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General Information

The fuel system delivers fuel from the fuel tanks to the engine. It consists of the engine fuel system components, the fuel tank(s) and tank mounting components, and the fuel lines and (if so equipped) shutoff valve.

The engine fuel system components include fuel filters, injectors, fuel transfer pumps, and a fuel governor. For service and maintenance procedures, refer to the applicable engine manufacturer's service and maintenance manuals.

The fuel tanks are held in place by metal straps and brackets that transfer the load to the vehicle frame. On some installations, cab-access and chassis-access step assemblies attach to the fuel tanks and tank brackets.

In diesel engine installations, fuel suction and return lines made of polyester-braid-reinforced nylon tubing bring fuel from the tank to the engine, and return surplus fuel from the engine to the tank. Dual-tank installations have single suction and return lines with a crossover fuel line (a flexible, wire-braid-reinforced hose) to equalize the level of fuel in the tanks. A shutoff valve in the crossover line attaches to the bottom fitting of the primary tank, and shuts off fuel flow to or from the secondary tank.

A dual suction/dual return fuel system has been added to late model vehicles. This system provides equal fuel levels in both fuel tanks without the need of a low crossover line. This system also reduces the tendency for fuel to gel in cold weather.

NOTE: EquiFlo fuel systems are not available on vehicles equipped with the Chrysler gasoline engine.

⚠ WARNING

On gasoline engines, release the fuel system pressure before servicing the fuel system. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire.

Gasoline engines are equipped with a returnless fuel system in which the fuel is held under constant pressure, even when the engine is shut down. While this eliminates the need for a return line, it makes it necessary to drain the fuel system pressure before servicing the fuel system.

The returnless fuel system also requires special high-pressure lines, tubes and fittings, which cannot be interchanged with diesel fuel lines, tubes or fittings.

Standard equipment for diesel engines includes a fuel level gauge sender in the primary tank, with an electric fuel level gauge mounted in the cab instrument panel. For gasoline engines, a float and sensing unit on the fuel pump module send data to the electric fuel gauge.

Tank-Mounted Step Assembly Removal and Installation

Removal

CAB-ACCESS STEP (Refer to Fig. 1)

To remove a *single-level* step, or the *lower step* of a *dual-level* installation (Ref. 5), remove the locknuts, bearing washers, and capscrews (Refs. 6 and 7) that attach the bottom of the step brackets to the fuel tank brackets (Ref. 1). Also, to remove the lower step from a 45-gallon *long* fuel tank, remove the *inboard* button-head capscrews, bearing washers, and locknuts (Refs. 8 and 9) that attach the step and step brackets to the fuel tank brackets. Don't remove the outboard fasteners (Ref. 10) that attach the step to the step brackets. Remove the step.

To remove the *upper step* of a *dual-level* installation (Ref. 4), remove the capscrews and bearing washers (Ref. 2) that attach the step brackets to the sealed weldnuts (Ref. 3) on the fuel tank. Remove the step.

CHASSIS-ACCESS STEP (Refer to Fig. 2)

1. Remove the capscrews and bearing washers (Ref. 2) that attach the step clamps (Ref. 3) to the top of the fuel tank.
2. Remove the step. Remove the step clamps and fasteners from the step.

Installation

CAB-ACCESS STEP (Refer to Fig. 1)

