FORD E450 (GAS) AIR-CHASSIS® 5000 TRANSIT SHUTTLE BUS: TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>LF230</th>
<th>LF240</th>
<th>LF250</th>
<th>LF270</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length, with standard bumpers Add for energy absorbing bumper - rear</td>
<td>281.0&quot; or 23' 4&quot; 5&quot;</td>
<td>294.0&quot; or 24' 6&quot; 5&quot;</td>
<td>307.50&quot; or 25' 9.5&quot; 5&quot;</td>
<td>327.0&quot; or 27' 3&quot; 5&quot;</td>
</tr>
<tr>
<td>Chassis/Wheelbase</td>
<td>Ford 176&quot; E450 186&quot;</td>
<td>Ford E450 186&quot;</td>
<td>Ford E450 186&quot;</td>
<td>Ford E450 208&quot;</td>
</tr>
<tr>
<td>GVWR</td>
<td>14,500 Pounds</td>
<td>14,500 Pounds</td>
<td>14,500 Pounds</td>
<td>14,500 Pounds</td>
</tr>
<tr>
<td>Exterior Height, to skin • Add for Roof Mount A/C • Add for closed vent • Add for open vent</td>
<td>111&quot; 9.5&quot; 4.5&quot; 7.5&quot;</td>
<td>111&quot; 9.5&quot; 4.5&quot; 7.5&quot;</td>
<td>111&quot; 9.5&quot; 4.5&quot; 7.5&quot;</td>
<td>111&quot; 9.5&quot; 4.5&quot; 7.5&quot;</td>
</tr>
<tr>
<td>Maximum Exterior Width</td>
<td>102&quot;</td>
<td>102&quot;</td>
<td>102&quot;</td>
<td>102&quot;</td>
</tr>
<tr>
<td>Interior Height at center of aisle (minimum)</td>
<td>Front - 81.0&quot; Rear - 78.0&quot;</td>
<td>Front - 81.0&quot; Rear - 78.0&quot;</td>
<td>Front - 81.0&quot; Rear - 78.0&quot;</td>
<td>Front - 81.0&quot; Rear - 78.0&quot;</td>
</tr>
<tr>
<td>Interior Width</td>
<td>96.75&quot;</td>
<td>96.75&quot;</td>
<td>96.75&quot;</td>
<td>96.75&quot;</td>
</tr>
<tr>
<td>Clear Passenger Door Opening</td>
<td>38.0&quot; x 74.5&quot;</td>
<td>38.0&quot; x 74.5&quot;</td>
<td>38.0&quot; x 74.5&quot;</td>
<td>38.0&quot; x 74.5&quot;</td>
</tr>
<tr>
<td>Ground to Step</td>
<td>15.0&quot;</td>
<td>15.0&quot;</td>
<td>15.0&quot;</td>
<td>15.0&quot;</td>
</tr>
<tr>
<td>Ground to first Step Kneeded</td>
<td>11.0&quot;</td>
<td>11.0&quot;</td>
<td>11.0&quot;</td>
<td>11.0&quot;</td>
</tr>
<tr>
<td>Aisle Width</td>
<td>22.0&quot;</td>
<td>22.0&quot;</td>
<td>22.0&quot;</td>
<td>22.0&quot;</td>
</tr>
</tbody>
</table>

1) SCOPE

These specifications define requirements for medium-duty, low-floor 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.

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) CHASSIS

The Ford E450 Shuttle Bus chassis with a GVWR of 14,500 pounds must include the following:

a. 5,000 pound maximum front GAWR Twin I-Beam IFS; 9,600 pound maximum Dana Full Floating Rear Axle
b. Engine shall be a 6.8l V-10 gas with 305 HP @ 4250 RPM/420lb-ft. torque @ 3250 RPM
c. 5-speed automatic transmission
d. Brake system to be power, self-adjusting, four wheel disc with four wheel anti-lock
e. Single fuel tank with maximum capacity available for the low floor chassis configuration.
f. Exhaust system to be aluminized exhaust pipes and muffler properly installed with heat shield and baffles
g. 225 amp alternator
h. Dual batteries rated at 650 CCA each
i. LT225/75Rx16E tires with 16.0x6, white steel wheels

FUEL TANK

The vehicle shall have a 55.0 Gallon (208L) fuel tank, located aft-rear axle.

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.

4) LOW FLOOR MODIFICATIONS/ SUSPENSION

Modified chassis shall be a Dallas Smith Corp. Air-Chassis® 5000.

All modifications and/or industry standard wheelbase extensions to the OEM frame rail shall only be made aft OEM chassis cab “B” pillar.

