

DESIGN RECOMMENDATIONS

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Revised 02-15-06

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FUEL SYSTEM

WARNING:

BEFORE OPENING THE FUEL SYSTEM ON VEHICLES WITH EFI ENGINES, RELIEVE FUEL PRESSURE BY FOLLOWING THE INSTRUCTIONS IN THE *FORD TRUCK SHOP MANUAL* FOR THE APPROPRIATE MODEL AND MODEL YEAR.

THE EVAPORATIVE EMISSION SYSTEM CONTAINS FUEL VAPOR AND CONDENSED FUEL VAPOR. ALTHOUGH NOT PRESENT IN LARGE QUANTITIES, IT STILL PRESENTS THE DANGER OF EXPLOSION OR FIRE.

WHEN WELDING NEAR FUEL SYSTEM COMPONENTS, ALL METALIC COMPONENTS SHOULD BE ADEQUATELY SHIELDED AND PROTECTED FROM HEAT OR WELD SPLATTER. ALL NON-METALLIC COMPONENTS SHOULD BE REMOVED.

REMOVAL OR REINSTALLATION OF ANY FORD FUEL SYSTEM COMPONENT SHOULD BE PERFORMED TO THE SPECIFICATIONS AND INSTRUCTIONS FOUND IN THE *FORD TRUCK SHOP MANUAL* FOR THE APPROPRIATE MODEL AND MODEL YEAR. (EXCEPT FOR E-SERIES VAN AFT-OF-AXLE TANK INSTALLATIONS, SEE THE FOLLOWING NOTE).

E-SERIES VAN AFT-OF-AXLE FUEL TANK

A Fuel System Modification Kit is available for some E-Series products for removing the midship fuel tank and adding an aft-of-axle fuel tank. This kit is distributed by:

Transfer Flow Inc.
1444 Fortress Street
Chino, California 95973
Phone: (800) 442-0056
Fax: (530) 892-0382

NOTE: The modifier is responsible for determining if the vehicle as modified with this kit meets applicable safety & emission regulations and is properly certified.

INFORMATION

The following recommendations are intended to assist in the design and completion of the fuel system capable of meeting the requirements of F/CMVSS 301. These recommendations are based on testing and analysis performed by Ford Motor Company.

Since completed vehicles may take many forms, this list of recommendations cannot cover all possibilities. Strict adherence to these suggestions will not ensure that the completed vehicle will comply with F/CMVSS 301. The responsibility for determining compliance to F/CMVSS 301 regulations is that of the final stage manufacturer.

Accordingly, Ford Motor Company makes no representations as to the appropriateness of any particular recommendation in its specific application to a particular design or act of intermediate or final stage manufacture.

To verify compliance with F/CMVSS 301, testing of representative vehicles to applicable F/CMVSS 301 procedures may be necessary. Questions regarding compliance with F/CMVSS regulations should be directed to your legal counsel, the National Highway Traffic Safety Administration, or Transport Canada.

Any alteration or modification of a vehicle's fuel or evaporative system may affect the vehicle's compliance with applicable federal and state emission laws, including on-board diagnostics (OBDII) and evaporative emissions requirements, and may also effect vehicle performance (driveability, idle quality, etc.). Vehicle modifiers are responsible for ensuring that a vehicle, as modified, complies with all applicable emissions regulations and for obtaining any necessary federal or state approval or certification relating to vehicle modification or sale of add-on or auxiliary parts.

A. NEW FUEL TANKS

1. The fuel tank should be designed with as few openings and connections as possible. Openings and connections generally should be located on the upper surface of the fuel tank.
2. Fuel tanks should be fitted with an evaporation control valve having the means to close if the vehicle is rotated about a longitudinal axis pursuant to F/CMVSS 301.
3. The tank should be of simple configuration minimizing sharp surface transitions and protrusions which may be required for attachment or function.
4. The tank should be strong enough to withstand instantaneous internal pressure imposed in the event of crash situations.
5. Hoses connected to the tank should be sufficiently flexible to permit small movements of the tank relative to fixed mounting surfaces, without rupture or disconnection of such hoses in the event of crash situations.
6. Emission regulations may require an OBDII fuel tank pressure sensor for the evaporative system. Any new fuel tank must be tested and comply with all emission regulations, including evaporative emissions.
7. Package new tank away from heat sources such as exhaust.

