Fuel Tanks and Lines — Diesel Engines

SECTION 25-50

APPLIES TO ALL MODELS WITH 6.9L DIESEL ENGINE

DESCRIPTION

Typical fuel tank and line installations are shown in Figs. 11 through 25. Refer to these illustrations and remove damaged or worn parts as necessary.

Push Connect Fittings

Push connect fittings are used to make most fuel line connections in F-250—F-350 diesel fuel systems. This fitting must be serviced using the procedures described in this Section. Service is not possible if the fitting is damaged, except to replace a damaged retaining clip.

Fuel Tank Filling

Expansion of fuel due to temperature increases, or overfilling ("Topping Off") could cause fuel overflow at the filler cap when the vehicle is standing or the cap is removed. To minimize this condition, it is recommended that the amount of fuel put in the tank when filling be limited to the automatic pump shutoff. If vehicle has two tanks, use fuel from both tanks after fill-up to reduce fuel levels.

Fuel Tank Draining

Use appropriate adapter to connect Rotunda suction pump 034-00006 or similar suction pump, to the fuel hose (at the fuel sedimenter to fuel tube connection) and drain the fuel tank.

Fuel Selector Valve (Vehicles with Dual Tanks Only)

Refer to Figs. 1, 2 and 3.

The 6-port diesel fuel valve is powered by a small electric motor which opens and closes the valve ports. The supply and return ports for either tank open and close simultaneously. The valve is shifted to the front mode (that is the front supply and return ports open to the engine supply and engine return port respectively) by applying a positive 12 volts to terminal number 2 and ground to terminal number 1. When the valve reaches the front mode position, an internal switch opens the circuit and stops the motor. Returning the valve to the rear mode is accomplished by reversing power: positive 12 volts to terminal number 1 and ground to terminal number 2. Terminals 3 and 5 connect to the front and rear fuel tank senders, respectively and terminal 4 feeds the fuel gauge. In the front tank mode an internal switch connects terminal 3 to terminal 4 thus supplying the front tank sender signal to the fuel gauge. Terminals 3 and 5 are connected in the rear tank mode. Therefore, a change in the fuel gauge reading (assuming at least 1/4 tank fuel level difference), is a means that the valve has shifted.

Power is supplied to the fuel tank selector switch from the fuse panel when the ignition switch is to the On position. This power goes through the fuel tank selector switch directly to the motorized fuel tank selector valve.

With the fuel tank selector switch in the front tank position, power is supplied from the selector switch to terminal number 2 of the fuel selector valve (Figs. 2 and 3). The ground path is completed through terminal number 1 of the fuel tank selector valve and is grounded through the selector switch. This causes the fuel selector valve to rotate internally, opening the ports to the front tank position which allows fuel to flow through the fuel line to the engine.

With the fuel tank selector switch in the rear tank position, power is supplied from the selector switch to terminal number 1 of the fuel tank selector valve. The ground path is completed through terminal number 2 of the fuel tank selector valve and is grounded through the selector switch. This current path causes the motorized valve to rotate internally, opening the ports to the rear tank position which allows fuel to flow through the fuel line to the engine.

NOTE: When diagnosing the selector valve for failure to switch tanks and voltage is on terminals number 1 and number 2 of the valve, make sure the ground wire is attached below the instrument panel.

Fuel/Water Separator

Water should be drained from the fuel/water separator whenever the warning lamp comes on or every 8046 km (5,000 miles). More frequent drain intervals may be required depending on fuel quality and vehicle usage.

The instrument panel warning lamp (WATER IN FUEL) will glow approximately 0.1 liters (0.1 quarts) of water has accumulated in the sedimenter. When the warning lamp glows, shut off the engine as soon as safely possible.

Drain Procedure

Econoline

1. Stop the vehicle and shut off the engine.

   NOTE: Failure to shut off the engine prior to draining separator will cause air to enter the fuel system.

2. Place an appropriate container under the water separator to collect the water. The water separator is located inside of the driver's side frame rail in line with the front wheel (Fig. 4).

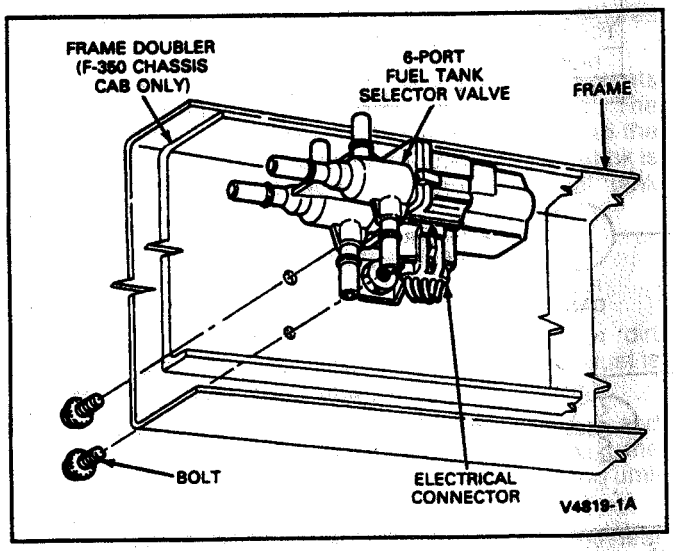


FIG. 1 Fuel Tank Selector Valve—Typical

3. Raise the plastic cover on the drain handle bracket located on the floor to the right of the driver's seat.
4. Grasp the handle and pull it firmly upward until it hits the stop (about 8.3mm or 3-1/4 inches). Hold the drain handle in the open position for approximately 15 seconds to drain the water.
5. After the water is completely drained, push the handle in all the way to fully close the cover on the drain handle bracket. Inspect the water separator to verify that draining has stopped. Properly dispose of the drained fluid.
6. Re-start the engine and check the WATER IN FUEL lamp. The lamp should not glow. If it continues to glow, check fuel system. The fuel/water separator should also be drained at 8046 Km (5000 mile) intervals according to the maintenance schedule. If the warning lamp is not glowing at the service interval, look at the draining fluid to determine when clear diesel fuel is flowing. Stop draining the separator as soon as clear diesel fuel appears.

F-Series

1. Stop the vehicle and shut off the engine.

   NOTE: Failure to shut off engine prior to draining separator will cause air to enter the fuel system.

2. Open the hood. Place an appropriate container under the water separator drain hose to collect the water.

   - Grasp the pull ring and pull upward until it stops. Hold the pull ring in this position for about 15 seconds or until water is completely drained. Release the pull ring.

3. Close the hood and properly dispose of the drained fluid.
4. Re-start the engine and check WATER IN FUEL indicator lamp. The lamp should not glow. If it continues to glow, check fuel system.

The fuel/water separator should also be drained at 8046 Km (5000 mile) intervals according to the maintenance schedule. If the warning lamp is not glowing at the service interval, look at the draining fluid to determine when clear diesel fuel is flowing. Stop draining the separator as soon as clear diesel fuel appears.

Fuel and Vapor Hoses

Fuel hoses should be assembled with the minimum engagement shown in Fig. 5.

Not all of these components are used on any one system, since usage depends on the calibration of the complete vehicle.

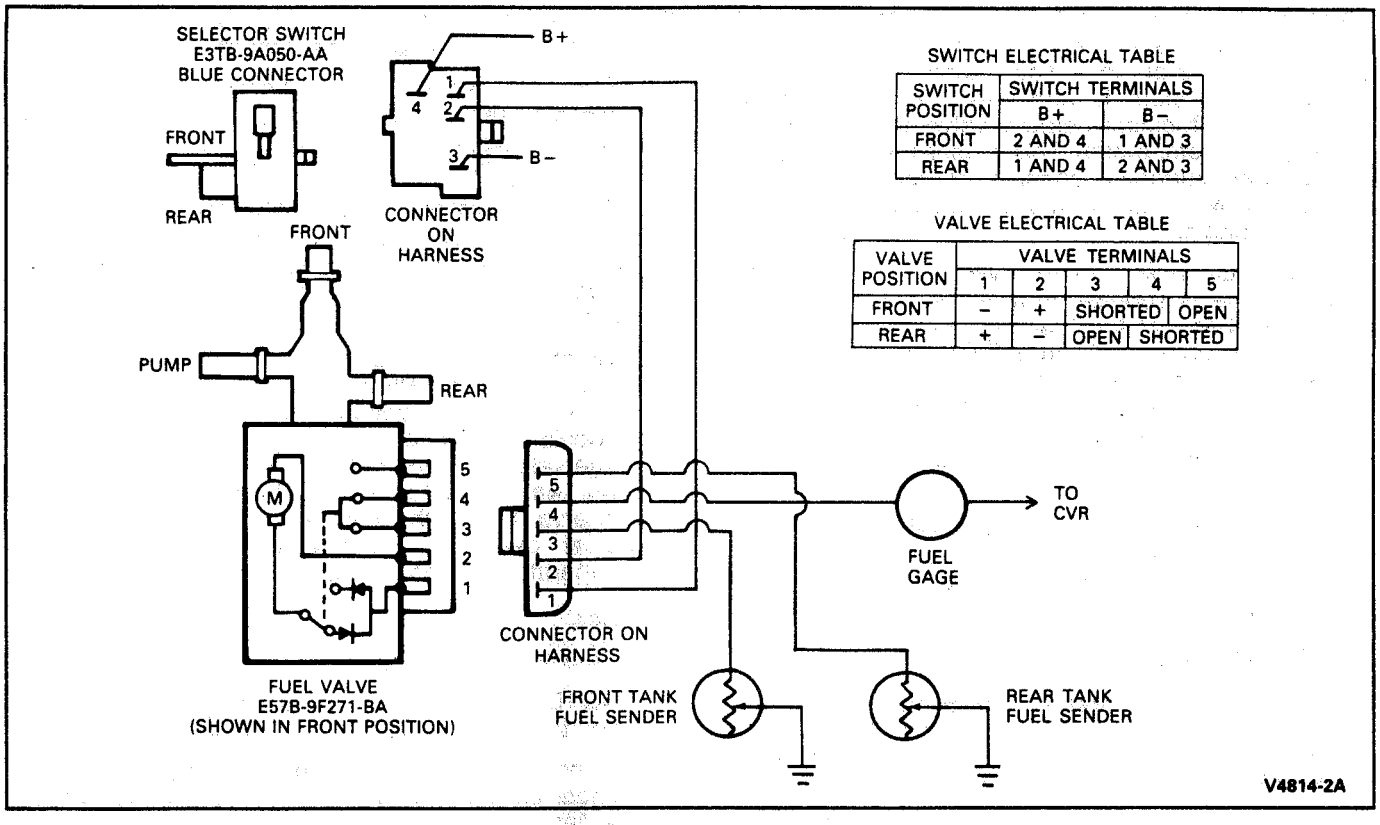
DIAGNOSIS

Refer to the following diagnosis charts for fuel valve system troubleshooting.

For diagnosis of fuel indicating system problems with fuel selector valve, refer to Fuel Indicating Systems, Section 33-20. For the following diagnostic procedure both tanks must contain some usable fuel.

REMOVAL AND INSTALLATION

NOTE—Torque specifications are included on applicable Figures.



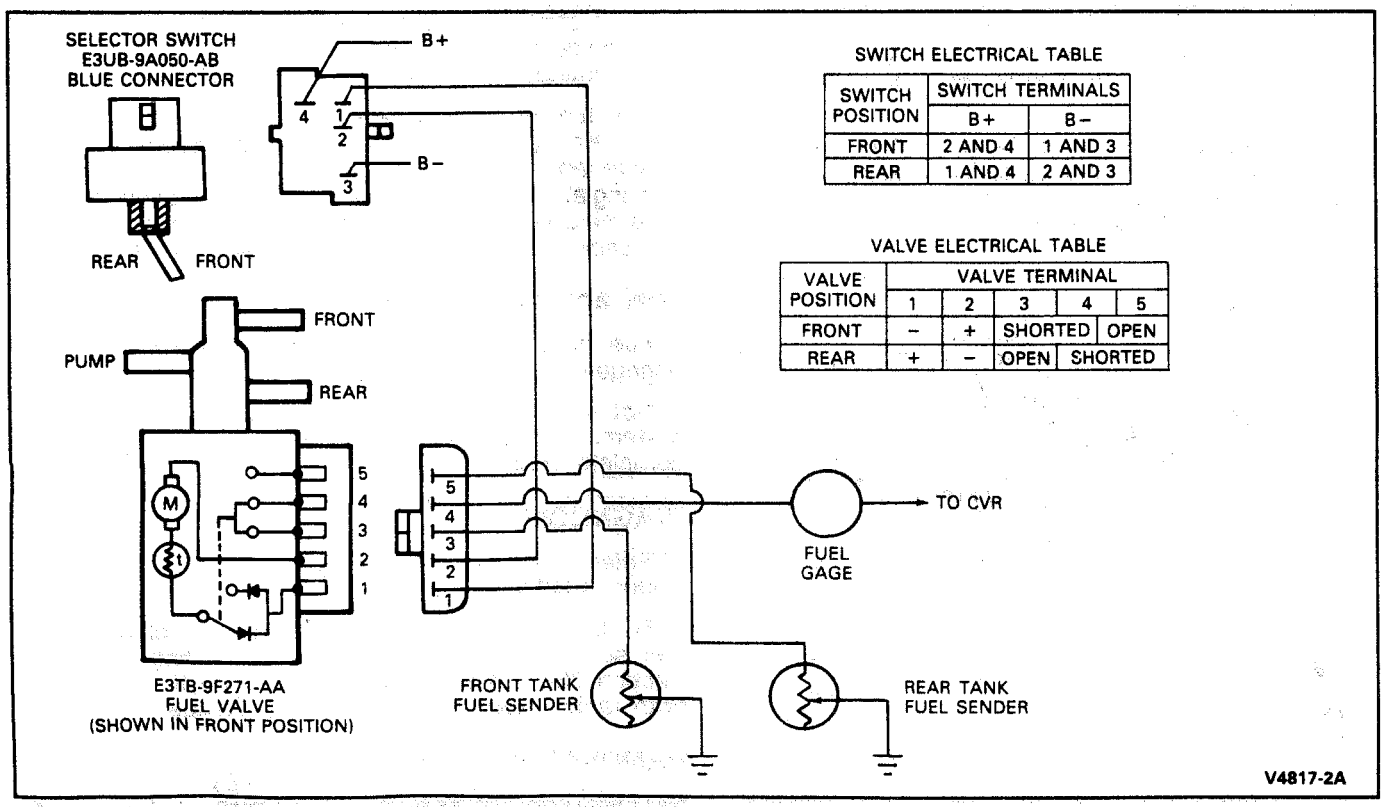
SWITCH ELECTRICAL TABLE

SWITCH POSITION	SWITCH TERMINALS	
	B+	B-
FRONT	2 AND 4	1 AND 3
REAR	1 AND 4	2 AND 3

VALVE ELECTRICAL TABLE

VALVE POSITION	VALVE TERMINALS				
	1	2	3	4	5
FRONT	-	+	SHORTED		OPEN
REAR	+	-	OPEN		SHORTED

FIG. 2 Fuel Tank Selector Valve Wiring Diagram—F-250—F-350



SWITCH ELECTRICAL TABLE

SWITCH POSITION	SWITCH TERMINALS	
	B+	B-
FRONT	2 AND 4	1 AND 3
REAR	1 AND 4	2 AND 3

VALVE ELECTRICAL TABLE

VALVE POSITION	VALVE TERMINAL				
	1	2	3	4	5
FRONT	-	+	SHORTED		OPEN
REAR	+	-	OPEN		SHORTED

FIG. 3 Fuel Tank Selector Valve Wiring Diagram—E-250—E-350

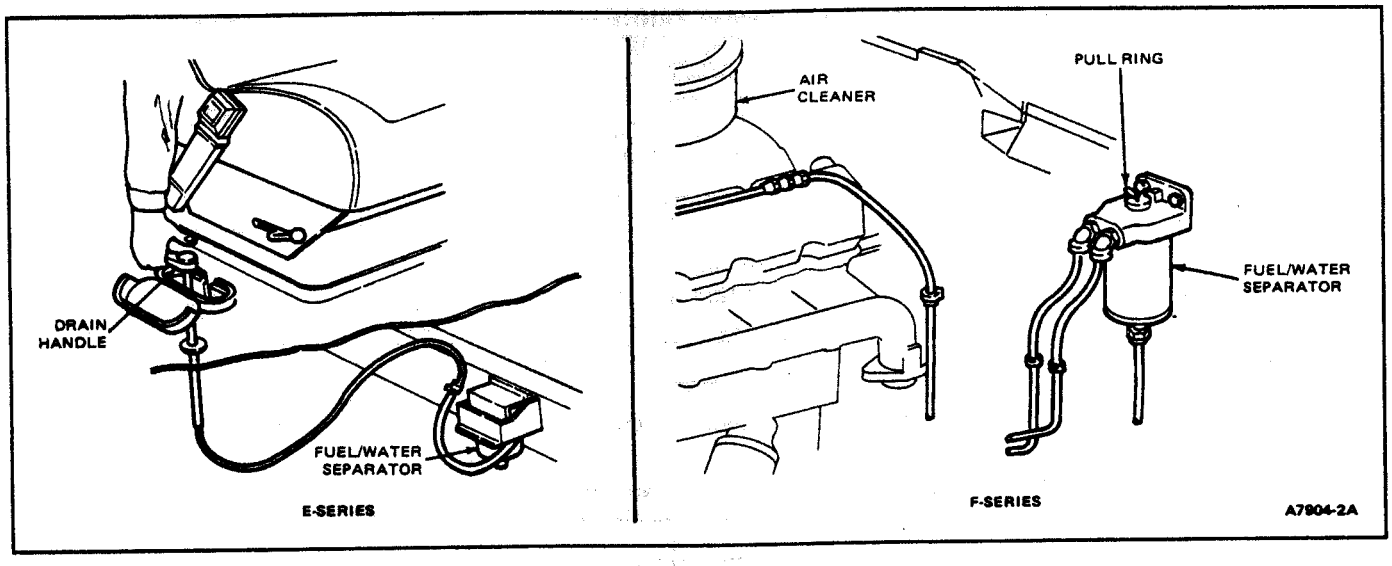


FIG. 4 Fuel/Water Separator—6.9L Diesel Engine

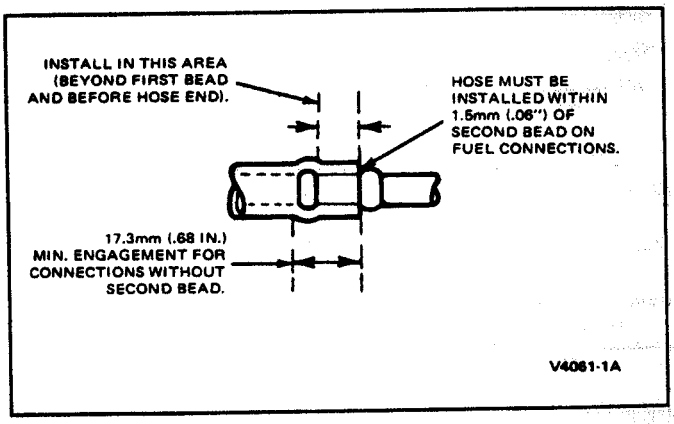


FIG. 5 Fuel and Vapor Hose Connections

Fuel Lines and Hoses

Push Connect Fittings

Push connect fittings are designed with two different retaining clips. The fittings used to connect to 3/8-inch and 5/16-inch nominal diameter metal tubing use a "hairpin" clip, Fig. 6. The fittings used with 1/4-inch nominal diameter metal tubing uses a "duck bill" clip, Fig. 6. Each type of fitting requires different procedures for service.

