximum 48" centers. The end of each roof bow is welded into a longitudinal 16 gauge G40 galvanized steel C-channel forming the perimeter of the roof. The continuous C-channels at the perimeter of the roof shall be MIG welded to the continuous longitudinal tubes along the top of each wall.
- d. Rear Wall: The rear wall consists of MIG welded 1.5" x 1.5" 16 gauge G40 galvanized main structural members and diagonal reinforcements. The rear wall design ensures similar strength and performance for both rear window and rear door versions. A section of 16 gauge G40 galvanized Z-section shall be welded to the bottom of the rear wall to form the interface to the floor.

7. Body Exterior

- a. Roof: The roof exterior panel shall consist of a one-piece composite material that is lightweight, extremely durable and impact resistant. The roof panel shall have no seams other than at the junction of the roof panel and the front and rear caps.
- b. Side Walls: Exterior side wall panels shall be constructed of a 3 mm gel-coated product that is a durable semi-rigid fiberglass reinforced polyester resin (FRP). This gel-coated surface shall be highly scratch and abrasion resistant with excellent weathering characteristics and shall maintain integrity from -40 to 180 degrees Fahrenheit.
- c. Wall Skirts: Exterior wall “skirting” below the floor line of the passenger compartment must be removable and replaceable for ease of maintenance. Collision with the skirting alone shall not transmit damage to the floor or wall structure. Wheels and tires shall be removable with the skirts in place. Flexible black fender flares shall be provided at the rear wheel housing. Mud flaps are included behind the rear tires.
- d. Front Bumper: The OEM chassis chrome bumper shall be provided on the front of the bus.
- e. Rear Bumper: The rear bumper shall be constructed from 10 gauge steel, powder coated.

8. Body Interior Panels and Finishes

Panels below the seat rail shall be a synthetic fiberboard, non-wood material. H-rail and screws along the seams retain the ceiling panels. Trim molding covers the seams and fasteners. Interior side wall panels are Vinyl coated lauan with upgrade options.

Front bulkhead and transition panel cover shall be light gray ABS plastic, or a combination of a padded vinyl and other automotive materials.

Entry grab rails shall be installed on the left hand of the front entry area, right hand will be optional. A stanchion and modesty panel shall be provided aft of the entry door.

9. Corrosion Resistance

Panels below the seat rail shall be a black, heavy-duty material. H-rail and screws along the seams retain the ceiling panels. Trim molding covers the seams and fasteners. Interior side wall panels are Vinyl coated lauan with upgrade options.

The body floor sub-frame assembly shall be galvanized to meet the 1,000-hour salt spray test per ASTM procedure B-117, with no structural detrimental effects to normally visible surfaces. The floor structure shall also be rated no less than five using the crosshatch adhesion test per ASTM D3359.

Prior to shipment, the vehicle may be optionally undercoated with water-based heavy duty undercoating.

10. Safety Interlock System

Units equipped with wheelchair lifts come standard with an automatic fast idle module and an FMVSS 403 and 404 compliant wheelchair lift interlock system. The fast idle module elevates engine speed under certain preset conditions, including low battery voltage. The wheelchair lift interlock

system will ensure the lift can only be activated when the vehicle transmission is in park and the parking brake is set. The interlock system will prevent the transmission from shifting from park if the wheelchair lift doors are open, or the parking brake is applied. Optionally, the interlock system can prevent the transmission from shifting from park if the entry or rear emergency doors are open.

11. Passenger Entry

The entry door shall be an outward opening, two-leaf type with an overlapping rubber seal at the meeting edges of the panels. The door shall be attached to the body with two heavy-duty steel pivot pins with nylon bushings. A heavy-duty bulb seal shall be installed at the top and hinged edges of the door. Each door panel shall be glazed with a full-height AS2 glass panel. The door shall be electrically controlled by a switch located within reach of a seated driver and will not permit opening unless the vehicle transmission is in park. The door clear opening shall be a minimum of 30" wide by 80" high or maximum 40" wide by 80" high.

Doors must be parallel to the frame rails of the vehicle to allow for safe parallel curb loading.

The original chassis door, with a roll-up window, shall be supplied on the driver's side of the vehicle.