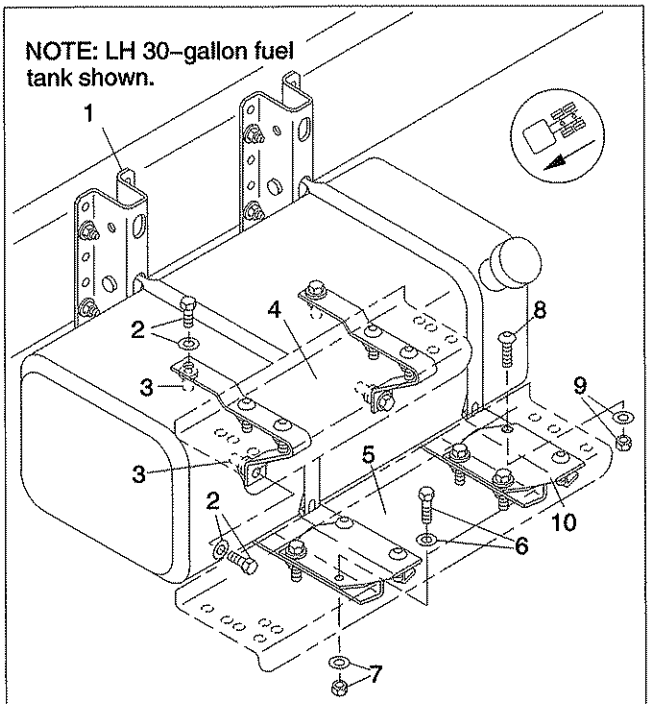
NOTE: The procedures below are for step *assemblies* ; if the step and its brackets have been disassembled, use the procedures below to install the brackets, then **refer to Fig. 3,** or **Fig. 4** to position the step on the brackets.

To install a *single-level* step, or the *lower step* of a *dual-level* installation (Ref. 5), on the right-hand side of the vehicle, position the step brackets against the rear flanges of the outboard ends of the fuel tank brackets; on the left-hand side of the vehicle, position the step brackets against the front flanges of the fuel tank brackets. Install the capscrews, bearing washers, and locknuts (Refs. 6 and 7) that attach the step brackets to the tank brackets. Tighten the locknuts 38 N·m (28 lbf·ft). Also, for a lower step on a 45-gallon long fuel tank, install the inboard button-head capscrews, bearing washers, and locknuts (Refs. 8 and 9). Tighten the locknuts 10 N·m (7 lbf·ft).

To install the *upper step* of a *dual-level* installation (Ref. 4), align the fastener holes of the upper step brackets with the sealed weldnuts (Ref. 3) on the top and outboard side of the fuel tank. Install the capscrews and bearing washers (Ref. 2) that attach the step brackets to the fuel tank. Tighten the capscrews 35 N·m (26 lbf·ft).

CHASSIS-ACCESS STEP (Refer to Fig. 2)

1. Install the step clamps, capscrews, and bearing washers (Refs. 3 and 2) on the fuel tank; leave the fasteners loose. Turn the step clamps so they point to the front and rear of the truck (parallel to the frame rail).



1. Fuel Tank Bracket
2. 3/8–16 Capscrew and Bearing Washer
3. 3/8–16 Sealed Weldnut
4. Upper Step Assembly
5. Lower Step Assembly
6. 3/8–16 Capscrew and Bearing Washer
7. Bearing Washer and 3/8–16 Locknut
8. Inboard Button–Head Capscrew
9. Bearing Washer and 1/4–20 Locknut
10. Outboard Button–Head Capscrew, Bearing Washer, and Locknut

Fig. 1, Tank-Mounted Cab-Access Step Installation (dual-level steps shown)