The chassis frame shall consist of an Equal-Access™ passenger side frame rail extension section engineered by Dallas Smith Corp. (patents pending), and shall be installed by a select Ford Motor Company recognized “qualified vehicle modifier (QVM).”

No modifications shall be made to the OEM drive train (i.e. engine, transmission), OEM drive train mounts, and/or OEM drive train specified component positioning.
SUSPENSION

The air-ride suspension shall be a DSC IntelliSYNC® 5000 Series electronic/automatic air-ride suspension system.

Suspension system shall be “Buy America” certified.

 Shall include Automatic Vehicle-Kneel Leveling (AVL) system to provide best possible flat floor passenger entry landing area.

Air-ride suspension system shall have all system critical operating components located in a dedicated, easily accessible function box, securely protected from outside vehicle elements within the driver’s compartment area.

The IntelliSYNC® 5000 air-ride suspension system, shall have a standard limited warranty, for a period of 36 months or 36,000 miles (whichever shall occur first).

Vehicle suspension air system shall be an IntelliSYNC® High Duty Cycle Compressor (DC powered), located aft-cab, on driver side frame rail, utilizing specific isolator compressor mounts and brackets.

Vehicle suspension air system shall incorporate an IntelliSYNC® in-line “air-cooler” to reduce operating air system temperature approximately 150° or less, to improve overall air system efficiency and suspension durability.

Vehicle suspension air system shall incorporate an automatic heated regenerating in-line dryer/filter, with dedicated purge tank.

All suspension air system lines, fittings, valves, connectors and tanks shall meet D.O.T. specifications.

Front vehicle springs shall consist of two (2) 5,000 (lbs.) maximum combined capacity, double convoluted air springs by Firestone® utilizing OEM brackets to mount.

Rear suspension shall consist of IntelliSYNC® FORD E450 designed air beams by DSC, rated specifically to vehicle’s GAWR, and provide enhanced “wide-trac” vehicle lateral and longitudinal stability.

Rear vehicle springs shall consist of two (2) 9,600 (lbs.) maximum combined capacity, single-lobe air springs by Firestone® utilizing OEM brackets to mount.

OEM Front suspension strut bushings shall be replaced with DSC LoPro™ Extenda-Life™ heavy duty unlimited travel urethane bushings.
Rear suspension air beam bushings shall be DSC LoPro™ Extenda-Life™ heavy duty unlimited travel bushings.

Vehicle front and rear suspension ride heights shall be electronically controlled by four (4) automatic precision ride height electronic sensors, with multi-port air-manifold valving to enhance overall vehicle operating performance.

Vehicle suspension shall incorporate a full vehicle kneel (4-Point) capability at all four corners lowering the vehicle height

The vehicle kneel feature shall be activated by a dash panel feature.

A vehicle interlock shall be incorporated to prohibit movement of the vehicle when in the kneeled position.

Vehicle suspension shall have a Digital display “user interface” dash panel that provides all vehicle suspension functionality, monitors overall vehicle suspension performance with real-time diagnostics (kneel cycles, weight distributions, air pressures, and more) capabilities, and allows for real-time remote programming.

Vehicle suspension shall be capable of a full vehicle (4-Point) flow-controlled kneel, within a not-to-exceed time of approximately eight (8) seconds after the vehicle operator has activated the “full vehicle kneel” function located on vehicle dashboard. (Results based/validated on a vehicle at the maximum GVW rating specified by OEM).

Vehicle suspension shall be capable of a full air system recovery from a full vehicle (4-Point) “kneeled position”, to vehicle ride height, within a not-to-exceed time of approximately five (5) seconds after the vehicle operator has activated the “vehicle raise” feature, located on vehicle dashboard (Results based/validated on a vehicle at the maximum GVW rating specified by OEM).

Vehicle suspension shall consist of two (2) specifically designed air tanks to meet the requirements, the rated duty-cycle application use, and power-coated both inside/outside of tank to protect against weather element corrosion, meeting the requirements of SAE J-10 and FMVSS standard 121.

Air suspension system shall contain an emergency “manual override” auxiliary air support system, which is separate and independent of the vehicle’s main air operating system, and which can provide immediate back-up source of air supply to the main air system to allow for the vehicle to be operated directly to servicing – under a main air producing system failure. Said “auxiliary manual override system” shall have its own independent and dedicated air supply tank and manual controls and safety valves.

Vehicle suspension wiring shall be constructed to D.O.T. standards.
Vehicle suspension wiring shall be adequately supported and protected from chafing, flexing, tension and vibration.

Vehicle suspension wiring shall be color-coded for identification.

Vehicle suspension wiring shall be easily referenced with a schematic/diagram.

**AIR LINES**

Vehicle suspension air lines shall conform to the installation and material requirements of SAE J844 and D.O.T. standards.