12. Windows

To create a feeling of light and spaciousness in the passenger compartment, the main passenger windows shall be as large as possible, 46" wide x 40" high minimum for E and G series, 30" wide x 40" high minimum for T-Series. Narrower windows may be used to fill smaller areas as necessary. The windows are to be glazed with nominal 1/8" tempered safety glass. Emergency escape provisions shall comply with FMVSS 217.

13. Mirrors and Sun Visors

- a. Exterior Rear View Mirrors: Exterior mirrors shall consist of a 7" x 9.5" flat and 7" x 4" convex mirror on each side of the vehicle. The right-hand mirror shall be mounted to the chassis fender and shall be visible thru the front windshield. Mirrors shall be mounted with steel tubular structure coated with black powder-coating and encased in a black, impact resistant plastic housing. Exterior mirrors are manual with the option to upgrade to heated and remote models.
- b. Interior Mirrors: The interior rearview mirror mounted to the windshield shall be chassis manufacturer standard.
- c. Sun Visor: The OEM chassis driver's side sun visor shall be provided and shall retain all OEM instructional/warning labels.

14. Electrical Body Power Distribution Center

The body builder power distribution center must use plug-in type connectors for easy removal or testing. It must be a printed circuit card with all base components located on the front of the card

including all relays and fuses. All of the relays must be +12V DC and removable for testing or replacement. All fuses shall be standard automotive type with the ability to upgrade to manual reset circuit breakers upon request. The system shall include (2) spare battery and ignition fuses. LED lights shall be included for troubleshooting by indicating blown fuses, relay activation and relay operation. A buzzer mounted near the driver shall have the ability to activate when lift door is open, rear door is open, entry door is open, or window is open and an auxiliary input for other requested items. The electrical system must include accommodations for the addition of options or aftermarket requirements. Power distribution center shall include silkscreen identification on the front and back that include all components / circuits. Wiring should be point to point and the use of relays is only allowed when switches are not available for the required load. AC High speed, AC Medium speed, AC condenser, AC Clutch and master body relay.

- a. A/C Electrical System: System shall include a single compressor AC system included in the power distribution center and have the ability to add a second single compressor system in the same location.
- b. Stop Request: An optional stop request system shall include 2 different tones for passenger and ambulatory passengers per ADA requirements including a remote mounted speaker located in the OEM dash driver switch panel. Buzzer must also have adjustable volume by the driver. A reset of the card system must be included for entry door cycle or switch in the driver console. Card must be plug and play for ease of replacement.
- c. Heating: The system must have the ability to operate two separate heaters with independent high and low speeds. An output shall be included that is common for any heater output to be used for a water valve or pump.
- d. Driver Switches: Switches must have amber backlighting that operates when the chassis running lamps are turned on. They must also include an amber operation LED for any components on the exterior of the vehicle or any item a driver cannot easily identify as being turned on. Switches must be a rocker style and rated at a minimum of 20A.

15. Electrical Body Wiring Harness

General-purpose wiring shall be cross-linked polyolefin insulated and shall meet SAE standards J1127 & J1128 types SGX and GXL. Wires shall be stamped every 6". Multiple colors are required for different circuits and can be done through solid colors or colors with stripes. One color harnesses are not allowed. All harnesses shall contain a protective barrier through the use of loom, grommets, wire ties and insulated clamps. Routing shall be used as to best protect the harness. Protective covering shall be rated for the area of routing. Temperature, liquids and chafing shall be considered. All connectors shall be plug in type and keyed connectors with locks meeting SAE automotive standards. Dielectric grease shall be used on all exterior connections.

16. Lighting, Exterior

All exterior lighting, with the exception of lighting supplied by the chassis manufacturer, shall be LED. The use of butyl tape is not allowed.

- a. Marker Lights: Lights must be mounted in a recessed grommet and be ¾" round / self-sealing style. This applies to all amber and red marker lights.
- b. Tag Light: Light must be mounted in an anti-corrosion ABS housing and mounted using a gasket.
- c. Side Turn / Marker: Should be Super 60 style single light and recess mounted.
- d. Stop-Tail-Turn-Backup Lights: Lights shall be 4" round and mounted in a recessed grommet. Grommet and lights shall be sealed separately during installation.

17. Lighting, Interior

LED dome lights to be provided. The passenger compartment lighting shall be controlled by a switch located within the driver area. All interior lights shall be the same style / model light for luggage light, lift light, dome lights, driver map light and entry door step light. Each light shall be a minimum of 500 lumens.