Disconnect all push connect fittings from components (pump, fitter, engine) prior to component removal. The push connect fittings to connect flexible fuel lines to the fuel tank sender cannot be disconnected until the tank is partially lowered just before removing the fuel tank completely.

5/16 Inch or 3/8 Inch Fittings (Hairpin Clip)

Removal

1. Inspect visible internal portion of fitting for dirt accumulation. If more than a light coating of dust is present, clean the fitting before disassembly.
2. Some adhesion between the seals in the fitting and tubing will occur with time. To separate, twist the fitting on the tube, then push and pull the fitting until it moves freely on the tube.
3. Remove "hairpin" type clip from fitting by first bending the shipping tab downward so that it will clear the body. Next, **(using hands only)** spread the two clip legs about 3.2mm (1/8 inch) each to disengage the body and push the legs into the fitting. Complete removal is accomplished by **lightly** pulling from the triangular end of the clip and working it clear of the tube and fitting.

   CAUTION: Do not use any tools.
4. Grasp the fitting and hose assembly and pull in an axial direction to remove the fitting from the steel tube.
5. When fitting is removed from the tube end, inspect the fitting and tube for any internal parts that may have been dislodged from the fitting. Any loose internal parts should be immediately reinstalled, using the mating tube to insert the parts.

Installation

1. It is recommended that the original clip **not** be reused in the fitting. To install the new clip, insert clip into any two adjacent openings with the triangular portion pointing away from the fitting opening. Install clip to fully engage the body (legs of "hairpin" clip locked on outside of body). Piloting with an index finger is necessary.
2. Before reinstalling fitting on the tube, wipe tube end with a clean cloth. Inspect the inside of the fitting to ensure it is free of dirt and/or obstructions.
3. To reinstall the fitting onto the tube, align the fitting and tube axially and push the fitting onto the tube end (Fig. 7). When the fitting is engaged, a definite click will be heard. Pull on fitting to ensure it is fully engaged.

1/4 Inch Fittings (Duck Bill Clip)

Removal

This fitting consists of a body, spacers, O-rings and a "duck bill" retaining clip, Fig. 6. The clip maintains the fitting to steel tube juncture. When disassembly is required for service, one of the two following methods are to be followed:

Preferred Method

To disengage the tube from the fitting, align the slot on push connect disassembly Tool T82L-9500-AH or equivalent with either tab on the clip (90 degrees from

FUEL SELECTOR VALVE DOES NOT CHANGE TANKS — 6.9L DIESEL WITH DUAL TANKS

TEST STEP		RESULT ▶	ACTION TO TAKE
A1	CHECK FOR VOLTAGE		
	• Disconnect electrical connector from tank selector valve. • Turn key to Run position. • Move selector switch to Front position and check for voltage between connector terminals No. 2 and No. 1.	Voltage present ▶ No voltage present ▶	GO to **A2**. GO to **A5**.
A2	CHECK VOLTAGE		
	• Check voltage between terminal No. 2 and ground.	Voltage present ▶ No voltage present ▶	GO to **A3**. GO to **A5**.
A3	CHECK FUEL VALVE MOTOR		
	• Jumper motor terminal No. 2 to battery positive and motor terminal No. 1 to frame ground. • Motor should run. • Reverse jumper leads to motor. • Motor should run in opposite direction.	Motor runs in both directions ▶ Motor does not run in one or both directions ▶	GO to **A6**. REPLACE motor.
A4	CHECK GROUND CIRCUIT		
	• Check for open ground circuit from motor, through switch to ground.	(OK) ▶ (OK) ▶	GO to **A6**. REPAIR ground circuit.
A5	CHECK FUSE		
	• Check for voltage across fuse No. 15 (10 Amp) in fuse panel.	(OK) ▶ (OK) ▶	GO to **A6**. REPAIR short(s) in selector valve circuits as necessary. REPLACE fuse. REPEAT Test Step **A1**.
A6	CHECK SELECTOR SWITCH CONTINUITY		
	• Remove fuel tank selector switch knob and trim bezel. Remove switch mounting screws and disconnect switch from harness connector. • With selector switch in Front position, check for continuity between terminals No. 2 and No. 4 and between terminals No. 1 and No. 3. • Move selector switch in Rear position, and check continuity between terminals No. 1 and No. 4 and between terminals No. 2 and No. 3.	(OK) ▶ (OK) ▶	GO to **A7**. REPLACE fuel selector switch.

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FUEL SELECTOR VALVE DOES NOT CHANGE TANKS — 6.9L DIESEL WITH DUAL TANKS (Continued)

	TEST STEP	RESULT	ACTION TO TAKE
A7	CHECK CONTINUITY OF CIRCUITS 974 and 674		
	• Check continuity of circuits 974 (orange) and 674 (brown/white) between selector switch and selector valve.	OK ▶	GO to **A8**.
		~~OK~~ ▶	REPAIR open circuit(s) as necessary.
A8	CHECK FOR FUEL FLOW FROM FRONT TANK		
	• Turn key to Run position. • Move selector switch to Front position and turn key OFF. • Pinch off fuel supply line from rear tank to selector valve with a suitable tool. • Remove vacuum purge valve from fuel filter adapter. • Install adapter 3019 from Rotunda Pressure Test Kit 019-00002, or equivalent (Figure 10). • Start engine and let idle with no load. • Open clamp on sample hose, allowing fuel to flow into a suitable container. • Check for solid, continuous flow of fuel.	OK ▶	REMOVE clamping tool from rear supply line. GO to **A11**.
		~~OK~~ ▶	GO to **A9**.
A9	BY-PASS FUEL SELECTOR VALVE		
	• Disconnect the supply hose to the engine at the selector valve. • Disconnect the supply hose from the front tank at the selector valve. • Connect the two hoses together using a suitable length of fuel line and repeat Test Step **A8**.	OK ▶	REPLACE fuel selector valve.
		~~OK~~ ▶	GO to **A10**.
A10	CHECK SYSTEM FOR RESTRICTIONS		
	• Check front fuel tank sender, sedimentor, fuel filter and fuel lines for kinks or restrictions.	OK ▶	CHECK fuel tank for sufficient amount of fuel. REPEAT Test Step **A8**.
		~~OK~~ ▶	CLEAN, REPAIR or REPLACE components as necessary. REPEAT Test Step **A8**.
A11	CHECK FUEL FLOW FROM REAR TANK		
	• Turn key to Run position. • Move selector switch to Rear position and turn key OFF • Pinch off fuel supply line from front tank to selector valve with a suitable tool. • Remove vacuum purge valve from fuel filter adapter. • Install adapter 3019 from Rotunda Pressure Test Kit 019-00002, or equivalent (Figure 10). • Start engine and let idle with no load. • Open clamp on sample hose, allowing fuel to flow into a suitable container. • Check for solid, continuous flow of fuel.	OK ▶	Fuel supply system OK. CONNECT fuel line to fuel injection pump. REMOVE clamping tool from front tank supply line. GO to Test Step **B1**.
		~~OK~~ ▶	GO to **A12**.

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FUEL SELECTOR VALVE DOES NOT CHANGE TANKS — 6.9L DIESEL WITH DUAL TANKS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A12	BY-PASS FUEL SELECTOR VALVE		
• Disconnect the supply hose to the engine at the selector valve. • Disconnect the supply hose from the rear tank at the selector valve. • Connect the two hoses together using a suitable length of fuel line and repeat Test Step **A8**.		(OK) ▶ (OK) ▶	REPLACE fuel selector valve. GO to **A13**.
A13	CHECK SYSTEM FOR RESTRICTIONS		
• Check rear fuel tank sender and fuel lines to selector valve for kinks and restrictions.		(OK) ▶ (OK) ▶	CHECK fuel tank for sufficient amount of fuel. REPEAT Test Step **A11**. CLEAN, REPAIR or REPLACE components as necessary. REPEAT Test Step **A11**.

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ENGINE RUNS ROUGH OR FLOODS OUT — ONE TANK POSITION ONLY — 6.9L DIESEL WITH DUAL TANKS

TEST STEP		RESULT	ACTION TO TAKE
B1	CHECK FUEL RETURN TO SELECTOR VALVE		
	• Disconnect fuel return hose from engine at selector valve and insert line into suitable container. • Turn key to Run position and move tank selector switch to problem tank. • Start engine and check for a solid, continuous flow of fuel.	(OK) ▶	TURN engine OFF. CONNECT fuel return line to selector valve. GO to **B2**.
		(OK) ▶	CHECK return line for kinks or restrictions. REPAIR or REPLACE as necessary. REPEAT Test Step **B1**.
B2	CHECK FUEL RETURN TO TANK		
	• Disconnect fuel return line to problem tank from selector valve. • Attach a length of 5/16 inch diameter hose to selector valve return port and insert line into suitable container. • Start engine and check for a solid, continuous flow of fuel.	(OK) ▶	CHECK fuel sender and fuel line to tank for kinks or restrictions. REPAIR or REPLACE as necessary. RUN engine and CHECK for smooth running.
		(OK) ▶	REPLACE fuel valve.

CV4265-2A

the slots on side of fitting) and insert the tool (Fig. 8). This disengages the "duck bill" from the tube. Holding the tool and the tube with one hand, pull fitting away from the tube (Fig. 9).

NOTE: Only moderate effort is required if the tube has been properly disengaged. **Use hands only.**

After disassembly, inspect and clean the tube sealing surface. Also inspect the inside of the fitting and the tube for any internal parts that may have been dislodged from the fitting. Any loose internal parts should be immediately reinstalled, using the mating tube to insert the parts to the retaining clip. If the retaining clip appears to be damaged, replace it.

NOTE: Some fuel tubes have a secondary bead which aligns with the outer surface of the clip. These beads can make tool insertion difficult. If there is extreme difficulty, use the disassembly method described below.

Acceptable Method

This method of disassembly disengages the retaining clip from the fitting body.

Use with a pair of narrow pliers, (6-inch channel lock pliers are ideal). The pliers must have a jaw width of 5mm (0.2 inch) or less.

Align the jaws of the pliers with the openings in the side of the fitting case and compress the portion of the retaining clip that engages the fitting case. This disengages the retaining clip from the case (often one side of the clip will disengage before the other. It is necessary to disengage the clip from both openings). Pull the fitting off the tube.

NOTE: Only moderate effort is required if the retaining clip has been properly disengaged. **Use hands only.**

The retaining clip will remain on the tube. Disengage the clip from the tube bead and remove.

Installation

1. It is recommended that the retaining clip **not** be reused. Install the new replacement clip into the body by inserting one of the retaining clip serrated edges on the duck bill portion into one of the window openings. Push on the other side until the clip snaps into place.
2. Before reinstalling fitting on the tube, wipe tube end with a clean cloth. Inspect the inside of the fitting to ensure it is free of dirt and/or obstructions.
3. To reinstall the fitting onto the tube, align the fitting and tube axially and push the fitting onto the tube end (Fig. 7). When the fitting is engaged, a definite click will be heard. Pull on fitting to ensure it is fully engaged.

Fuel Lines—Steel

Conventional Fuel System

With the exception of the pump-to-carburetor fuel supply tubes, the various fuel lines are not serviced as assemblies. They must be cut, squared and formed out of rolls of fuel system service tubing and hose material available at dealerships.

A damaged section of tubing longer than 305mm (12-inches) can be cut out of the existing line and replaced by a comparable service tubing section, spliced into the line by means of connecting hoses and retaining clamps. A damaged section of tubing shorter than 305mm (12-inches) can be cut out of the line and replaced by a length of service hose and two retaining clamps.

All replacement hoses must be cut to a length that will assure proper clamp retention beyond the flared ends of the connecting tubing.

Removal

1. Drain the fuel from the tank.

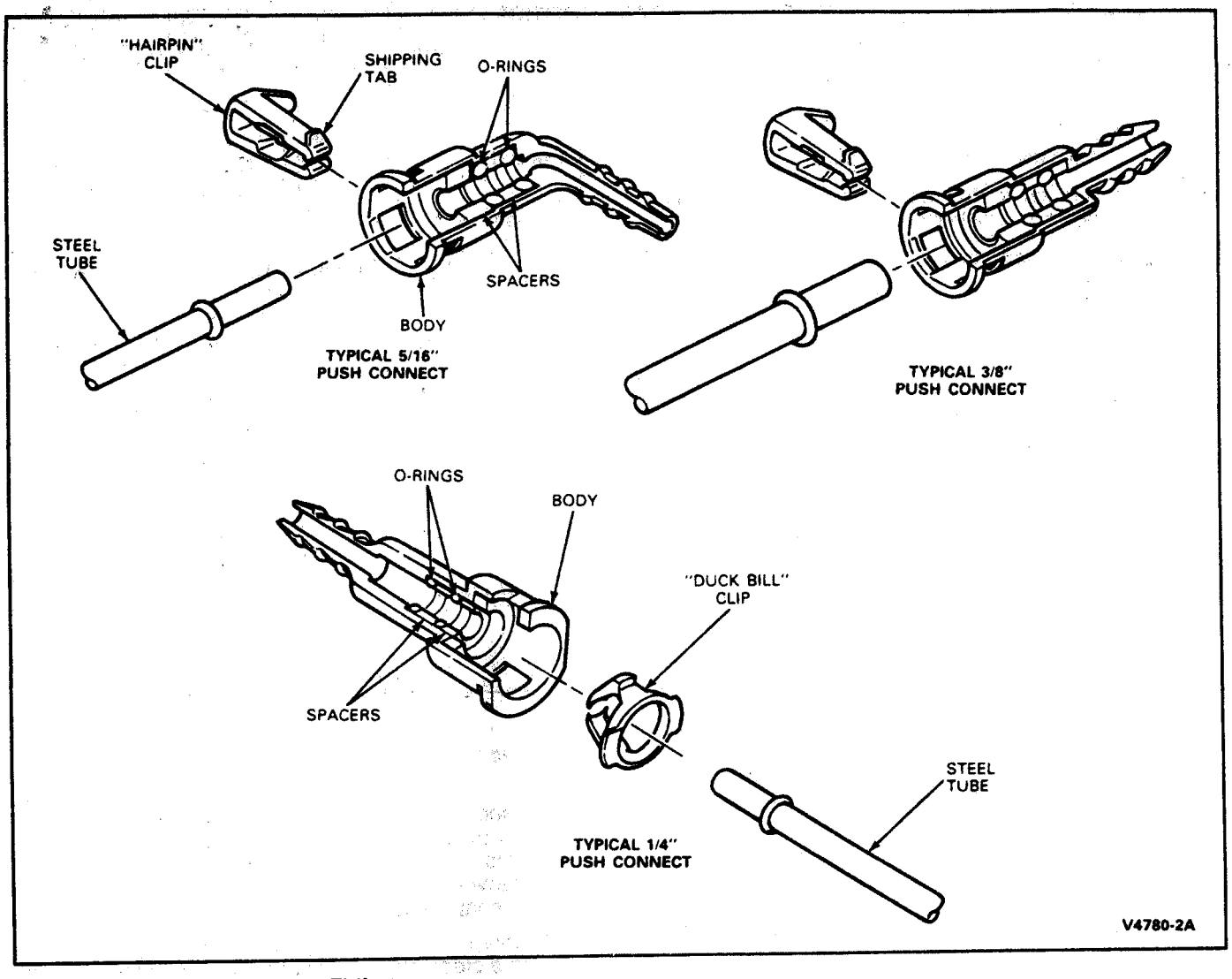

FIG. 6 Typical Push Connect Fittings

2. Disconnect the line at the fuel gauge sender unit at the fuel pump. Remove the lines from the holding clips along the underbody, remove all damaged hose section and tube sections.

Installation

1. Cut a new section of tubing to approximately the same length as the section to be replaced. Allow extra length for flaring the ends of the tubing. Square the ends of the cut tubing with a file.
2. Ream the inside edges of the cut tubing with the reamer blade on the tube cutter. Be sure metal chips are removed from inside the tube(s). Double flare the ends of the cut tubing, as required.
3. Bend the tube section to conform to the contour of the original tube. Cut an ample length of hose to form a coupling between the flared ends of the fuel lines. Connect the hose couplings to the tubing and install the retaining clamps.
4. Position the lines in the underbody clips and tighten the clips. Connect the line to the fuel gauge sender unit and the fuel pump. Fill the tank and check for leaks.