Tank-Mounted Step Assembly Removal and Installation

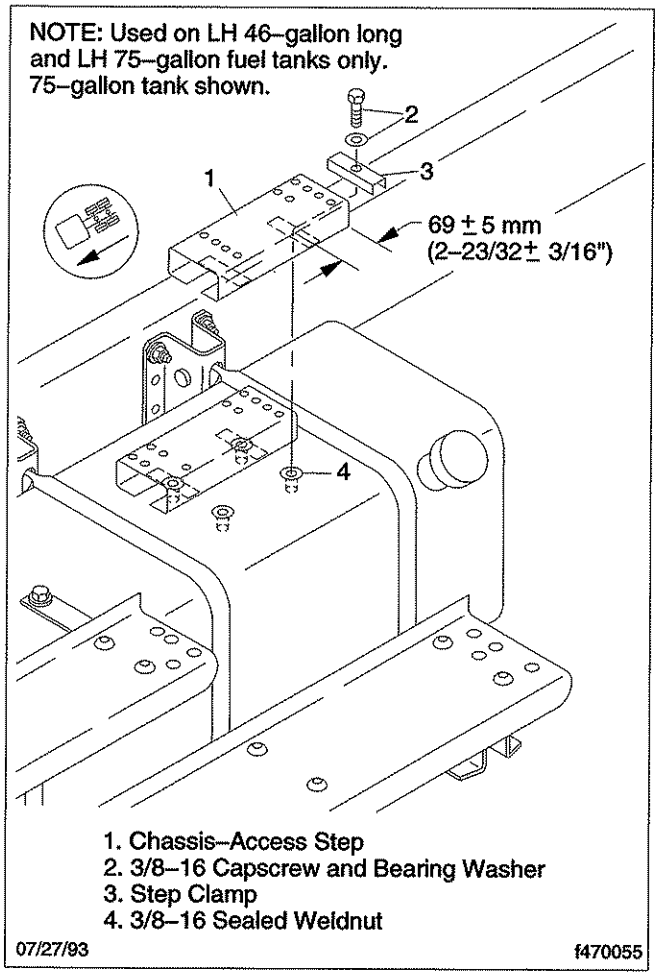


Fig. 2, Tank-Mounted Chassis-Access Step Installation

2. Install the step on the fuel tank so the distance from the rear of the step to the center of the step clamp is 69 ± 5 mm (2-23/32 ± 3/16 inches).
3. Turn the step clamps so they point from side to side, and the ends are positioned over both bottom flanges of the step.
4. Tighten the step clamp capscrews 35 N·m (26 lbf·ft).

Fuel Tank Removal and Installation

Removal (See Fig. 1, Fig. 2, Fig. 3, Fig. 4, or Fig. 5)

⚠ WARNING

Damaged fuel tanks must be replaced. A repaired fuel tank will not meet the strength, leakage, and venting standards required by U.S. Federal regulations for original and replacement fuel tanks. A repaired fuel tank may be more likely to spill fuel or be ruptured in a vehicle accident, which could lead to personal injury or property damage.

If a damaged tank is found, use the following procedure:

1. Park the vehicle on level ground. Apply the parking brakes and chock the tires.
2. Remove the cab-access step(s); see **Subject 100**.

⚠ WARNING

Do not drain fuel near, or expose fuel vapor to, open flame or intense heat. To do so is a dangerous practice, which would create a hazardous work area. This could lead to personal injury or property damage.

NOTE: Dual suction/dual return fuel systems on Business Class vehicles are not equipped with shut-off valves.

3. On a single-tank installation or a dual suction/dual return fuel system, place a suitable container under the fuel tank and remove the drain plug.

   On a dual-tank installation with a shut-off valve, place a suitable container under the fuel tank, close the fuel shutoff valve located on the primary fuel tank, then remove the drain plug.

   If the fuel is to be re-used, store it in a clean container to protect it from contaminants.

4. Disconnect the fuel return and suction lines from the tank; then cap the lines to prevent fuel spillage.

   On a dual-tank installation with a fuel crossover line, disconnect the fuel crossover line from the bottom of the tank that is to be removed; then cap the line.