B. NEW FUEL TANK RETENTION SYSTEMS

1. The retention system should attach the fuel tank to the frame, between the frame rails, and below the body of the vehicle with sufficient clearance for normal body to frame movement under loaded conditions.
2. A retention system should restrict fuel tank movement in all possible directions to prevent contact or rupture with rigid or sharp objects, and the disconnection of fuel system tubes and hoses under crash conditions. Retention straps should avoid sharp edges and tank supports should be designed with fuel tank compatible surfaces and edges to the fuel tank.
3. System fasteners and attachments should be designed to retain the tank during deflections incurred in crash situations.

C. FUEL FILL SYSTEM

1. Fill system should be sufficiently flexible to prevent possible rupture or disconnection resulting from movement of the fuel tank relative to frame during crash situations. Use the original pickup truck filler if the fill location is similar to the original pickup truck location. For Ranger, user Ranger Fuel Fill Kit 9B149.
2. Any appliance or hardware attachments to the body in the area of a fuel system component should be designed, positioned, and secured so as not to impact any fuel system component during crash situations.
3. The fuel filler opening area of the body should provide adequate sealing from the vehicle interior because holes or cracks in this area may allow fuel vapors to enter the vehicle interior. Openings should be sealed with a product which is fuel resistant. See Figure A on this page.
4. The metal outer end of the fuel fill neck tube provided by Ford must be properly grounded to the chassis to dissipate any electrostatic charge that may be produced and so reduce the possibility of a spark during fueling. A fill neck support made of metal would provide a ground path if directly mounted on the chassis. If the filler neck support is made of plastic or other non-metallic material, a ground strap or wire must connect the metal end of the fuel filler neck and a metal chassis component.

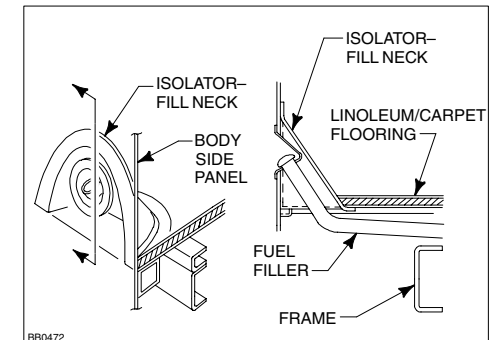


FIGURE A – BODY MOUNTED FUEL FILLER OPENINGS

5. Fill openings should be recessed, and caps, when installed, should be inside the normal body plane.
6. Whenever possible, the fill system should pass under the body rather than through it. Where passing through floors and sides, the fill system should be shielded and have adequate clearance to surrounding structure. Fuel Filler and Vent Hoses should maintain a minimum of one inch clearance to body and surrounding chassis components, except where the hoses and protective sleeve material pass through the designed frame opening.
7. Be sure that the fuel tank filler cap is the correct Ford designated part. Provide adequate hand clearance for cap installation and correct sealing of the cap to filler pipe.
8. The recommended horizontal and vertical locations for the fuel tank filler pipe is shown on page 64 (E-Series), pages 118 and 141 (Super Duty F-Series) and page 179 (Ranger).

SUPER DUTY F-SERIES FUEL FILLER KITS SERVICE PART NUMBERS	
Gas	5C34-9B149-GC
Diesel	6C34-9B149-HA

Other parts that can be ordered/purchased separately:

SERVICE PART NUMBERS	PART DESCRIPTION
E0TZ-9040-A	Support (unskirted body)
D702-9A095-A	Label – Unleaded Fuel
E432-9A095-A	Label – Diesel Fuel

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C. FUEL FILL SYSTEM (CONT'D)

9. When installing accessories or equipment, avoid exposure of fuel and vapor hoses to surfaces with sharp edges (see Figure A on this page) or high temperature surfaces (near hot exhaust or coolant). Also avoid installations which result in the exposure of these lines to road debris or undercoating, except as specified on page 194.
10. Install or route fuel tank filler hoses and filler vent hoses as follows:
 - a. Avoid sags below the horizontal which allow fuel puddling (i.e., avoid sink traps). See Sink Traps in Figure A. Fuel trapped in low spots can be expelled when the cap is removed, even if the tank is nearly empty.
 - b. Avoid pinches or kinks, as they restrict fuel filling or venting. Hose length may require adjusting depending on second unit body width. See Kinked Fuel Fill System, Figure A.
 - c. Do not place adjacent hardware such that it may cut or otherwise damage the filler neck and vent hoses and cause fuel or vapor leakage (i.e., avoid unfriendly surfaces) see Hostile Surfaces, Figure A.
 - d. Keep the flow of fuel continuously downward from the inlet of the fuel filler pipe all the way to the tank.
 - e. The filler hose and vent hose must be clear of moving suspension components so as to prevent abrasion which can result in fuel leakage. They should maintain a minimum of 1 inch clearance to body and surrounding chassis components, except where the hoses and protective sleeve material pass through the designed frame opening.
 - f. Be certain that all clamps are secure and properly located.
 - g. The fuel filler and filler vent hoses should not contain fittings or connections other than those incorporated in the original design, nor should they be interconnected with each other in any way.
 - h. Ford released parts should be used.