Fuel Tubes—Plastic

CAUTION: Ford approved nylon fuel tubing is made from material which has been tested and proven to be acceptable for use with commercially available fuels. It is also resistant to most environmental conditions. Avoid using alternate tubing materials. Use of non-approved tubing could pose a hazard in service.

CAUTION: Plastic fuel tube must not be repaired using hose and hose clamps. Push connect fittings cannot be repaired except to replace the retaining clips. Should the plastic tubes, push connect fittings or steel tube ends become damaged and leak, approved service parts shown in Fig. 31 must be used to service the fuel lines.

The 6.9L diesel engine, on F-250—F-350 vehicles, uses flexible fuel supply and return lines. These nylon lines replace the conventional steel tubing. The individual tubes are taped together by the manufacturer and are supplied as an assembly. The plastic fuel tube assembly is secured to the body rails with nylon wrap-around clips and push-in pins. The tubes are secured to the floor pan with pop-rivet clips or wrap-around clips and screws. The clips are located along the tube assembly by upsets on the fuel tube. In addition to locating the clips, these upsets prevent the tubes from sliding through the clips after they have been installed on the vehicle.

CAUTION: The plastic fuel lines can be damaged by torches, welding sparks, grinding and other operations which involve heat and high

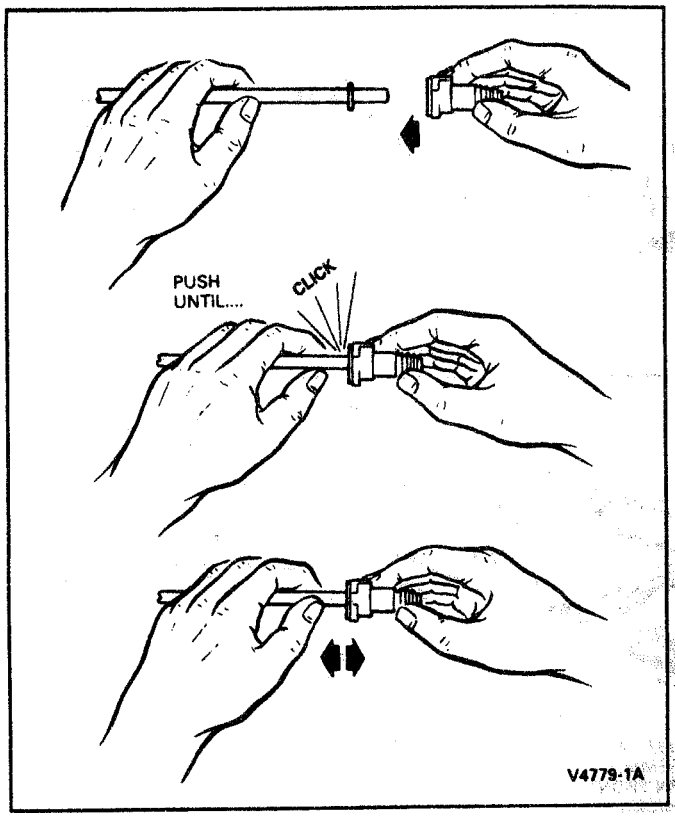

FIG. 7 Connecting "Push Connect" Fittings

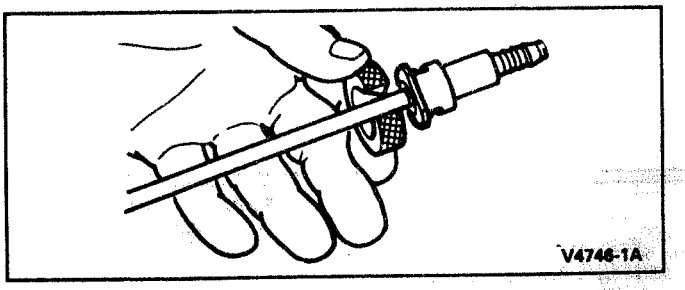

FIG. 8 Removal Using Push Connect Disconnect Tool

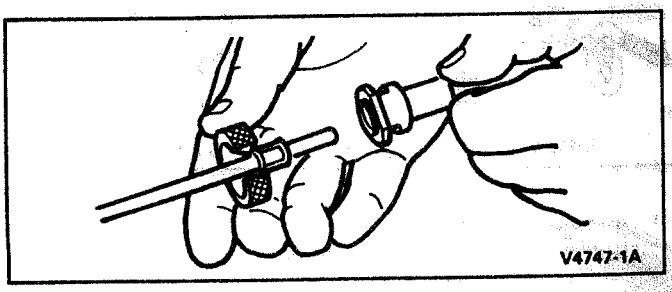

FIG. 9 Pulling Off Push Connect Fitting

temperatures. If any repair or service operation will be used which involves heat and high temperatures locate all fuel system components, especially the plastic fuel lines to be certain they will not be damaged. It is recommended that the plastic fuel tubes be removed from the vehicle if a torch or high heat producing equipment is to be used for service in the following areas:

1. Exhaust or suspension components in proximity to fuel tubes.
2. Underbody frames, rails and crossmembers, (right side).
3. Firewall or dash panel; under vehicle or inside the passenger compartment, (lower right side).
4. Front or rear wheel house/fender apron, (right side).

Fuel Tanks

F-250—F-350

Aft-Of-Axle Fuel Tank

Fuel tank installations are shown in Figs. 20 and 21.

Removal

1. Raise the rear of the vehicle.
2. To avoid electrical sparking at the tank, disconnect the ground cables on both batteries. Then disconnect the fuel gauge sending unit wire at the fuel tank.
3. On vehicles with dual tanks disconnect the ground wire after both tanks have been drained. Siphon the fuel from the tank into a suitable container at the hose between the fuel pump and the fuel tube.
4. Loosen the fuel line hose clamps, slide the clamps forward and disconnect the fuel line at the fuel gauge sending unit.
5. If the fuel gauge sending unit is to be removed, turn the unit retaining ring counterclockwise and remove the sending unit, retaining ring and gasket.
6. Loosen the clamps on the fuel filler pipe as necessary and disconnect the filler pipe hose and vent hose from the tank.
7. If removing the metal type tank, support the tank and remove the bolts attaching the tank supports to the frame. Carefully lower the tank. Finish removing the filler pipe and filler pipe vent hose if not possible in Step 6. Remove the tank under the vehicle.
8. If removing the plastic type tank, support the tank and remove the bolts attaching the combination skid plate and tank support to the frame. Carefully lower the tank. Complete removing the filler pipe if not possible in Step 6. Remove the skid plate and tank from under the vehicle. Disassemble the skid plate from the tank.