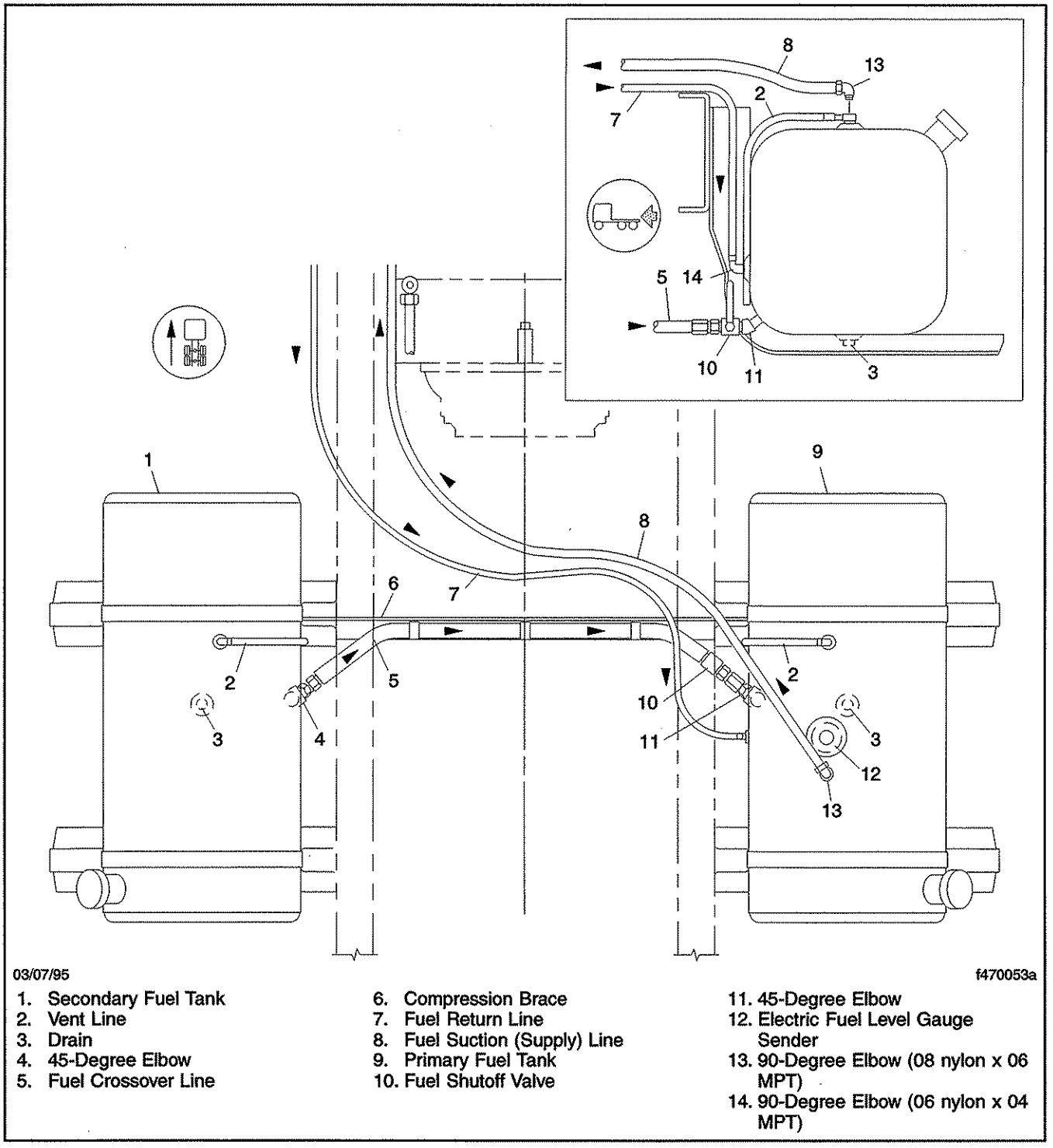
5. If removing a single or primary tank, disconnect the wires from the fuel level gauge sender. See **Fig. 6.**
6. Remove the tank straps and isolators. See **Fig. 7.**
   - 6.1 Remove the nuts and washers from the tank strap T-bolts at the outboard end of the tank brackets.
   - 6.2 Remove the cotter pins and clevis pins from the inboard end of the tank straps. Remove the tank straps and isolators.
7. Using a fork lift, remove the fuel tank.
8. Inspect the tank straps, isolators, and brackets for wear and damage. Replace worn or damaged parts with new parts.