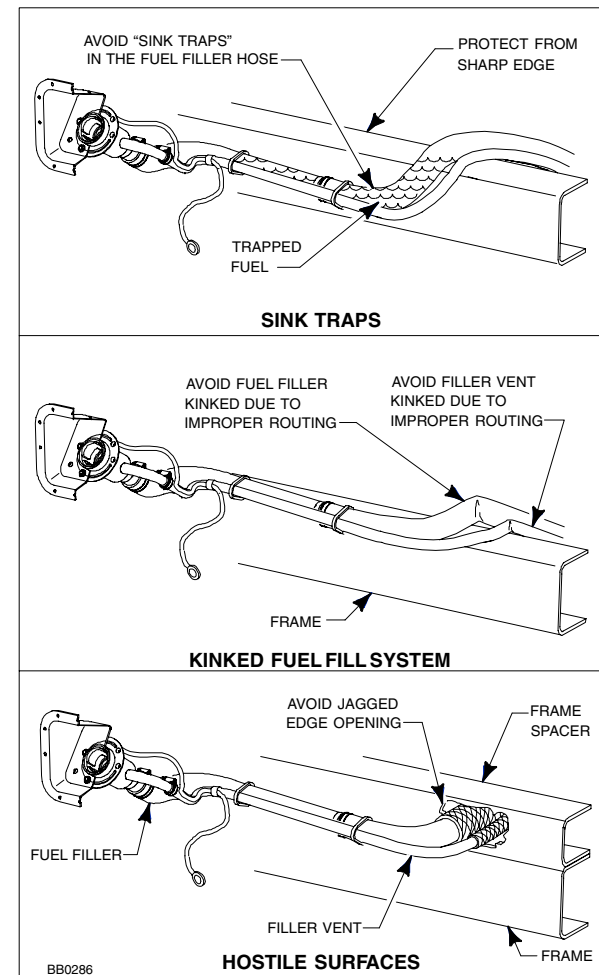


FIGURE A – FUEL FILL SYSTEM INSTALLATION CONDITIONS TO BE AVOIDED

D. FUEL TUBES, HOSES AND PUMPS

1. Do not reroute or change the attachment of fuel lines or fuel vapor hoses. Doing so may alter the vehicle's ability to comply with F/CMVSS 301, Fuel System Integrity, and may adversely affect vehicle performance by increasing the amount of heat absorbed by the fuel system or by restricting its venting.
2. Tubes and hoses should be routed away from and not attached to members that will move or deform during crash situations.
3. Tubes and hoses must be sufficiently flexible to avoid rupture or disconnection resulting from movement of the engine relative to the frame during crash situations.
4. Tubes and hoses should be routed away from hot regions and sharp objects and should be retained adequately to prevent movement into such regions or against such objects.
5. Do not add fuel or vapor line flow restrictors as they can cause engine fuel starvation or abnormally high fuel tank pressures.
6. Do not install auxiliary fuel pumps. This could cause the engine to run rich, producing additional exhaust heat.
7. The special removal tool shown in Figure C on the next page must be used to open push connectors installed on flexible fuel lines if the lines need to be disconnected. The appropriate tool is available from Ford Customer Service Division.
8. The push connectors on flexible fuel lines, if disconnected, must be reconnected by snapping them back into position and installing the appropriate retainer as shown in Figure C on the next page.