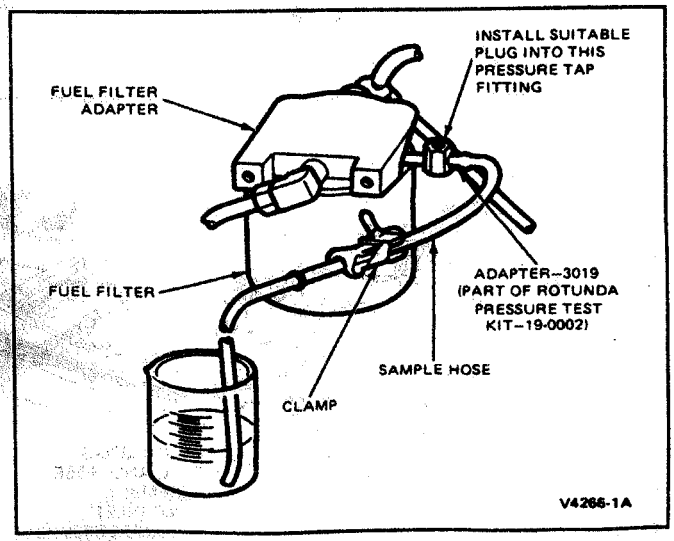

FIG. 10 Fuel System Pumping Capacity Test—Dual Tanks

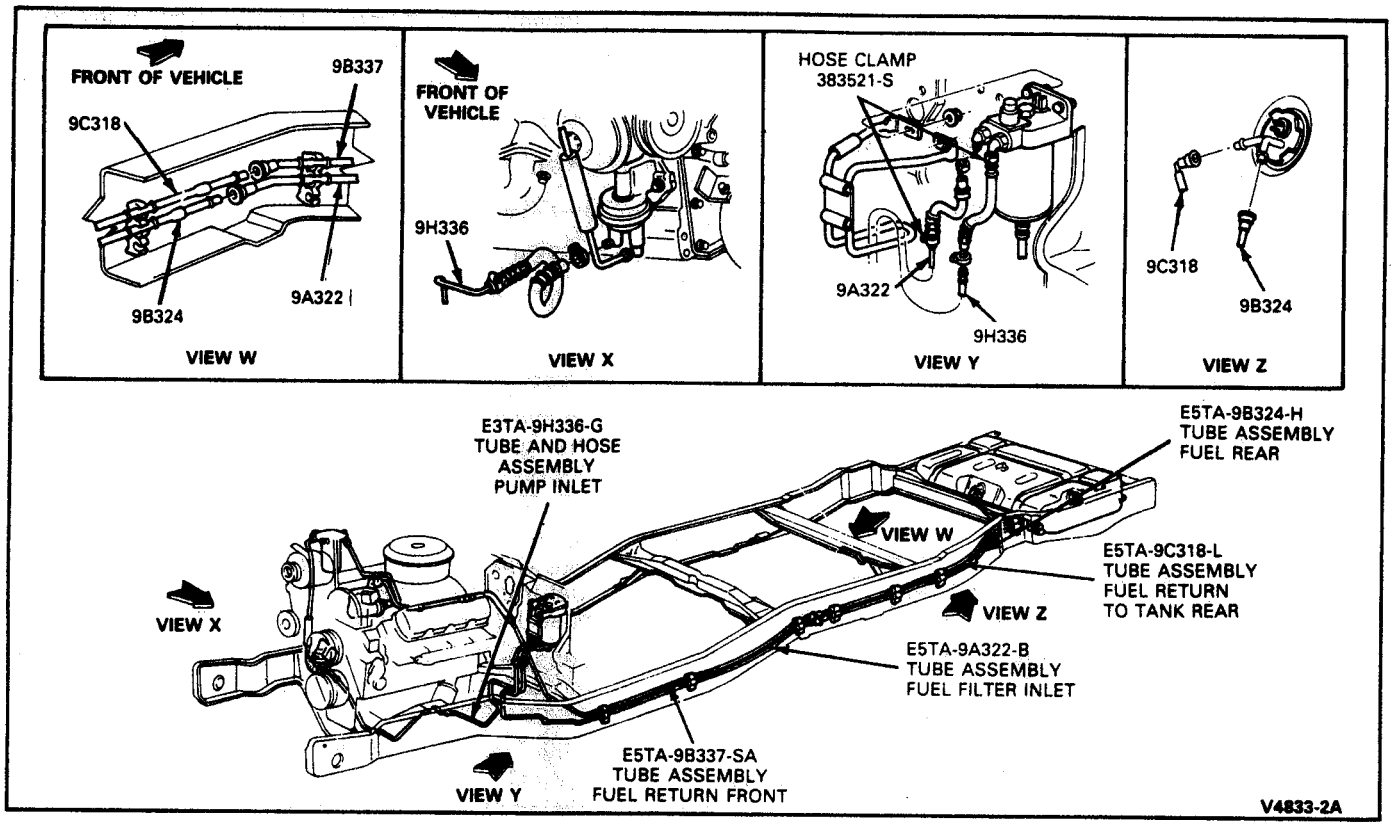

FIG. 11 Fuel Line Installation—Aft Axle Fuel Tank, 133 Inch W.B.—F-150—F-350

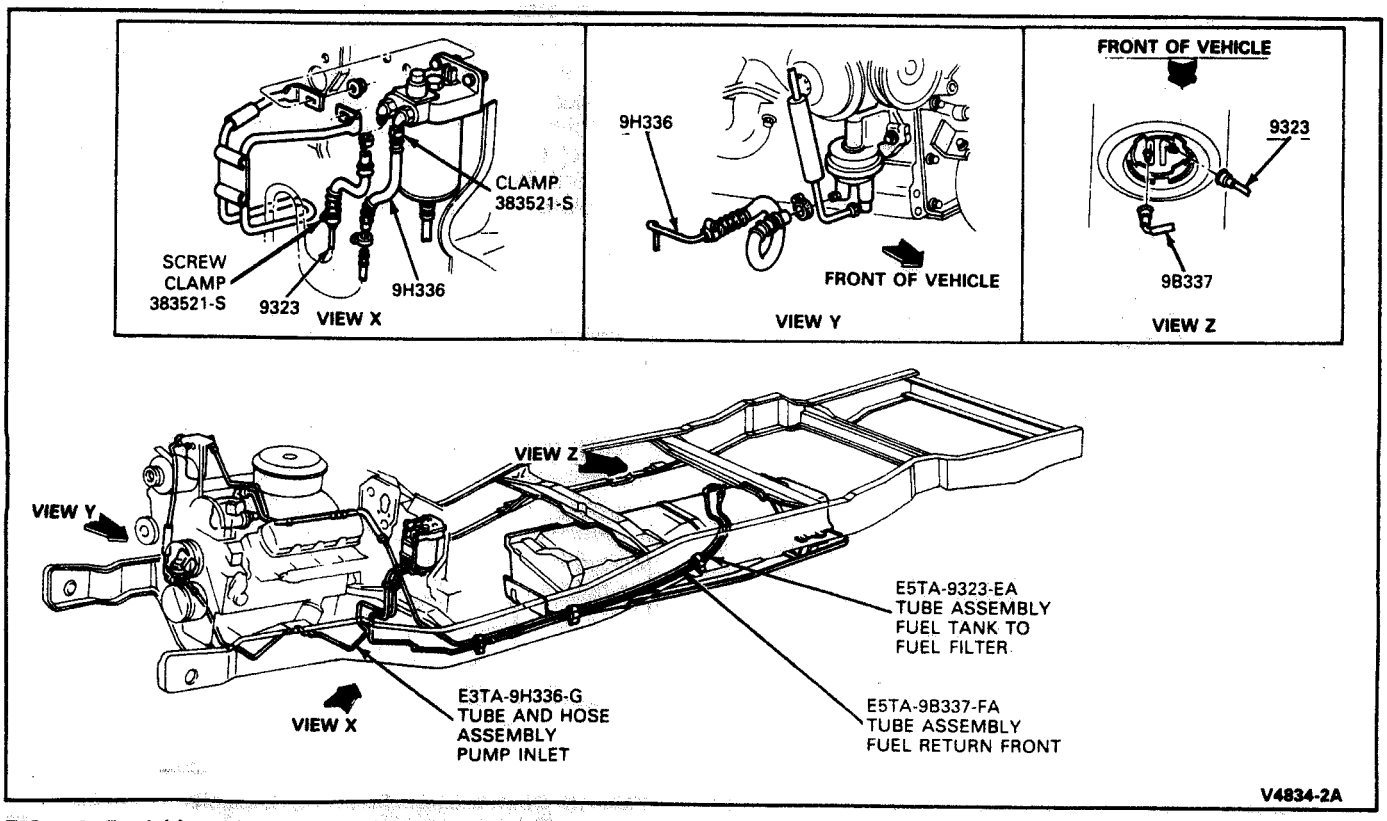

FIG. 12 Fuel Line Installation—Midship Fuel Tank, 133 Inch W.B.—F-150—F-350

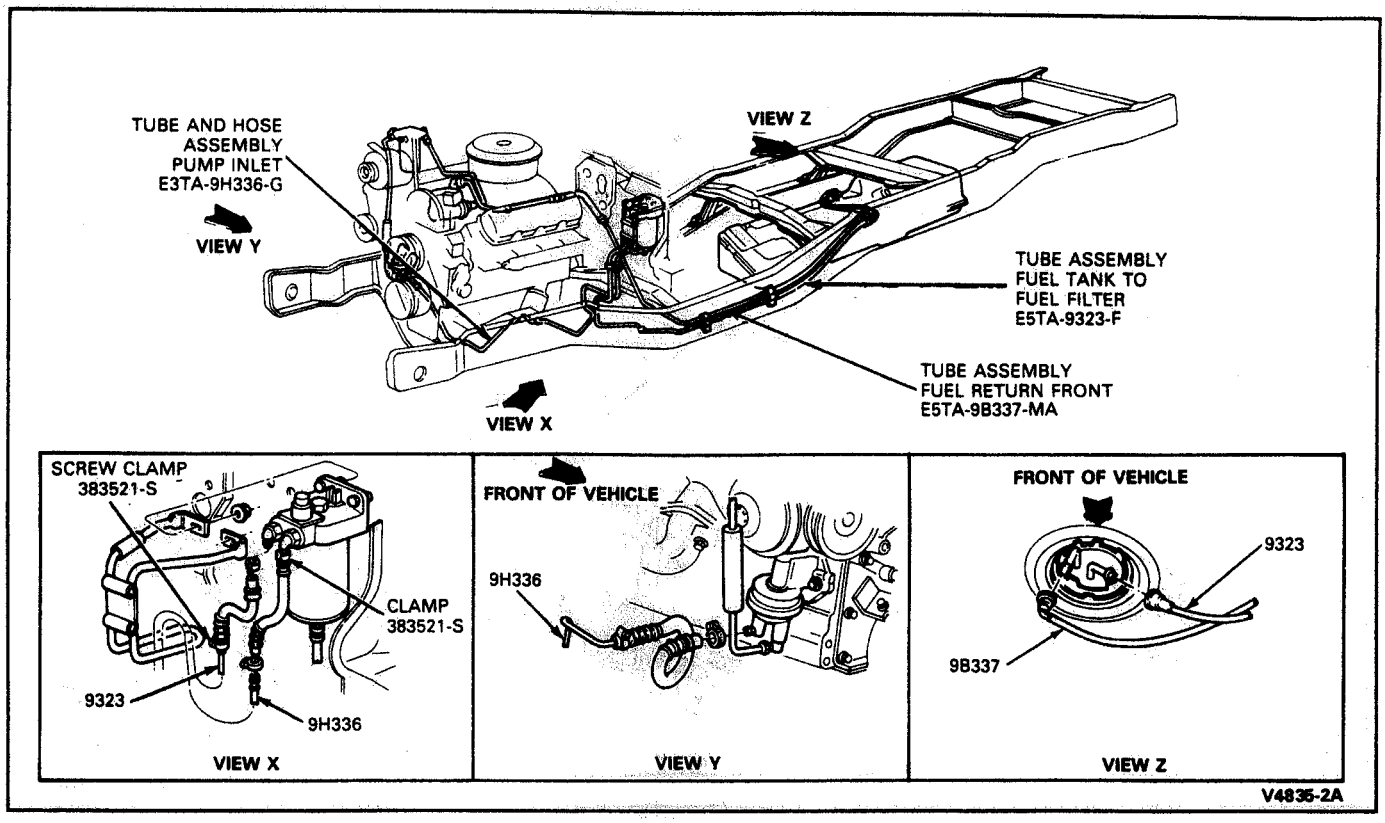

FIG. 13 Fuel Line Installation—Midship Fuel Tank, 137 Inch W.B.—F-150—F-350

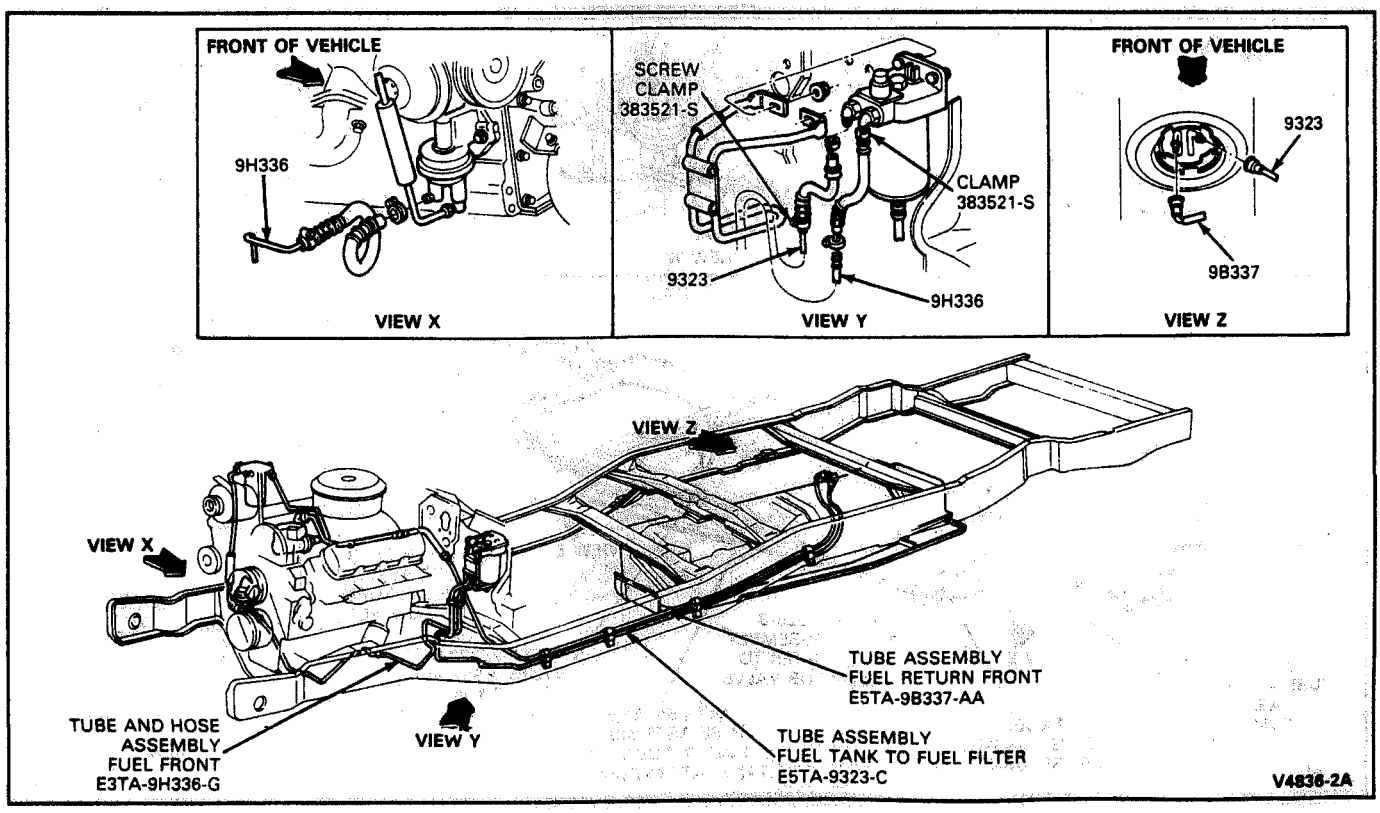

FIG. 14 Fuel Line Installation—Midship Fuel Tank, 155 Inch W.B.—F-150—F-350 Super Cab

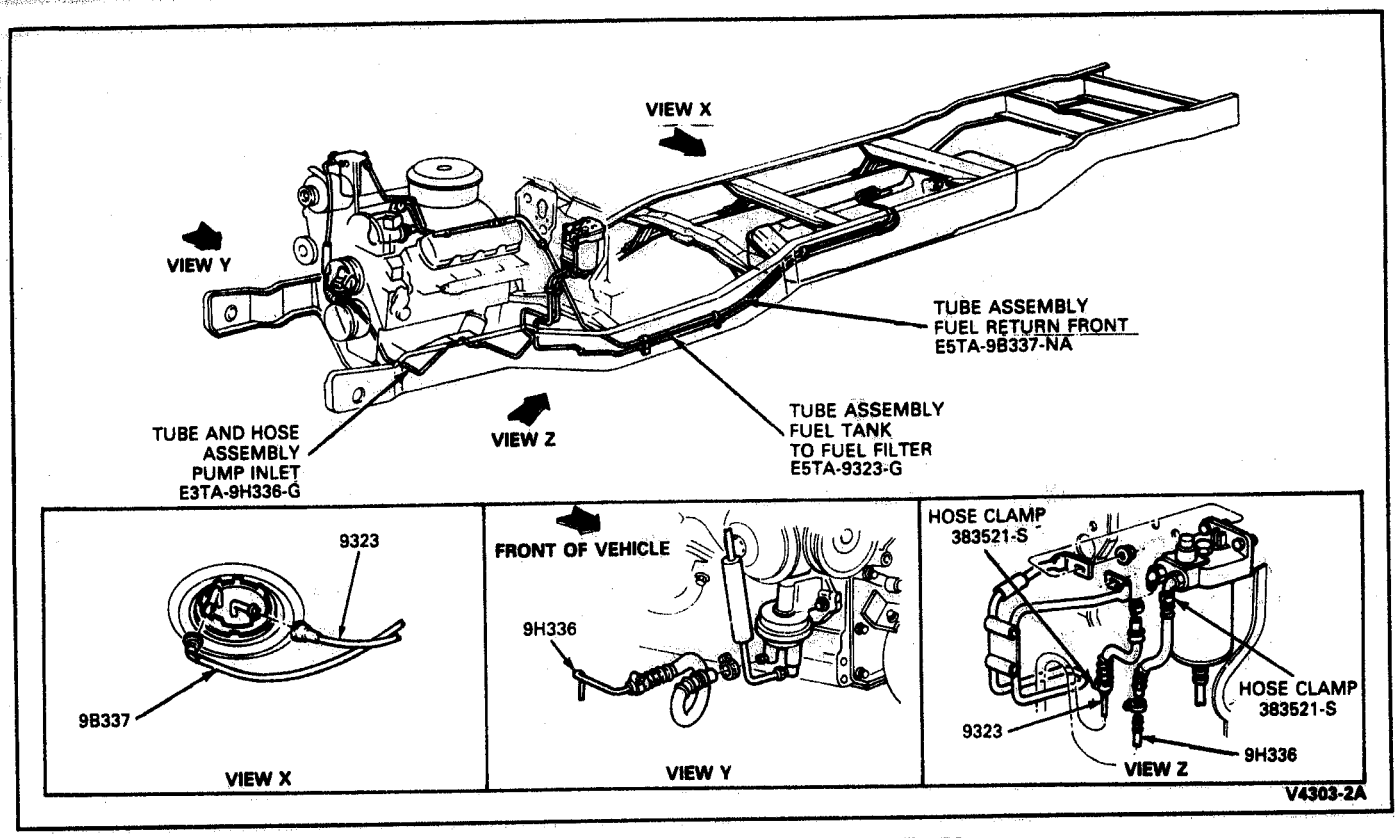

FIG. 15 Fuel Line Installation—Midship Fuel Tank, 161 Inch W.B.—F-150—F-350

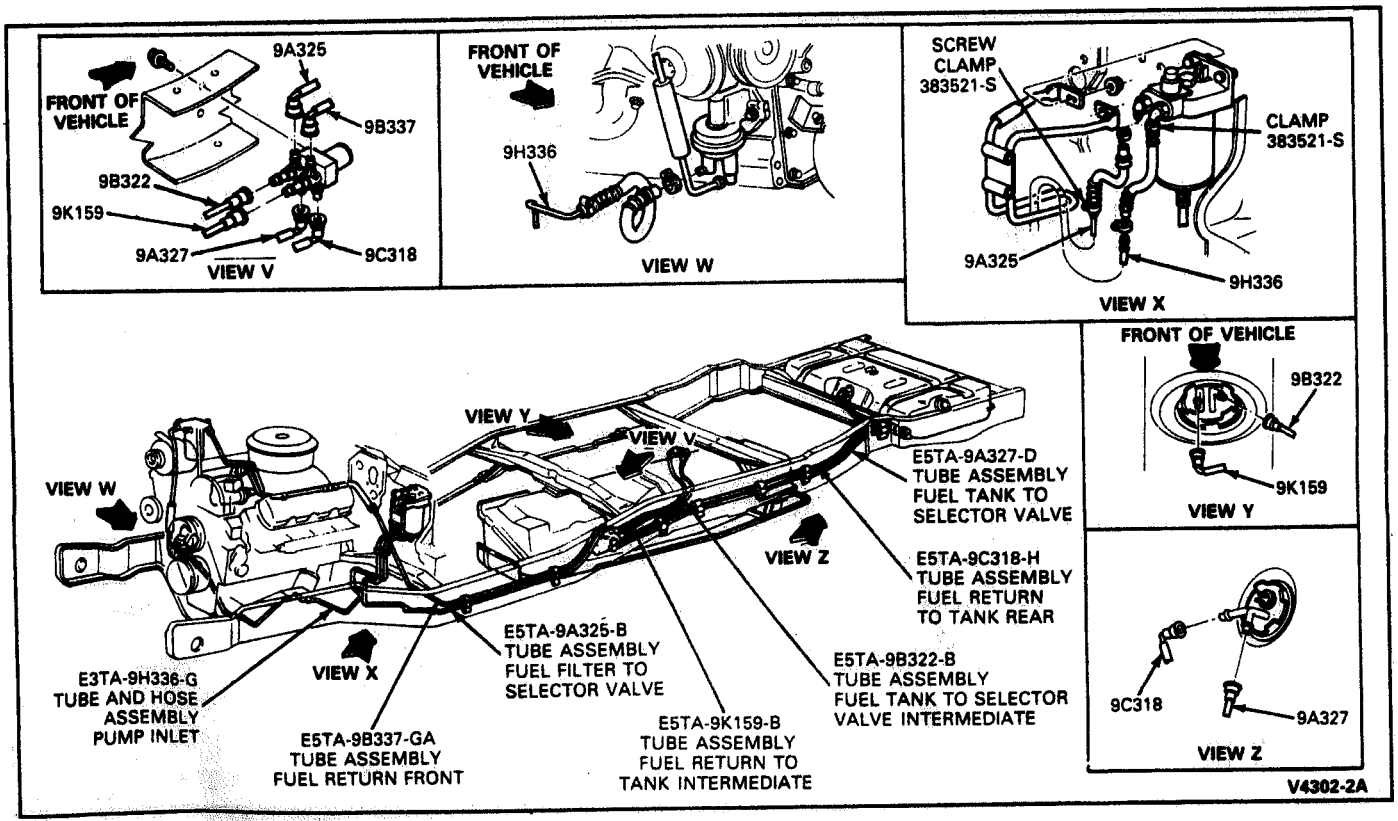

FIG. 16 Fuel Line Installation—Dual Fuel Tanks, 133 Inch W.B.—F-150—F-350

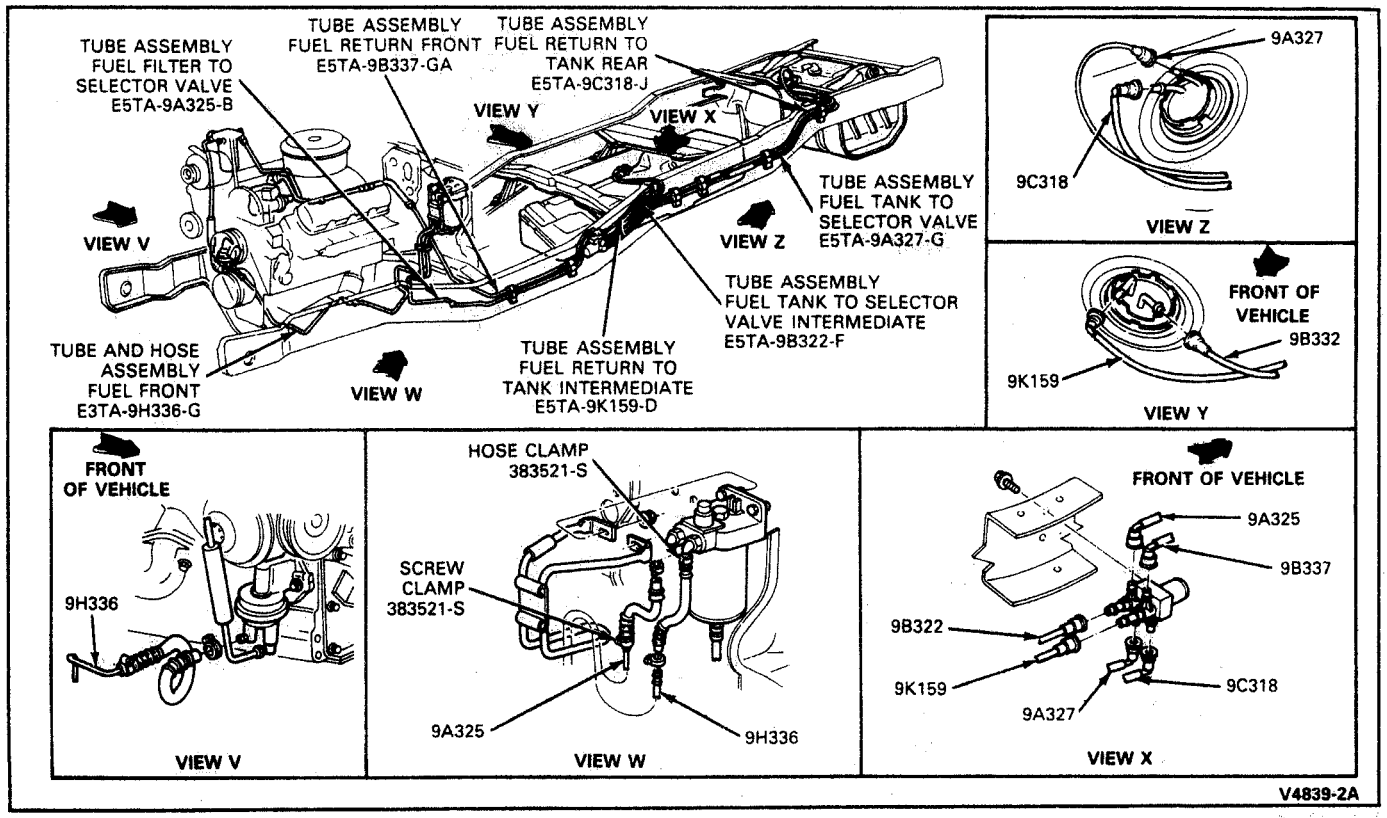

FIG. 17 Fuel Line Installation—Dual Fuel Tanks, 137 Inch W.B.—F-150—F-350

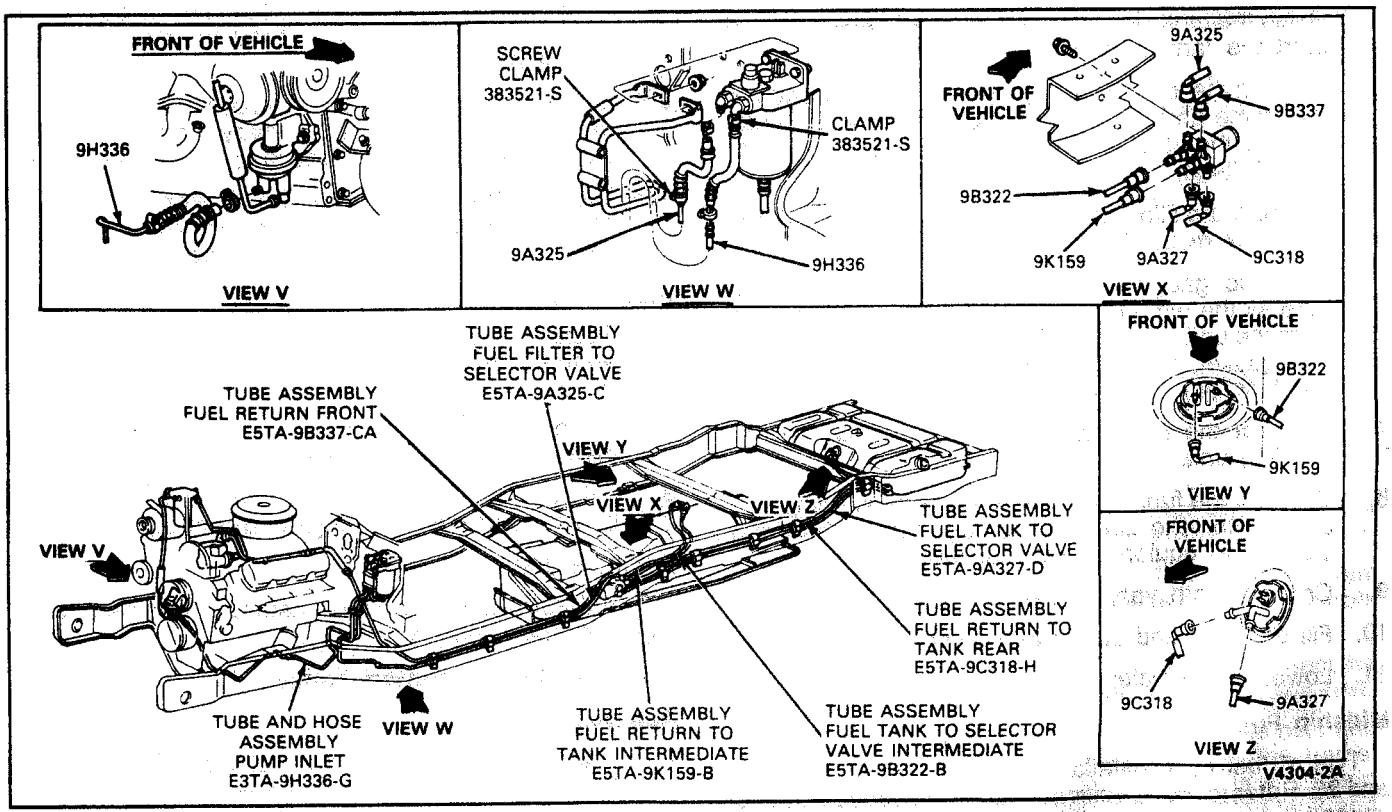

FIG. 18 Fuel Line Installation—Dual Fuel Tanks, 155 Inch W.B.—F-150—F-350 Super Cab