⚠ WARNING

Failure to replace worn or damaged parts could result in loss of a fuel tank and spilling of fuel, which could cause property damage or personal injury.

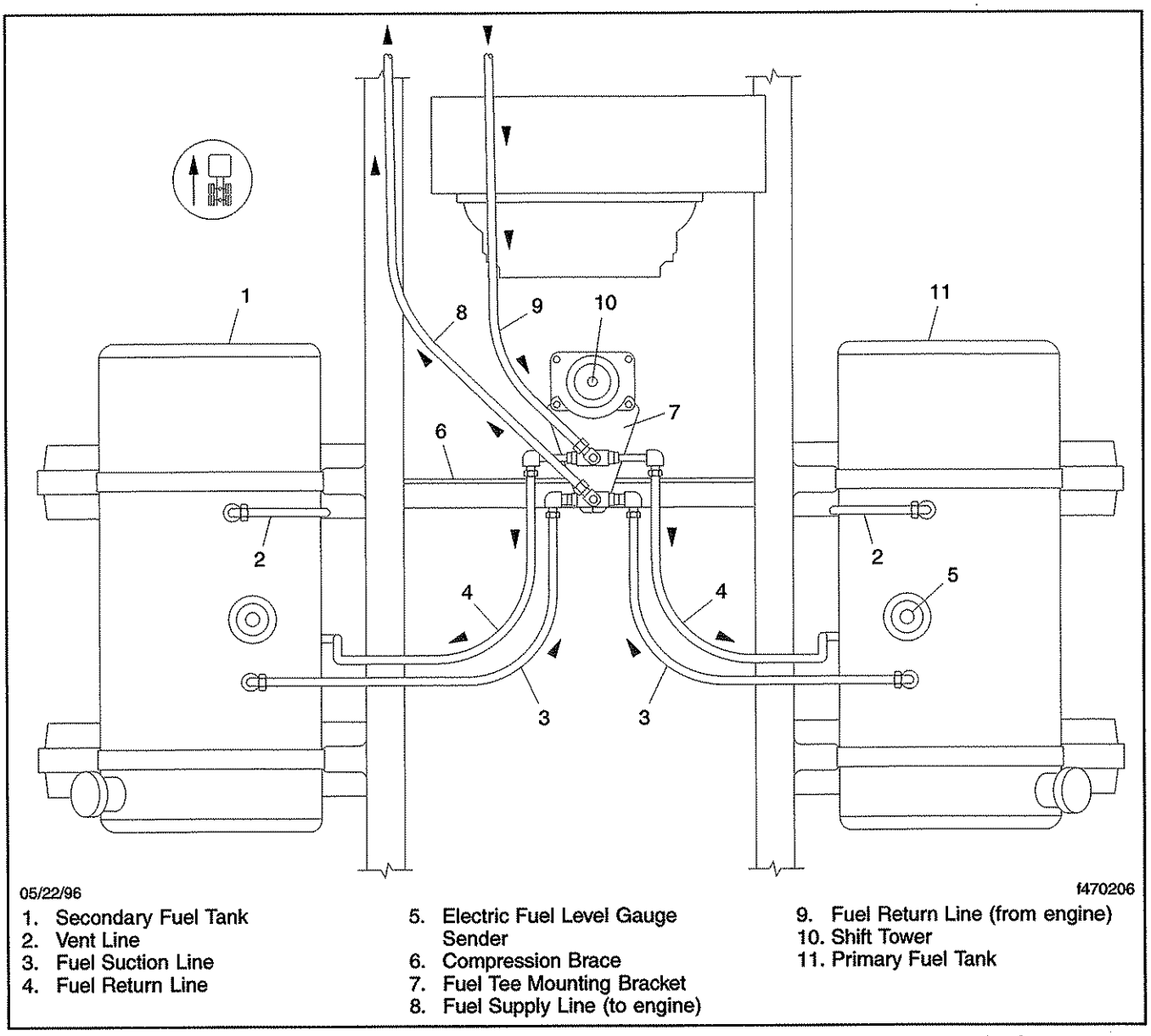
9. When replacing a fuel tank, remove all parts necessary to install the new fuel tank. Inspect the parts, and replace them as needed. Install all necessary components on the new fuel tank before installation.
   - 9.1 Remove and clean all pipe plugs, fittings and lines, then transfer the components to the new fuel tank. Coat all tapered pipe plug and fitting threads with Loctite® 592, or an equivalent sealer.
   - 9.2 Inspect the vent line, then transfer it to the new fuel tank.
   - 9.3 Transfer the chassis-access steps to the new tank, if so equipped; see **Subject 100.**
   - 9.4 If a single or primary fuel tank is being replaced, transfer the fuel level gauge sender and gasket to the new fuel tank. Install the machine screws until contact is made with the sender unit. Use a star pattern (see **Fig. 8**) to distribute the torque evenly around the sender unit.