9. Avoid pinching or kinking of any fuel vapor hose. (See Figure B below).

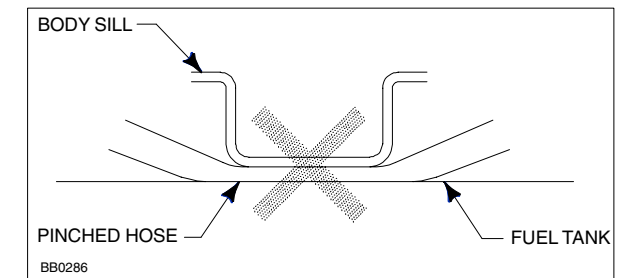


FIGURE B – FUEL VAPOR VENT LINES

10. Each of the fuel lines and fuel vapor hose retention clips provided by Ford must be used in original factory locations to prevent misplacement or movement of the lines.
11. Be certain that the vent valves on top of the fuel tanks are seated and secure; do not dislodge or damage them when mounting the second unit body. If they are unseated, fuel leakage may occur. If damaged, the vapor vent system may not function, resulting in increased fuel tank pressure.
12. If a fuel sender is removed for any reason, use a new gasket when it is reinstalled so as to prevent fuel leaks. Be certain the fuel sender is seated and secure on the top of each fuel tank. Do not step upon or place weight upon the sender during vehicle manufacture. See page 64.
13. Fuel filters installed in the fuel supply line must be of sufficient size to be nonrestrictive to fuel flow and placed so as to be protected from exposure to exhaust heat and physical damage. Ford replacement fuel filters are recommended. Filters are not to be installed in the fuel return line.
14. **Temporary shipping fuel lines are not to be reused.** They should be disposed of in an appropriate manner.
15. Fuel system components which are disconnected during manufacturing should be capped or plugged promptly to prevent possible contamination.
16. When welding near fuel system components, all metallic components must be adequately shielded and protected from heat or weld splatter. All nonmetallic components must be removed.

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E. FUEL SYSTEM ACCESS FOR AUXILIARY FUEL POWERED EQUIPMENT

Precautions similar to those described in this Fuel System section should be taken in the design and positioning of a fuel system for auxiliary fuel-powered equipment. The auxiliary fuel-powered equipment should be securely mounted so as to withstand forces during crash situations.

E-Series Super Duty Cutaway, Super Duty F-Series, and E-Series Super Duty Stripped Chassis aft-of-axle fuel tanks are equipped with an auxiliary fuel port in the fuel sender unit. The purpose is to provide a fuel supply for fuel powered accessories such as generator sets.

E-Series van vehicles may have an optional auxiliary fuel port which is located on the midship fuel tank sender unit.

Final Stage Manufacturers that utilize the auxiliary fuel port must install a check valve because of Onboard Fuel System Diagnostics (OBDII). The system may affect the vehicle's compliance with applicable Federal/State emissions laws. Additional information is available in Bulletin Q-42. To obtain a copy, log on to www.fleet.ford.com/truckbbas/ and select from the list of Bulletins required.

All auxiliary fuel ports have a safety cap which must remain in place until a fuel consuming accessory is installed.

E-Series van vehicles equipped with the auxiliary fuel port have a braided jumper hose which provides access without removing the fuel tank. A cap removal tool is provided on the jumper line immediately behind the cap and must be removed and reversed before it can be used to remove the cap.

A push connector F7UA-9J274-AA, available from your local Ford dealer, will attach to the auxiliary fuel port and accept a 1/4 inch hose and clamp. See page 64.

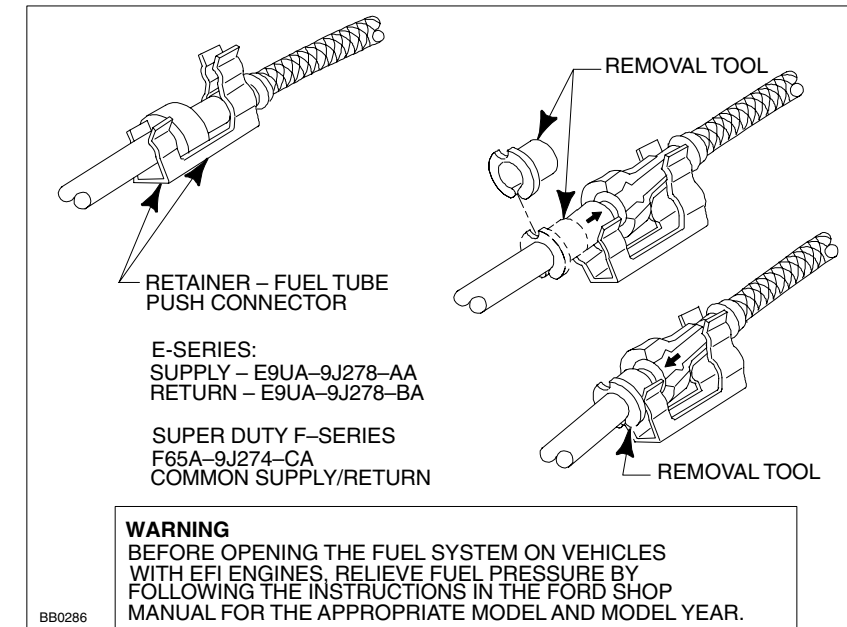


FIGURE C - FLEXIBLE FUEL LINE PUSH-CONNECT