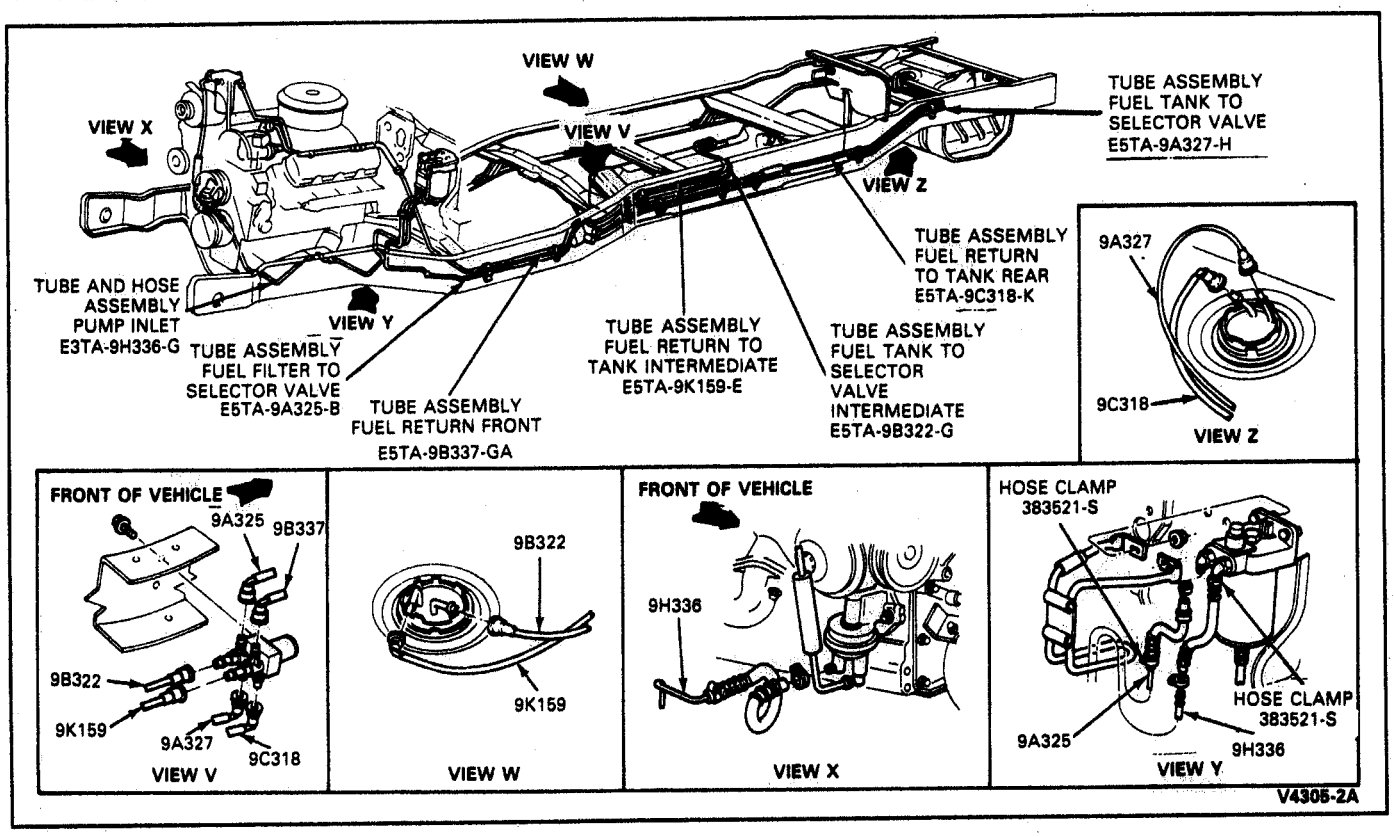

FIG. 19 Fuel Line Installation—Dual Fuel Tanks, 166 Inch W.B.—F-150—F-350

Installation

1. Install new support strap insulation as required.
2. If installing the plastic type tank, preassemble the skid plate and support straps to the tank as shown in Figs. 20 and 21.
3. Raise the tank skid plate and support assembly and start the tank neck into the hose.
4. Position the tank assembly against the top straps or the frame and install the attaching bolts and nuts. Tighten the attaching bolts and nuts to 37-50 N·m (27-37 ft-lbs).
5. Connect the filler pipe hose and tighten the clamps to 3-4 N·m (25-35 in-lbs).
6. If the fuel gauge sending unit was removed, make sure all the old gasket material has been removed from the unit mounting surface on the tank. Using a new gasket, position the fuel gauge sending unit to the fuel tank and secure with the retaining ring.
7. Connect the fuel gauge sending unit wire to the sending unit.
8. Connect the fuel line at the fuel gauge sending unit and tighten the clamps securely. Install the drain plug, if so equipped. Fill fuel tank.
9. Connect both vehicle battery ground cables.
10. Fill the tank and check all connections for leaks.
11. Lower the vehicle.

Midship Fuel Tank

Typical fuel tank installations are shown in Figs. 22 and 23. Refer to the specifications for the capacities and usage.

Removal

1. Drain the fuel into a suitable container by siphoning through the fuel hose at the fuel pump-to-fuel tube connection.
2. To avoid electrical sparking at the tank, disconnect the ground cables on both batteries. Then disconnect the fuel gauge sending unit wire at the fuel tank.
3. On vehicles with dual tanks, disconnect ground wire after draining both tanks. Remove the clamps and disconnect the hoses attached to the fuel tank.
4. Support the tank, remove the nuts and bolts from the retaining straps, and lower tank to floor. Replace any worn or damaged parts.

Installation

1. Position retaining straps around fuel tank and attach bolts and nuts. Tighten to 30-41 N·m (22-30 ft-lbs).
2. Connect the hoses to the tank and tighten the clamps to 3-4 N·m (25-35 in-lbs).
3. Fill tank with fuel, connect both battery ground cables, and start the engine and check for leaks.

E-250, E-350

The E-250—E-350 fuel tank installations are shown in Figs. 24, 24A and 25.

Aft Axle Body Mounted Tanks

Removal

1. Insert a siphon through the fuel filler pipe assembly and drain the fuel into a suitable container.
2. Raise the rear of the vehicle.

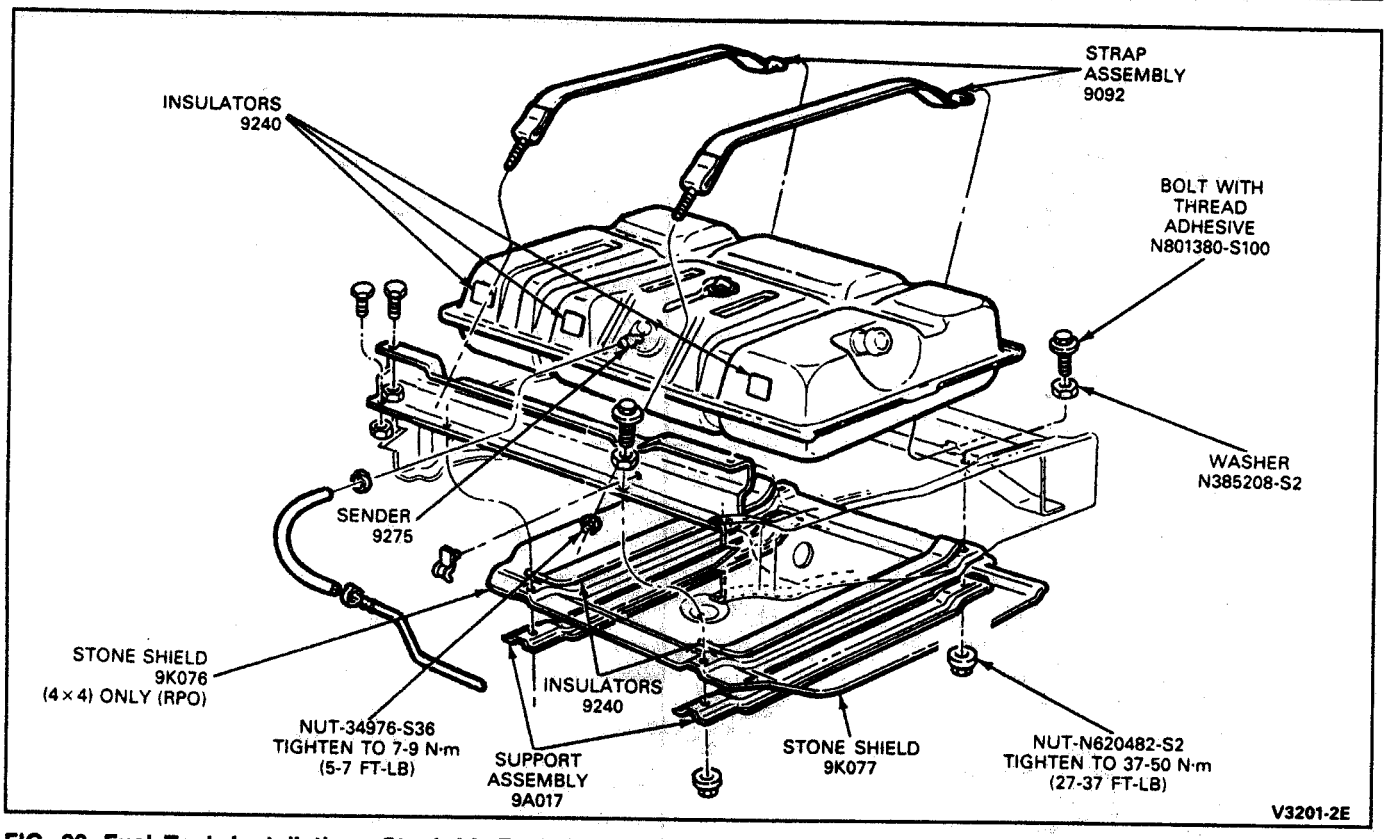

FIG. 20 Fuel Tank Installation—Steel Aft Fuel Tank—F-150—F-350

3. To avoid electrical sparking at the tank, disconnect the ground cable on both vehicle batteries. Then disconnect the fuel gauge sending unit wire at the fuel tank.
4. Loosen the clamps on the fuel filler hose and vent hose at the tank neck. Disconnect the hoses from the tank.
5. Loosen the fuel line hose clamp and disconnect the fuel line hose from the fuel gauge sending unit.
6. Support the tank in position. Remove the nuts that attach the mounting straps to the "T" bolts.

   NOTE: The "T" bolts are attached to body brackets located at the rear of the tank),

   Disengage the straps from the J-bolts and the front body brackets and lower the tank enough to gain access to the vapor valve.
7. Lower the fuel tank and remove it from underneath the vehicle.
8. If the fuel gauge sending unit is to be removed, turn the unit retaining ring counterclockwise and remove the sending unit retaining ring and gasket.
9. If the vapor control valve is to be removed, pull it out of the grommet located in the top of the tank and remove the grommet.

Installation

1. If the fuel gauge sending unit was removed, scrape away the old gasket material from the unit mounting surface on the fuel tank. Using a new gasket, position the fuel gauge sending unit to the fuel tank and secure with the retaining ring.
2. If the vapor control valve was removed, install the grommet in the tank opening and press-fit the valve into place.
3. Attach the front ends of the mounting straps to the front body brackets.
4. Secure the strap ends to the J-bolts with the attaching nuts. Tighten nuts to 10-14 N·m (7-11 ft-lbs).
5. Connect the fuel line hose to the fuel gauge sending unit.
6. Connect the fuel filler hose to the filler neck and vent neck at the tank. Tighten hose clamps to 2.82-3.95 N·m (25-35 in-lbs).
7. Connect both vehicle battery ground cables. Connect the fuel gauge sending unit wire.
8. Fill the tank and check all connections for leaks.

Aft Axle Frame Mounted Tank

Removal

1. Insert a siphon through the fuel filler pipe assembly and drain the fuel into a suitable container.
2. Raise the rear of the vehicle.
3. To avoid electrical sparking at the tank, disconnect both battery ground cables. Then disconnect the fuel gauge sending unit wire at the fuel tank.
4. Loosen the clamps on the fuel filler hose and vent hose at the tank neck. Disconnect the hoses from the tank.
5. Loosen the fuel line hose clamp and disconnect the fuel line hose from the fuel gauge sending unit.
6. Support the tank in position. Remove the nuts and bolts that attach the tank supports to the frame. Disengage the straps from the front tank support and the rear crossmember and lower the tank and remove it from underneath the vehicle.

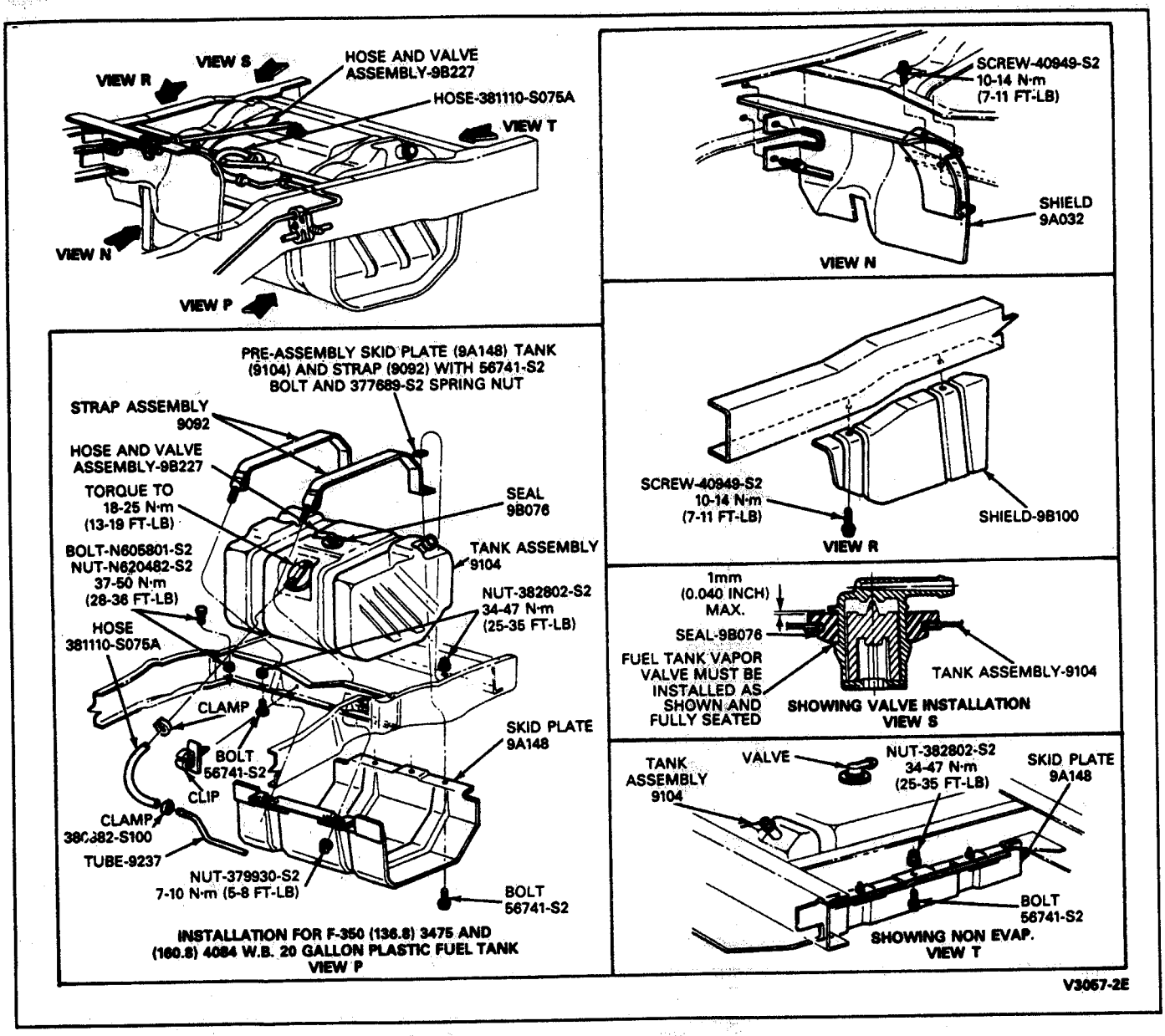

FIG. 21 Fuel Tank Installation—Plastic Aft Fuel Tank—F-150—F-350

7. If the fuel gauge sending unit is to be removed from the unit, turn the unit retaining ring counterclockwise and remove the sending unit, retaining ring and gasket.
8. If the vapor control valve is to be removed, pull it out of the grommet located in the top of the tank, and remove the grommet.