Fuel Tank Removal and Installation



1. Secondary Fuel Tank
2. Vent Line
3. Drain
4. 45-Degree Elbow
5. Fuel Crossover Line
6. Compression Brace
7. Fuel Return Line
8. Fuel Suction (Supply) Line
9. Primary Fuel Tank
10. Fuel Shutoff Valve
11. 45-Degree Elbow
12. Electric Fuel Level Gauge Sender
13. 90-Degree Elbow (08 nylon x 06 MPT)
14. 90-Degree Elbow (06 nylon x 04 MPT)

Fig. 1, Fuel Tank Installation with Early-Style Single Suction/Single Return Fuel System



1. Secondary Fuel Tank
2. Vent Line
3. Fuel Suction Line
4. Fuel Return Line
5. Electric Fuel Level Gauge Sender
6. Compression Brace
7. Fuel Tee Mounting Bracket
8. Fuel Supply Line (to engine)
9. Fuel Return Line (from engine)
10. Shift Tower
11. Primary Fuel Tank

Fig. 2, Fuel Tank Installation with Early-Style Dual Suction/Dual Return Fuel System (Typical)

Installation (See Fig. 9)

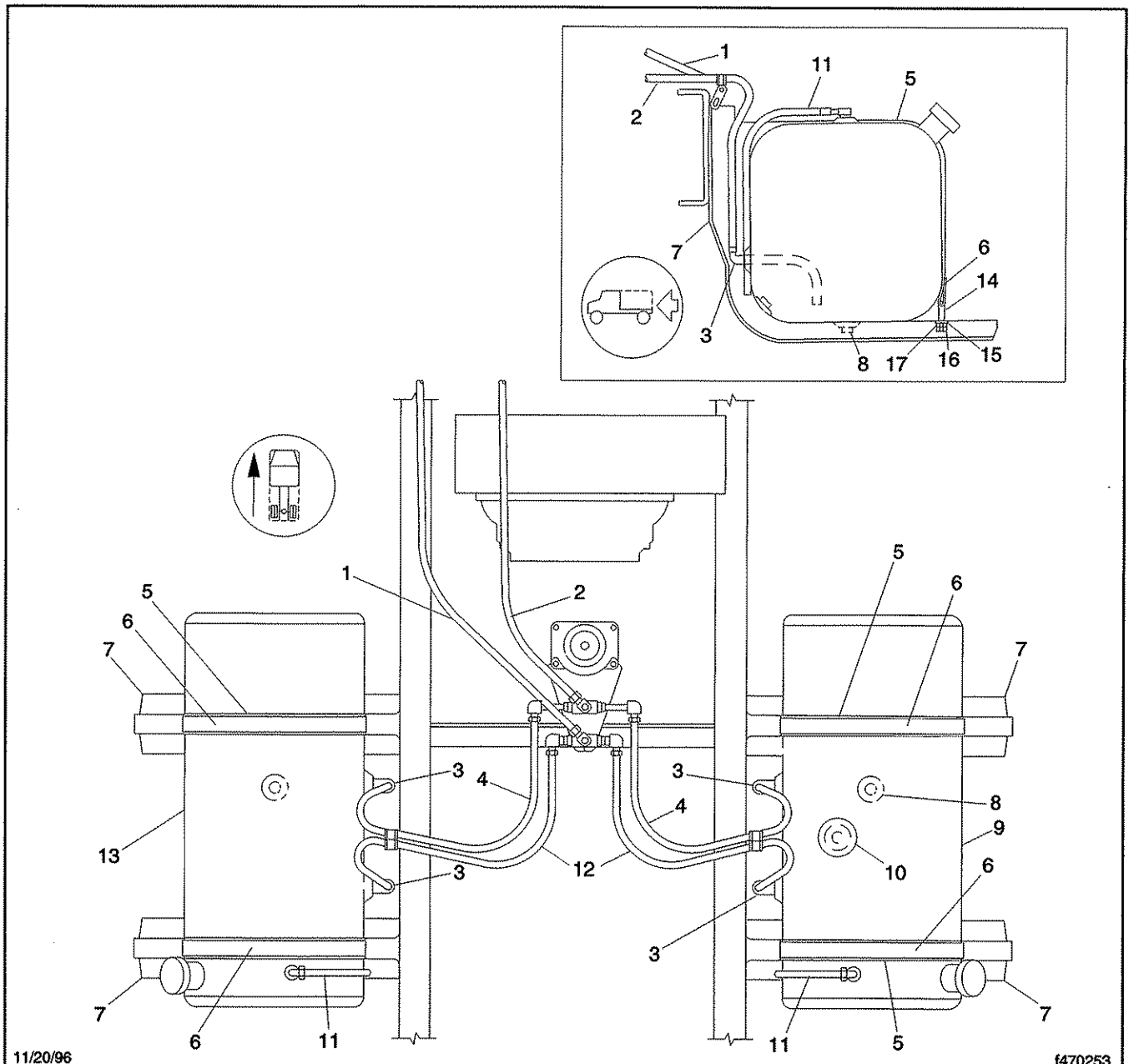
1. Using a fork lift, or other approved lifting device, and place the fuel tank in its approximate installed position. Make sure the fuel filler neck is outboard.

   Move the tank fore or aft until the distance from the front of the tank to the centerline of the forward tank bracket (Ref. B) is 10-13/16 ± 3/16 inches (275 ± 5 mm).

2. Install the isolators and tank straps. See **Fig. 7.**

   2.1 Install the clevis pins through the inboard end of the tank brackets and tank straps. Install and lock new cotter pins in the clevis pins.

Fuel Tank Removal and Installation



1. Fuel Supply Line (to engine)
2. Fuel Return Line (from engine)
3. 90-Degree Elbow (08 nylon x 08 MPT)
4. Fuel Return Line
5. Tank Strap Isolator
6. Fuel Tank Strap
7. Fuel Tank Bracket
8. Fuel Tank Drain
9. Primary Fuel Tank
10. Electric Fuel Level Gauge Sender
11. Vent Line
12. Fuel Supply Line
13. Secondary Fuel Tank
14. Tank Strap T-Bolt
15. Bearing Washer
16. 1/2–13 Jam Nut
17. 1/2–13 Hexnut

Fig. 3, Fuel Tank Installation with Later-Style Dual Suction/Dual Return Fuel System, (Typical)