Vehicle suspension air lines shall be adequately supported and protected from chafing, flexing, tension and vibration.

Vehicle suspension air lines and air line fittings shall be color-coded for identification.

Vehicle suspension air lines shall be easily referenced with a schematic/diagram.

**5) SAFETY INTERLOCK SYSTEM**

The safety interlock will disable the suspension lowering system unless certain vehicle safety conditions are achieved, and will lock the transmission shifter while in Park when the suspension is in the lowered or kneeled state, or if the Park Brake is applied. Locking the shifter while Park Brake is set prevents premature brake wear from driving with the Park Brake set.

The safety interlock will also disable air compressor operation unless the engine is running to prevent draining the battery.

**6) MANUFACTURER CERTIFICATIONS**

The body manufacturer must be an ISO 9001:2000 certified company and have a Fully Meets rating in the Ford Quality Vehicle Manufacturer Program. Proof of compliance must be submitted with the bid.

**7) BODY STRUCTURE**

The body must be constructed of minimum 16 gauge tubular steel cage body to ensure passenger safety. Minimum requirements include:
a. Sidewalls shall be constructed of 1.5” x 1.5” 16-gauge tubular steel studs and corner posts on maximum 48” centers. A 14-gauge, 1-1/2” x 2” tubular horizontal stringer shall be welded to the top of the studs with a 16 gauge Z-rail welded to the studs at the bottom of the sidewall. Seat track shall be welded to the sidewall studs.

b. The roof consists of 1.5” x 1.5” 16 gauge tubular steel rafters installed on maximum 48” centers. The rafters are welded into two (2) 16-gauge steel "U" shaped sidewall caps. The rafters, in conjunction with “C” Channels, form a "steel cage" type of construction.

c. The back wall has a 1.5” x 1.5” 16 gauge tubular steel frame, reinforced with 16-gauge "C" channel. A section of 16-gauge Z-channel shall be welded to the bottom of the back wall.

d. The floor frame shall be constructed of 11-gauge, 2”x 2.88” x 2” channel cross members, on a maximum 34” center, with an outer 14-gauge angle steel impact rail. 11-gauge, 4” wide flat steel shall be provided to support the floor track. The floor frame shall be secured to the chassis frame in accordance with Ford’s QVM requirements.

e. Shall incorporate a mid-vehicle step up to rear flat seating area, with optional fixed ramp to rear or optional automatic ramp to rear.

f. The body shall be plumb, square and level before installation on the body.

g. In order to ensure passenger safety in the event of skin delaminating, the body structure shall comply with FMVSS 220, School Bus Rollover Protection, when tested without the exterior or interior skin. Proof of compliance (test results based on body structure alone) shall be submitted with the bid.

8) CORROSION RESISTANCE

In order to provide superior corrosion resistance, all tubular steel shall be galvanized, coated with a 99.9% pure zinc coating during the steel milling process. The steel shall have minimum 50 ksi strength and three layers of corrosion prevention coatings.

The body floor sub-frame assembly shall be primed 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.

Certification of compliance with this requirement shall be published by an independent company and be submitted with the bid. Prior to shipment, the vehicle shall be undercoated.
9) BODY EXTERIOR

The roof shall consist of a one-piece composite material that is lightweight, extremely durable and impact resistant. The only roof seams that are allowed are at the junction of the roof skin and the front and rear cap.

The exterior sidewall shall be constructed of a 3.9 mm gel-coated product (Noble Choice) that is a durable semi-rigid fiberglass reinforced polyester resin (frp). This gel-coated surface is highly scratch and abrasion resistant with excellent weathering characteristics and has been tested in a thermotron from -40 to 180 degrees Fahrenheit.

Exterior mirrors are to be Rosco heated remote.

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and driver’s side window. When the bus is decelerated, the gutters shall not drain onto the windshield, driver’s side window or door boarding area. Cross-sections of the gutters shall be adequate for proper operation.

Flexible black fender skirts shall be provided at the rear wheel housing. Wheels and tires shall be removable with the fender skirts in place. Mud flaps are required behind the rear duals.

The OEM chassis chrome bumper shall be provided on the front of the bus. The rear bumper shall be constructed from 10-gauge steel, powder coated black.

10) PASSENGER ENTRY

VEHICLE ACCESSIBILITY RAMP - Vehicle shall be integrated with a purpose built IntelliSYNC® Equalizer Ramp Assembly which automatically adjusts the passenger accessibility ramp slope angle to a continuous grade slope. The Equalizer Ramp assembly shall incorporate a Braun ramp with an 800 pound capacity with a minimum useable ramp area of 34” in width x 94” inches in length.