Installation

1. If the fuel gauge sending unit was removed, scrape away all the old gasket material from the unit mounting surfaces on the fuel tank. Using a new gasket, position the fuel gauge sending unit to the fuel tank and secure with the retaining ring.
2. If the vapor valve was removed, install the grommet in the tank opening and press-fit the valve into place.
3. If the insulation pads were worn or damaged, remove the material and install new pads.
4. Attach the mounting straps to the rear crossmember.
5. Position the tank assembly against the top straps and install the support and attaching bolts and nuts. Tighten the nuts to 41-57 N·m (30-42 ft-lbs).
6. Connect the fuel filler hose to the filler neck and vent neck at the tank. Tighten the hoses clamps to 3-4 N·m (25-35 in-lbs).
7. Connect the vehicle battery ground cable removed in Step 3 of the removal procedure. Connect the fuel gauge sending unit wire.
8. Fill the tank and check all connections for leaks.

Midship Tank

Removal

1. Insert a siphon through the fuel filler pipe assembly and drain the fuel into a suitable container.
2. Raise the vehicle.
3. To avoid electrical sparking at the tank, disconnect both the battery ground cables from both vehicle batteries. Then disconnect the fuel gauge sending unit wire at the fuel tank.

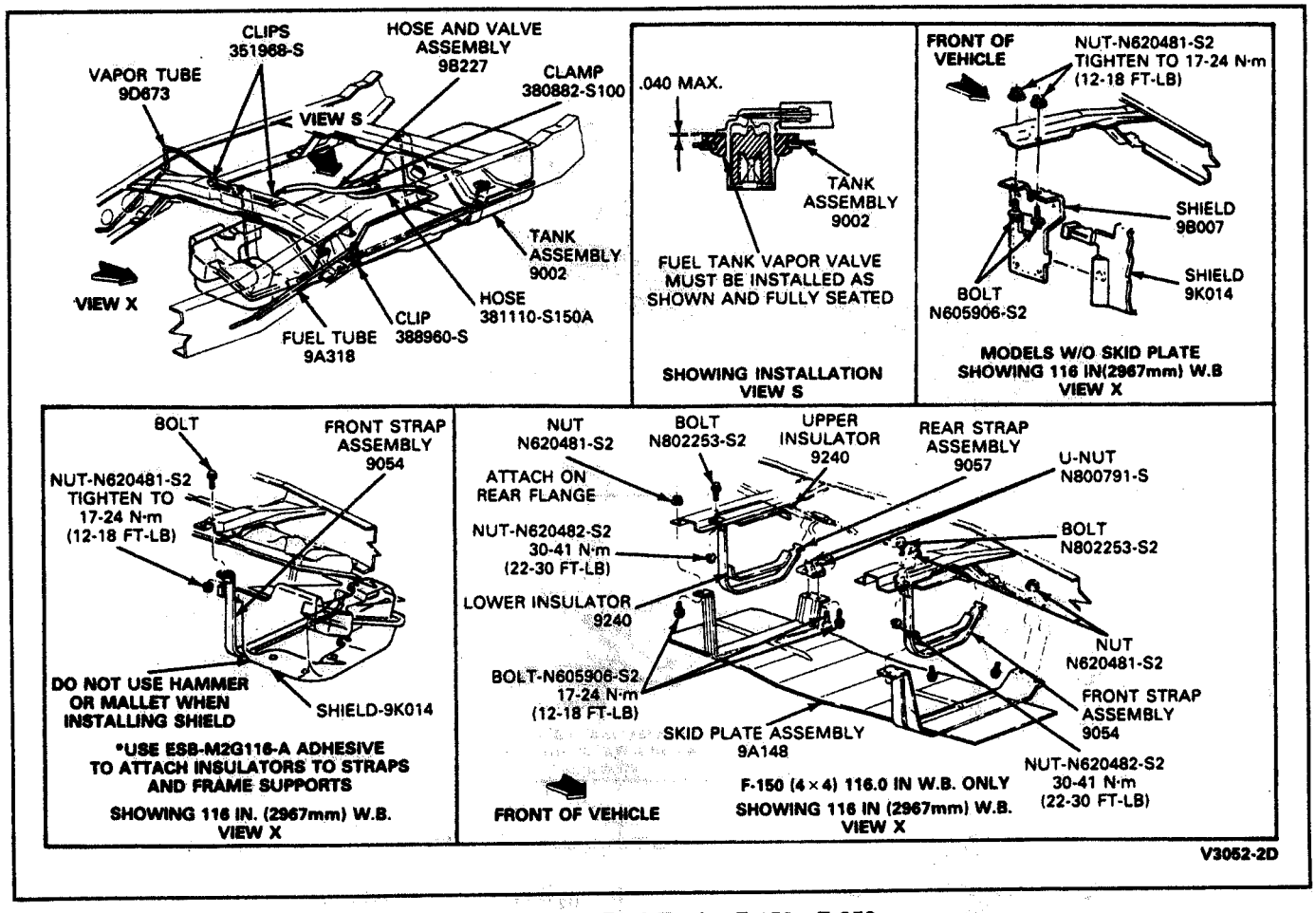

FIG. 22 Fuel Tank Installation—Midship 16.5 Gallon Fuel Tank—F-150—F-350

4. Support the tank in position. Disengage the mounting strap ends attached to the frame side rail. Remove the other end from the tank support by rotating the strap to disengage the "T" shaped hook end.
5. Lower the tank enough to gain access to the fuel filler hose, and fuel line hose. Loosen the attaching clamps and disconnect the hoses.
6. Lower the tank and remove it from underneath the vehicle.
7. If the fuel gauge sending unit is to be removed, turn the retaining ring counterclockwise and remove the sending unit, retaining ring and gasket.
8. If the vapor control valve is to be removed, turn the unit retaining ring counterclockwise and remove the vapor valve, retaining ring and gasket.

Installation

1. If the fuel gauge sending unit was removed, scrape away all the old gasket material from the unit mounting surface on the fuel tank. Using a new gasket, position the fuel gauge sending unit to the fuel tank and secure with the retaining ring.
2. If the vapor valve was removed, install the valve in the tank opening, following the procedure described for the fuel gauge sending unit installation.
3. If the insulation tape was worn or damaged, remove the material and install new pieces approximately 4.19mm (16.5 inches) long, (two pieces).
4. Attach the "T" hook mounting strap ends in the tank supports. Raise the tank high enough and connect the vapor hose, fuel filler hose, fuel vent hose, and fuel line hose. Tighten the clamps that attach the hoses to the mating tank parts.
5. Attach the mounting straps stud end to the frame side rail with attaching nuts and tighten to 1.25-1.50 inch of exposed stud length.
6. Connect the vehicle battery ground cables removed in Step 3 of the removal procedure. Connect the fuel gauge sending unit wire.
7. Fill the tank and check all connections for leaks.

Filler Pipes

F-250—F-350, and E-Series Cutaway and PDV

Procedures are the same for aft axle and midship fuel filler pipes, (Figs. 26, 27 and 28).

Removal

1. Drain fuel to a level (approximately 3/4 full) below the fuel tank filler connection by using the fuel hose at the fuel pump to fuel tube connection.
2. Loosen clamps attaching filler pipe to fuel filler and vent hoses.
3. Detach fuel filler pipe from support bracket and disconnect fuel filler and vent hoses.
4. Remove fuel filler pipe from vehicle.
5. Remove hose and clamps. Replace all damaged or worn parts.

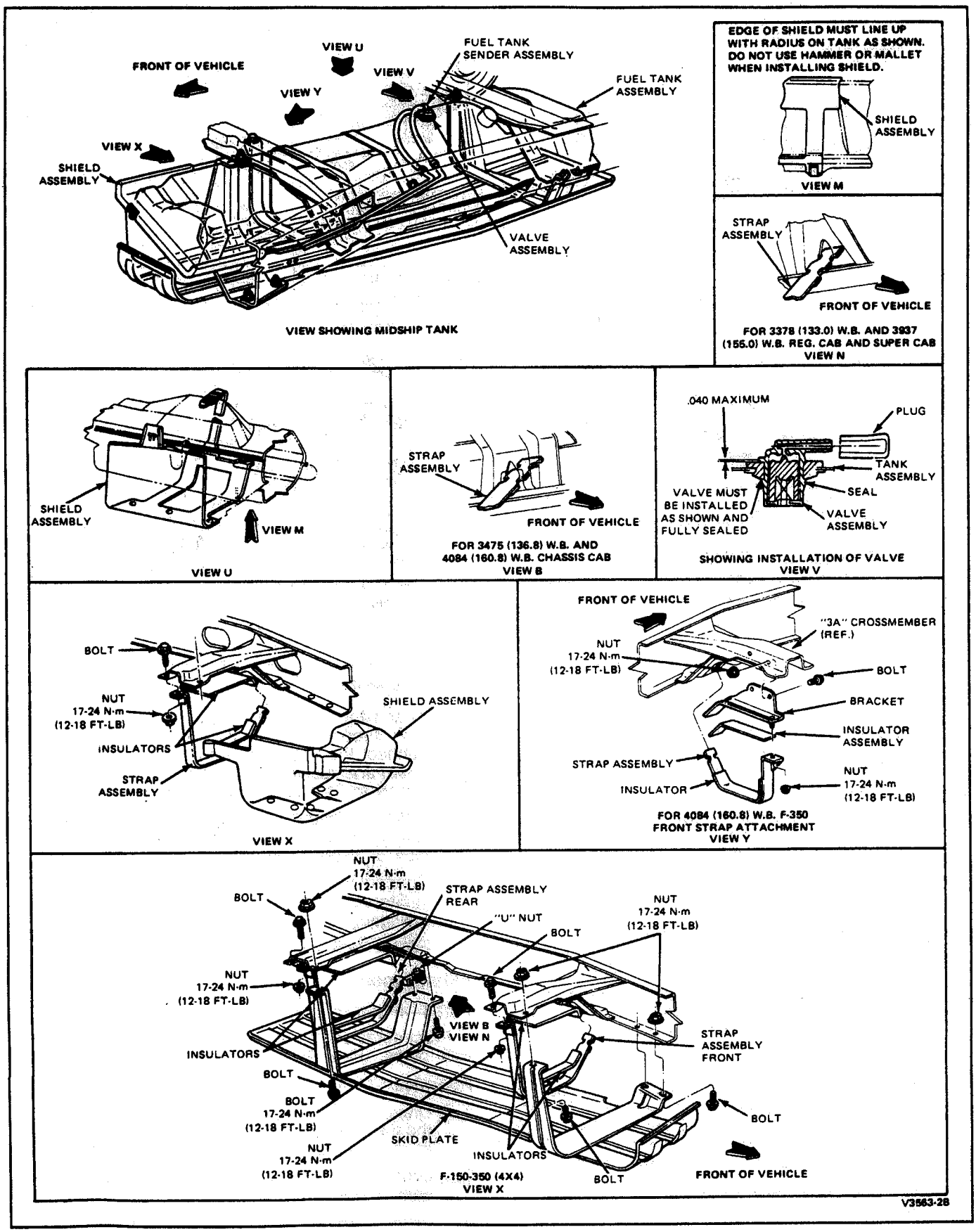

FIG. 23 Fuel Tank Installation—Midship 19 Gallon Fuel Tank—F-150—F-350

Installation

1. Position fuel filler pipe in vehicle.
2. Position clamps and fuel filler vent hoses on filler pipe.
3. Secure fuel filler pipe to mounting brackets.
4. Adjust hose to obtain snug filler pipe installation and tighten hose clamps to 3-4 N·m (25-35 inch lbs.). Make certain clamps are forward of flange on filler pipe to ensure a leakproof connection.
5. Fill tank with fuel. Install filler cap; check for leaks.

E-250—E-350 Vans and Club Wagons

The procedures are the same for both aft axle and midship filler pipe assemblies (Fig. 29).

Removal

1. Insert a siphon through the fuel filler pipe assembly and drain the fuel to a level below the filler pipe.
2. Remove the three retainer screws that attach the filler pipe flange to the body fuel filler pipe housing.

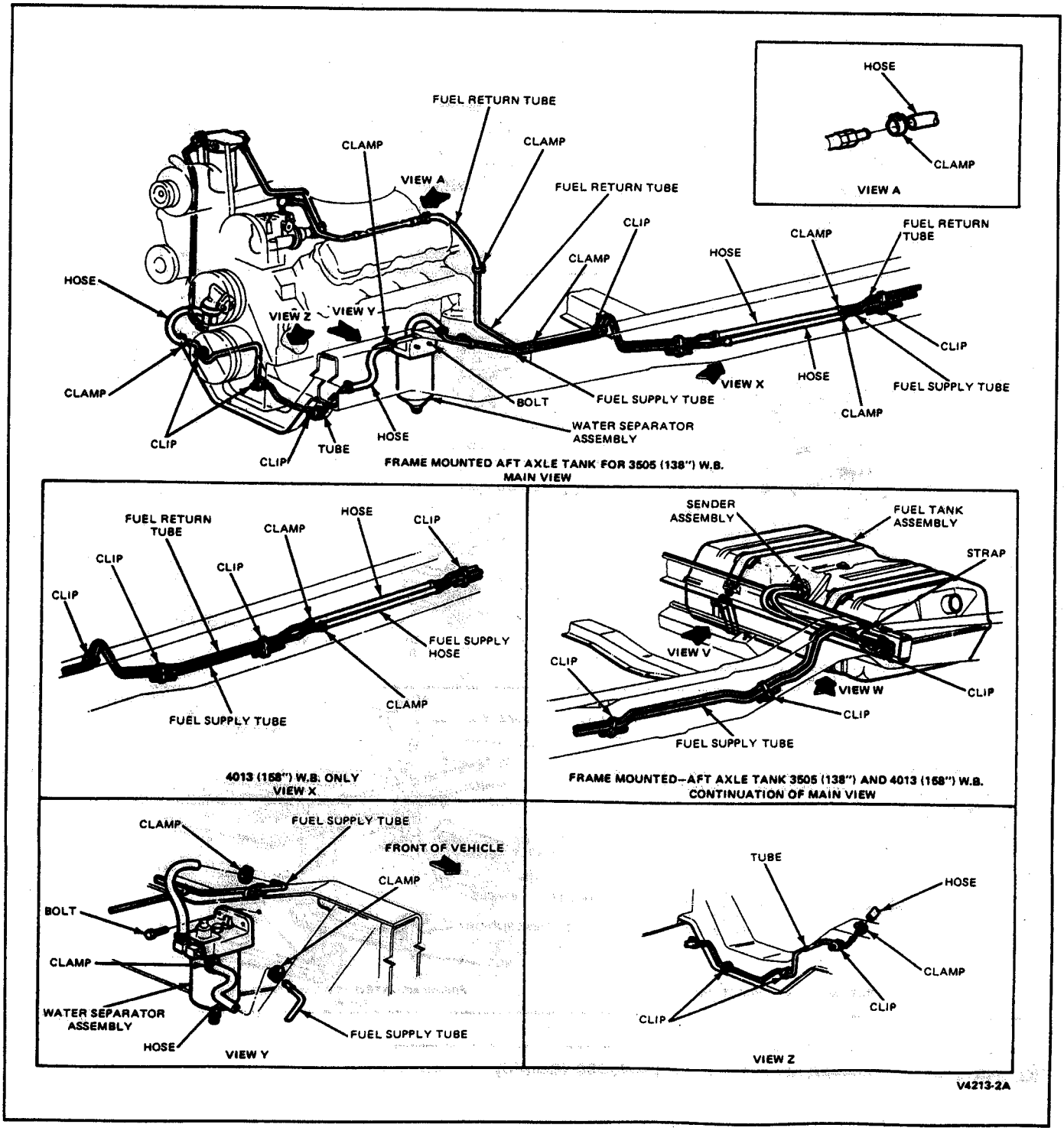

FIG. 24 Fuel System—Aft Axle Tank—E-250—E-350

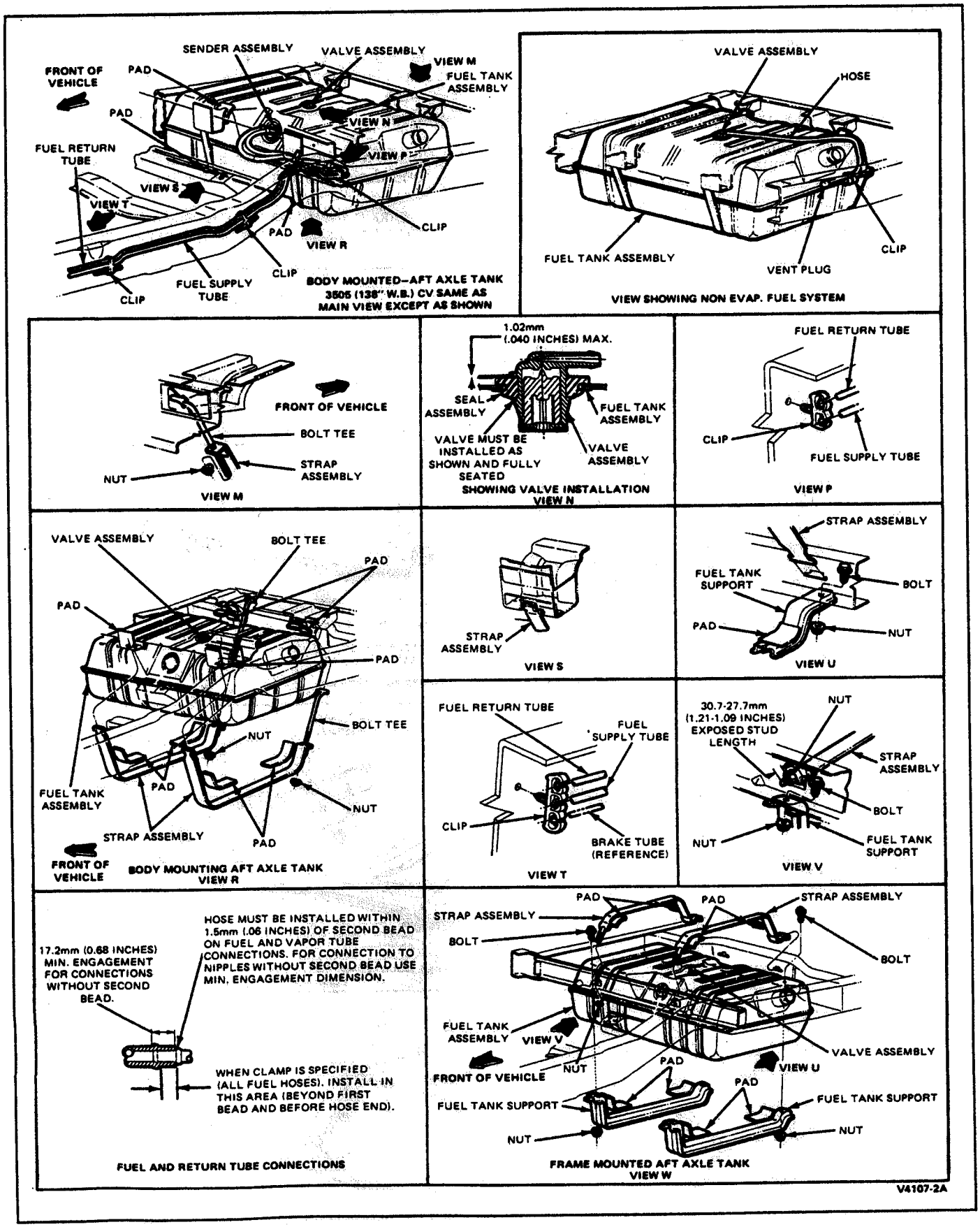

FIG. 24A Fuel System—Aft Axle Tank, E-250—E-350 (Cont'd)