- a. Driver Map Light: Light must operate with the OEM driver door open or OEM dash dome light switch.
- b. Interior Dome Lights: Interior lights require a minimum of 3 lights (2 driver side located across from wheelchair door locations and 1 passenger side centered in the body) with the ability to upgrade to 6 lights (3 spaced evenly on the driver and 3 on the passenger side). Lights must operate with passenger entry door open or interior dome light switch located in the driver dash.
- c. Entry Door Step Light: Step light shall be mounted above the entry door. Step light must operate with passenger entry door open or interior dome light switch located in the driver dash.

18. Floor Subfloor and Covering

The plywood floor shall be minimum 5/8" thick, CDX or equivalent grade plywood, mounted with Tek screws installed into the steel floor frame. All plywood edges should be sealed. The rear wheel housings shall be 14 gauge galvanized steel.

Interior floor covering shall be slip resistant flooring with a minimum of 70 mills in thickness. The passenger area will have a level floor throughout except for the wheel well section for the rear axle/wheels. A flat floor option is available to provide a level floor throughout the passenger compartment.

19. Insulation

The body roof and side walls shall be insulated with spray-applied expanding foam insulation to fill gaps and provide adhesion to the exterior panels across the entire panel surface. Insulation in sides

shall be equal to an R-8.8 thermal barrier and sound absorption. Insulation in rear and roof shall be equal to an R-7 thermal barrier and sound absorption.

20. Seating

Driver seat shall either be OEM, HSM Helium or Freedman Shield.

Standard offering passenger seats shall be manufactured by HSM. Optionally Freedman seats will be offered.

HSM Fixed Doubles 2pt, HSM 5 Passenger Fixed 2pt, HSM Foldaway Doubles 2pt, HSM Foldaway Doubles 3pt, and HSM Flip Doubles 2pt shall be tested to prove compliance with FMVSS 210.

Freedman Fixed Doubles 2pt, Freedman Fixed Doubles 3pt, Freedman Flip Doubles 2pt, Freedman Flip Doubles 3pt, and Freedman Foldaway Doubles 3pt shall be tested to prove compliance with FMVSS 207/210.

Freedman CRS seats shall be tested to prove compliance with FMVSS 225.

Seats shall be installed as shown on the vehicle floor plan.

Passenger seats shall to be fastened to floor and wall seat tracks spanning the length of the passenger seating area utilizing a galvanized seat track. The seat track shall be spot welded to a continuous HSLA Grade 60 G40 galvanized roll formed stringer supporting the seat track on three sides, and the stringer shall be welded to adjacent structural members of the cage floor or wall. All seat installations shall comply with FMVSS 210 seat pull testing requirements.

21. Heating, Ventilation, and Air Conditioning

- a. The front heater, front air conditioner, and defroster shall be OEM as supplied by the chassis manufacturer with controls located on the dash within easy reach of the driver.
- b. Provisions shall be made for supplying heated coolant to optional heaters in the passenger cabin. A coolant shut-off valve installed in the rear heater hoses is standard and shall be located under the cab behind the driver's area.
- c. The vehicle may be equipped with an optional heater rated at 65K Btu.
- d. The vehicle may be equipped with an optional rear auxiliary air conditioning system. The rear system shall include an independent compressor, skirt-mounted condenser, and rear evaporator. When combined with the OEM front air conditioning, the total system capacity shall exceed 70K BTU and shall meet performance requirements for the Houston pull down test.
- e. All heating and air conditioning lines and hoses shall be sufficiently protected to ensure against wear from friction and the elements. There shall be no heating lines routed within the passenger compartment.

22. Road and Water Test

Prior to shipment, the bus shall undergo thorough road and water testing to verify operational readiness.

The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion. Each bus shall be driven a minimum of 5 miles on the road test.

Prior to water test, the bus shall be driven a minimum of one-half mile on a track simulating various rough road conditions including staggered bumpers, chatter bumps and frame twists. The water test shall be run for 15 minutes to check the integrity of the vehicle's body seams, window frame seals and other exterior component close-outs for their ability to keep rainwater, road splash, melting snow and slush, and other exterior water from entering the inside of the vehicle. If a water leak is found, it will be repaired and the vehicle will be retested.

23. Quality Assurance

The Contractor's Quality Management System shall be registered as compliant with ISO 9001:2008.