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 edge of the door. Each door panel shall have an 11-gauge aluminum frame and 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. The door clear opening shall be a minimum of 38” wide by 74” high.

Driver’s Door - The original chassis door, with a roll-up window, shall be supplied.
11) WINDOWS

To create a feeling of light and spaciousness in the passenger compartment, the main passenger windows shall be as large as possible, 45” wide x 36” high minimum. Narrower windows may be used to fill smaller areas as necessary. The windows are to be glazed with nominal 1/8” tempered safety glass, in a top t-slider configuration. Emergency escape provisions shall comply with FMVSS 217.

12) ELECTRICAL BODY POWER DISTRIBUTION CENTER

The body builder power distribution center must use connector plug in type or equivalent for easy removal or testing. It must be made of a heavy duty type printed circuit card with all base components located on the front of the card including all interior light relays, master relay, destination sign, master breaker and fuses. It must include an 80 amp non-replaceable relay to minimize resistance for the ignition circuits including a 50-amp maxi fuse. All of the relays must be removable for replacement except the primary 80-amp relay and shall be +12v DC. All fuses shall be standard automotive type with the ability to upgrade to auto or manual reset circuit breakers upon request. LED lights shall be included for troubleshooting. Red LED indicates a fuse is blown and in use while a green LED indicates the relay is good and a yellow LED to indicate a signal wire is active. All grounds must use a connector plug in type at the electrical center for common grounding location and can only use single wire termination for each ground wire by the use of a standard blade type fuse to commonize parts. These options will be marked as Jumpers and shall be considered low current. The card shall contain a single common buzzer utilizing these jumpers. The buzzer shall have the ability to activate when lift door is open, rear door is open, entry door is open, and window is open and an auxiliary input for other requested items.

The power distribution center must include all major options to be adapted directly to the main card. These must be included on 3 distinct cards listed as stop request module, heater module and flasher module. All cards shall contain LED lights for troubleshooting. The cards below shall not use any harness or wires to connect to the main card. They shall use metal type standoffs to carry the circuit with screws.

a. The stop request card shall include 2 different tones for passenger and ambulatory passengers per ADA requirements including a remote mounted speaker. A reset of the card must be included for entry door cycle or switch in the driver console.

b. The heater module must have the ability to relay 2 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.

c. The flasher module shall contain options for OEM lights or body builder added lights through the use of jumpers. Options will include lift door open, rear door open, entry
The complete electrical system shall be installed, certified, tested and warranted by the system manufacturer.

13) 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” and stamping shall be opposite color of wire to allow easy reading (dark wire uses white ink, light wires use dark ink). 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. All primary harness connectors shall be color coded for ease of removal and assembly. The harness shall include all options available on the primary power distribution center and the use of add on modules. This allows multiple spare circuits. The harness shall be split into sections for easy replacement with one single harness for the rear, body and front of the vehicle. All connectors must be accessible.
14) LIGHTING

Exterior Lighting – All exterior lighting, with the exception of lighting supplied by the chassis manufacturer, shall be incandescent.

Interior Lighting – Incandescent dome lights to be provided. The passenger compartment lighting shall be controlled by a switch located within the driver area.

15) FLOOR

The plywood floor shall be a minimum 5/8” thick (minimum), CDX plywood, mounted with Tek screws installed into the steel floor frame. All plywood edges should be sealed. The rear wheel housings shall be a minimum of 14-gauge steel.

The finished floor shall be covered with black rubber transit flooring with a minimum 3/16” ribbed rubber aisle. Flooring under the seats shall be minimum 1/8” thick smooth rubber.

16) INSULATION

The insulation shall be a minimum of ½” thick polyurethane foam, sprayed between the exterior skin and the interior panels. Insulation shall be moisture proof and have excellent thermal and acoustic insulating characteristics.

17) INTERIOR PANELS & FINISHES

For washability, the ceiling and wall panels shall be vinyl-coated luaun in a light gray color.

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 sidewall panels are vinyl-covered luaun. The panels are held in place at the lower edge by J-rail and at the top edge by the window trim ring. Pushpins secure the panels to the sidewall studs.

Front bulkhead and transition panel cover shall be light gray ABS plastic.

Entry grab rails shall be installed on both sides of the front entry area. A stanchion and modesty panel shall be provided aft of the entry door.
Passenger compartment heating and air conditioning are optional and should be specified based on the prevailing conditions in your operating area. The selected system shall be installed by the Contractor and be tested by a 3rd party air conditioning installer.

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18) SEATING

Passenger seats shall be Freedman, or approved equal, mid-high type, installed as shown on the vehicle floor plan.

19) HEATING/AIR CONDITIONING

20) 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 15 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.

21) QUALITY ASSURANCE

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