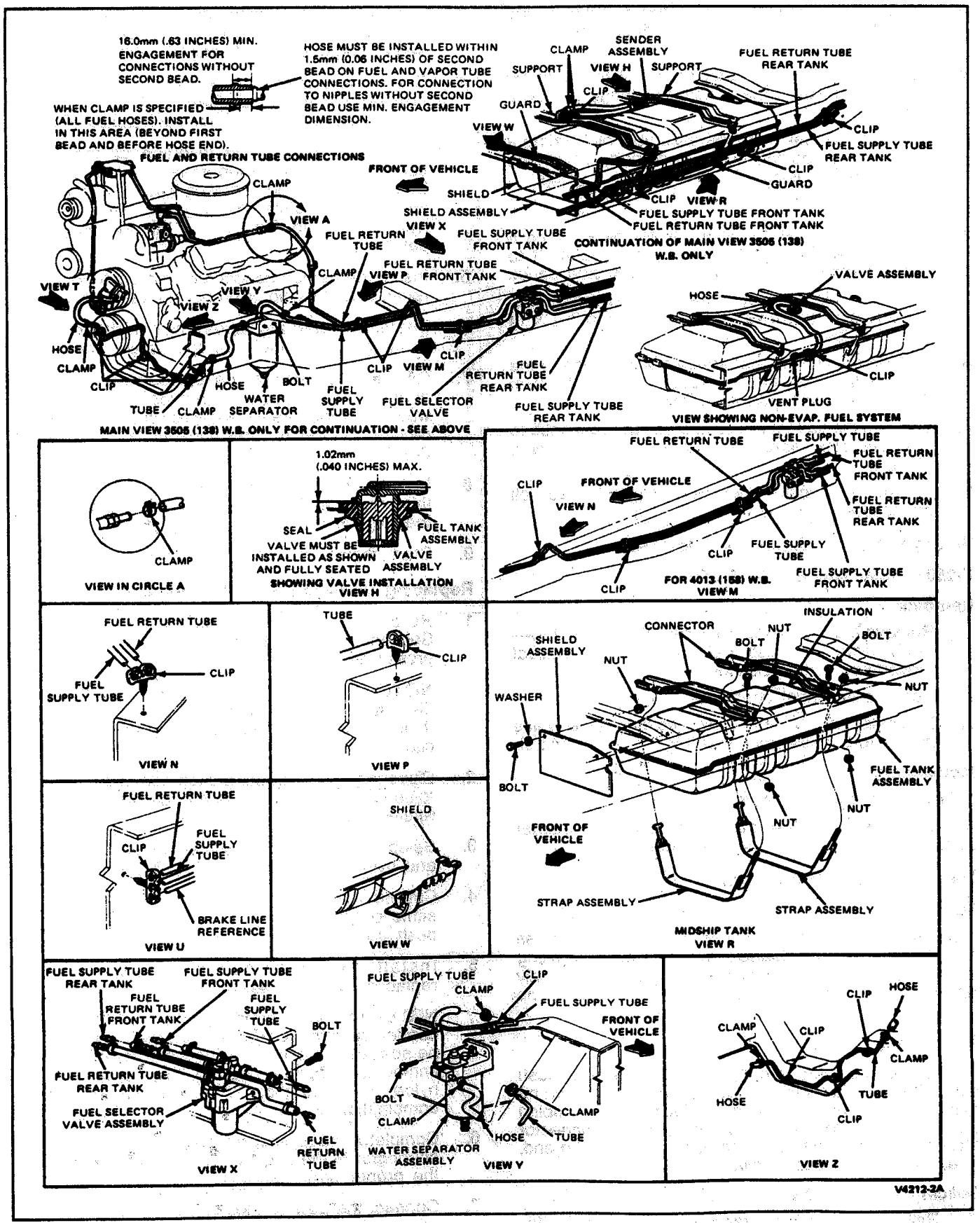

FIG. 25 Fuel System—Duel Tanks—E-250—E-350

3. Loosen the clamps that attach the filler pipe to the fuel filler hose and the fuel vent hose. Disconnect the hoses.
4. Loosen the clamp that attaches the filler pipe to the support bracket at the underbody flange (Aft/Axle Only).
5. Remove the fuel filler pipe assembly by rotating it through the opening in the underbody below the body housing assembly.

Installation

1. Install the fuel filler pipe assembly by inserting it through the underbody opening and rotating it to butt the pipe flange against the body side panel.
2. Attach the pipe flanges to the body side panel with three retaining screws. Tighten screws to 3-4 N·m (25-35 in-lbs).
3. Tighten the clamps that attach the filler pipe to the support bracket at the underbody flange to 3-4 N·m (25-35 inch lbs.) (Aft/Axle Only).
4. Connect the fuel filler hose and the fuel vent hose to the fuel filler assembly. Tighter the attaching clamps.
5. Fill the tank, install fuel filler cap and check all connections for leaks.

Selector Valve—Auxiliary Fuel Tank

F-250—F-350 and E-250—E-350

Removal

1. Remove the fuel hoses from the valve. For F-150—F-350, refer to Push Connect Fitting Removal procedures in this Section.
2. Remove electrical connector.
3. Remove the two bolt and washer assemblies mounting the selector valve (Figs. 1, 7, 7A and 9).

Installation

Reverse above procedure.

NOTE: Make sure the mounting bolt and washer assemblies are tightened to specification.

Major Service Operations

Fuel Tanks

Fuel tanks do not require special service procedures and may be steam-cleaned and/or serviced using standard procedures. After steaming, allow to thoroughly air dry. The vapor separator assembly should be replaced. Replace fuel tank strap bolts.

Fuel Lines

Vehicles equipped with nylon fuel tubes and push connect fittings have three types of service that can be performed to the fuel lines; replacing nylon tubing (splicing nylon to nylon), replacing push connector fittings, and replacing damaged push connect tube end. These three methods follow:

Splicing Nylon to Nylon

1. Relieve fuel system pressure as outlined in this Section. Read cautionary note prior to relieving pressurized fuel system.
2. Cut out damaged section of tubing and retain as a guide.
3. Cut a section of service tubing (type 11 or 12 nylon available in 1/4, 3/8, and 5/16-inch sizes) to the same length as the damaged section of tubing.
4. Select the proper (1/4, 3/8 or 5/16-inch) barbed connectors from completing the splice. Two connectors are required for each splice (Fig. 32).

   NOTE: To make hand insertion of the barbed connectors into the nylon easier, the tube end must be soaked in a cup of boiling water for one minute immediately before pushing the barbs into the nylon. Refer to Fig. 31 for all splicing service combinations.
5. Install the barbed connectors into each end of the replacement tubing using boiling water as outlined.
6. Install clips onto any tubes which might be difficult to access once the final splices are completed.
7. Complete the splice of the replacement nylon to the original nylon tubing at both ends. (Use the boiling water method mentioned previously, to get the required number of barbs engaged, as shown in Fig. 32).
8. Install any remaining clips which were removed for this service and check that the tubes are secure in the original clips.
9. Start engine and check for leaks.

Replacing Damaged Push Connectors

1. Relieve fuel system pressure as outlined in this Section. Read cautionary note prior to relieving pressurized fuel system.

   NOTE: Damaged push connectors must be discarded and replaced with new push connectors. If only the retaining clip is damaged, replace the clip.
2. Disconnect the damaged push connector. Be sure to bend the shipping tab to the side before removing retaining clip.
3. Select the proper size replacement push connector and nylon tube assembly (Fig. 31).
4. Cut out a section of the original nylon tube to the same length as the nylon tube attached to the new push connector.
5. Install proper barbed connector into the replacement nylon assembly.

   NOTE: To make hand insertion of the barbed connectors into the nylon easier, the tube end must be soaked in a cup of boiling water for one minute immediately before pushing the barbs into the nylon. Refer to Fig. 32 for all splicing service combinations.
6. Complete the splice by connecting the barbed connector to the original nylon. Refer to Fig. 32 for the proper barb insertion.
7. Connect the new connector assembly to the steel tube end.
8. Check that the underbody clips are properly securing the fuel tubes.
9. Start engine and check for fuel leaks.

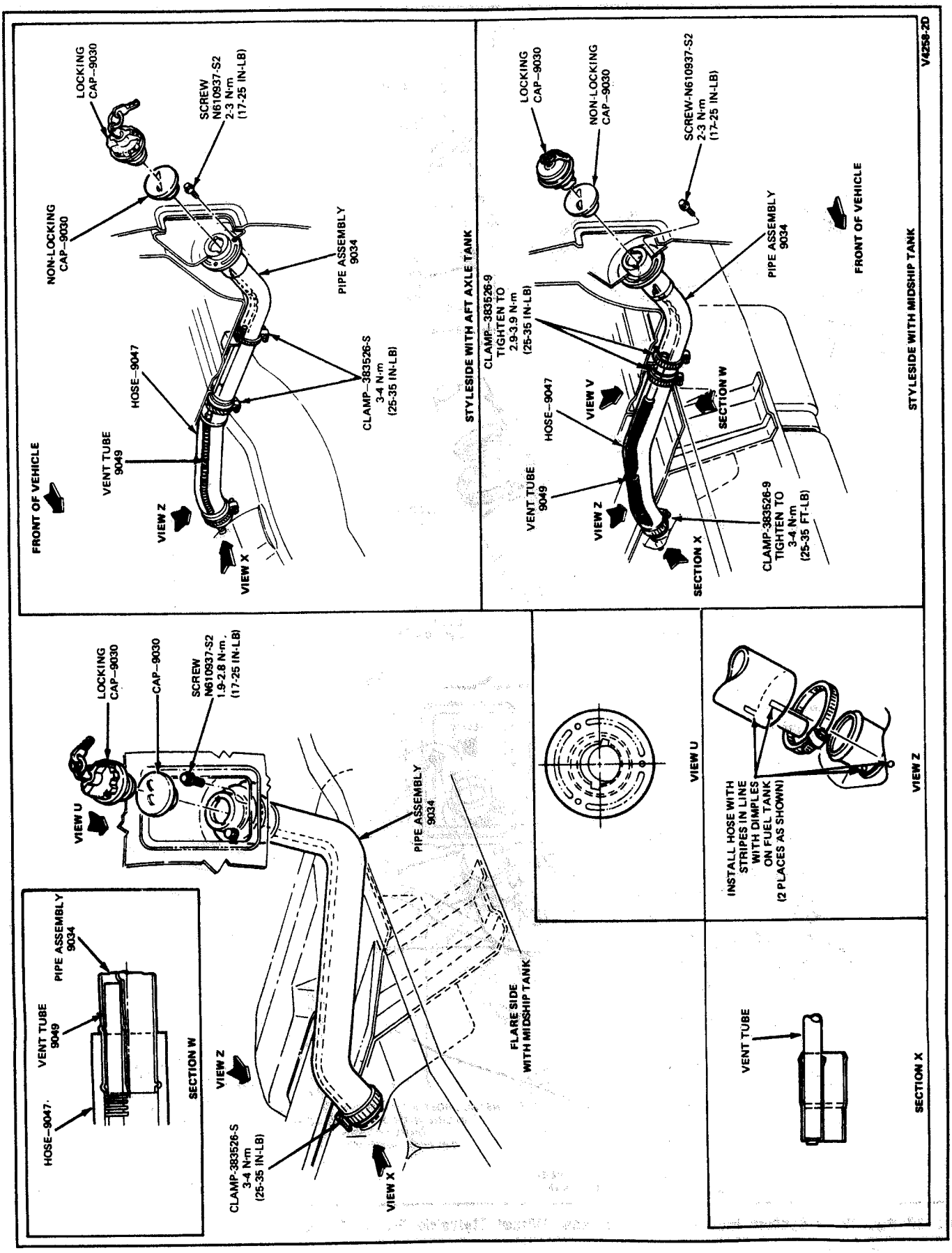

FIG. 26 Fuel Filler System Installation—Single Rear Wheel Styleside F-250—F-350

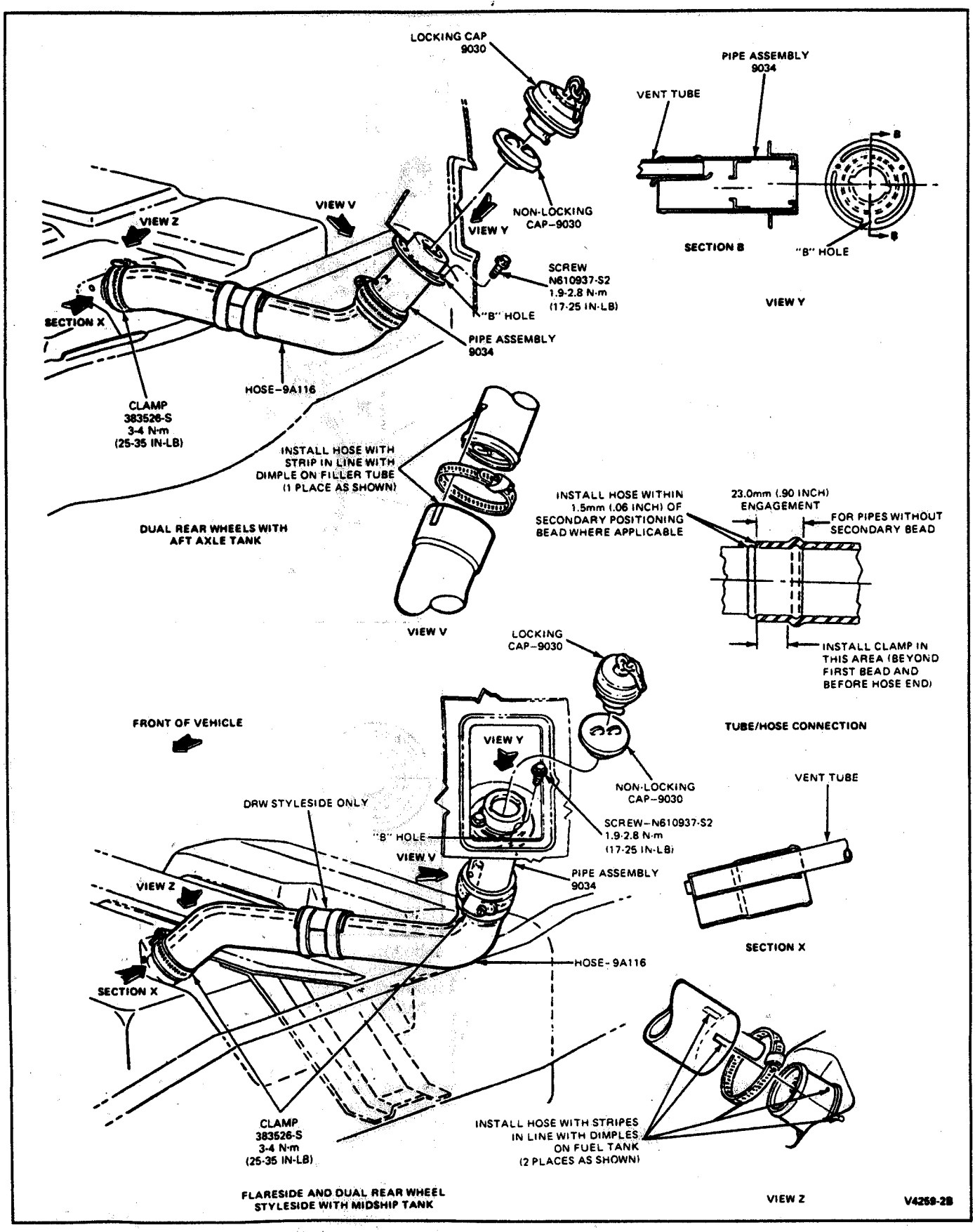

FIG. 27 Fuel Filler System Installation—Dual Rear Wheel Styleside F-250—F-350

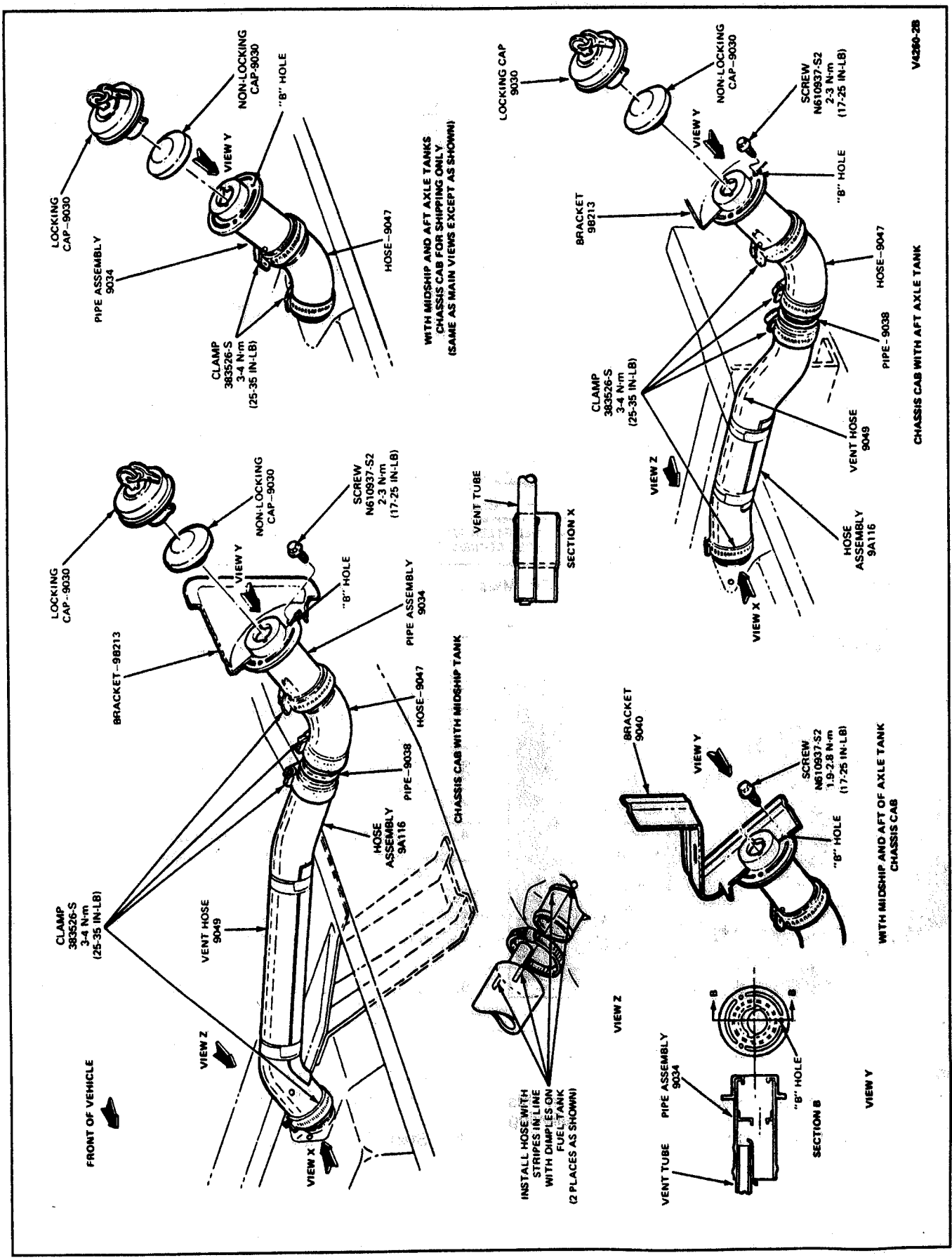

FIG. 28 Fuel Filler System Installation—F-Series Chassis Cab

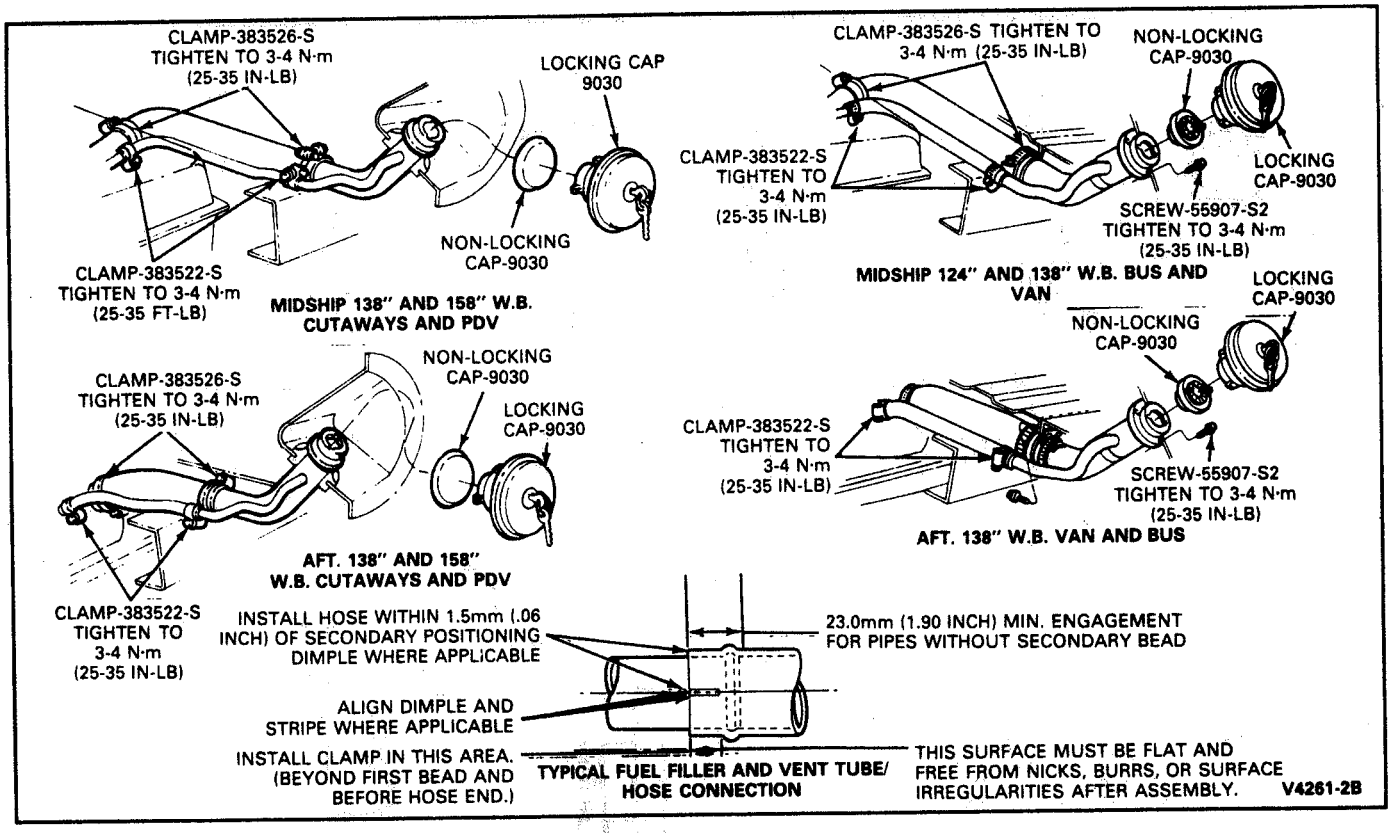

FIG. 29 Fuel Filler System Installation—E-250—E-350 (Midship and Aft Tank)

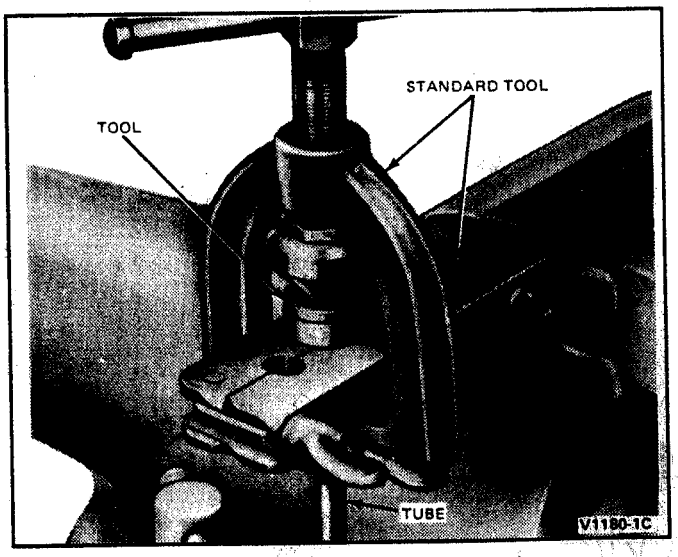

FIG. 30 Fuel Line Tube Die

Replacing Damaged Steel Push Connect Tube Ends

1. Relieve fuel system pressure as outlined in this Section. Read cautionary note prior to relieving pressurized fuel system.
2. Using a tube cutter, remove the damaged push connect tube end at a convenient distance from the end.

   NOTE: Allow for adequate room to tighten a union with a wrench at this location.
3. Choose a proper replacement push connect tube end (refer to Fig. 31).
4. If required, form the new tube end to the same shape as the damaged tube end which was removed.
5. Select the proper size union (Fig. 32) and attach the new steel tube end to the original tube.
6. Clean off the steel tube end and replace the push connector onto the tube. (A new retainer clip is recommended).
7. Check that the underbody clips are properly securing the fuel tubes.
8. Start engine and check for leaks.

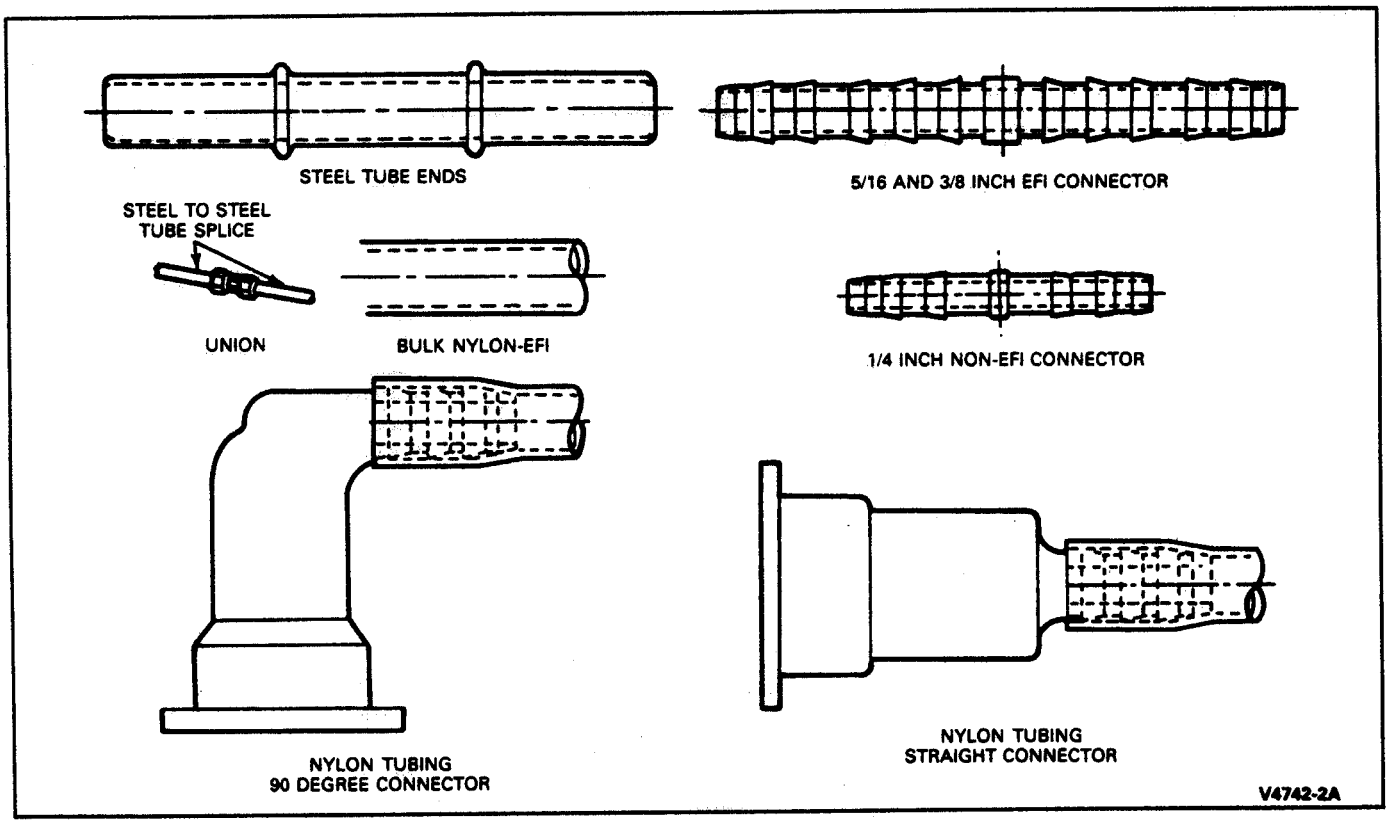

FIG. 31 Fuel Line Service Parts

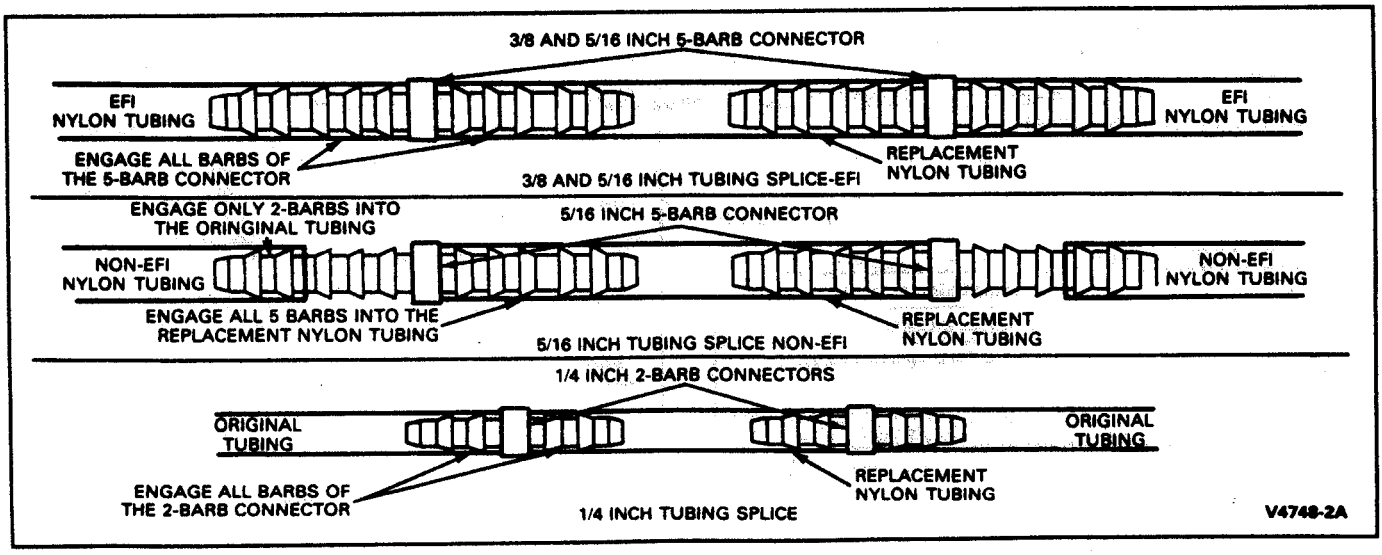

FIG. 32 Splicing Service Combinations

SPECIFICATIONS

STANDARD AND AUXILIARY FUEL TANKS — CAPACITY IN LITERS (GALLONS)

Model		Body Style	Location	Advertised Tank Cap. Refill Liters (Gal.)
Series	W. B. MM (in)			
E-250 350 Van E-250 Wagon 350 Cutaway & Stripped Chassis ⑤	3505 (138) 4013 3505 (138) 4013 (158)	All	Aft/Axle Midship	84 (22.1) ⑥ 68 (18)
E-250, 350 Super Van, Super Wagon	3505 (138)	All	Aft/Axle Midship ②	84 (22.1) 68 (18)
F-250 (4x2)	3378 (133.0)	Reg. Cab	Midship Aft/Axle ②	72 (19) 72 (19)
	3526 (138.8)	Super Cab	Midship Aft/Axle ②	64 (16.5) 72 (19)
	3937 (155.0)	Super Cab	Midship Aft/Axle ②	72 (19) 72 (19)
(4x4)	3378 (133.0)	Reg. Cab/ Cab Chassis	Midship ① Aft/Axle ①②	72 (19) 72 (19)
	3937 (155.0)	Super Cab	Midship ① Aft/Axle ①②	72 (19) 72 (19)
F-350 (4x2) and (4x4)	3378 (133.0)	Reg. Cab/ Cab Chassis	Midship Aft/Axle ②	72 (19) 72 (19)
	3475 (136.8)	Cab Chassis	Midship Aft/Axle ③④	72 (19) 72 (19)
	4064 (160.8)	Cab Chassis	Midship Aft/Axle ③④	72 (19) 72 (19)
	3937 (155.0)	Crew Cab	Midship Aft/Axle ②	72 (19) 72 (19)

① W/R.P.O. Skid Plate
② Steel Auxiliary Tank
③ Plastic Auxiliary
④ Standard Skid Plate
⑤ 15 Liters (4 Gal.) Throwaway Standard on RV Chassis/RT Cutaway, Commercial Cutaway, Commercial Chassis and PDV.
⑥ 19.6 Gallons in Specific Applications

CV4267-2B

SPECIAL SERVICE TOOLS

Tool	Description
T63P-9171-A	Keystone Clamp Pliers
T74P-9275-A	Fuel Tank Sender Wrench
Rotunda Equipment	
034-00006	Fuel Storage/Pump Tanker

CV3657-1B