Tank-Mounted Step Assembly Removal and Installation

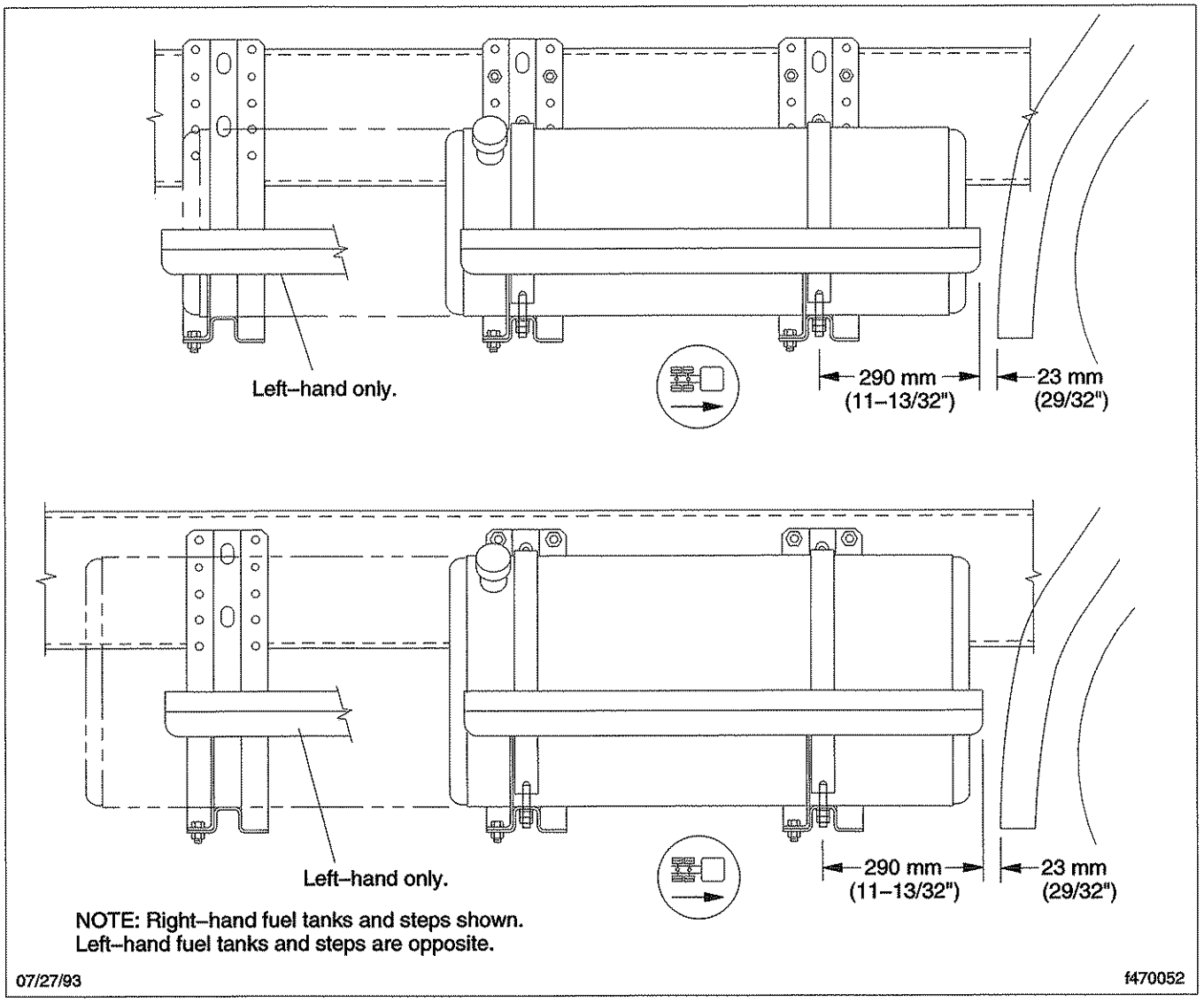


Fig. 3, Single-Level Cab-Access Step Positioning

Tank-Mounted Step Assembly Removal and Installation

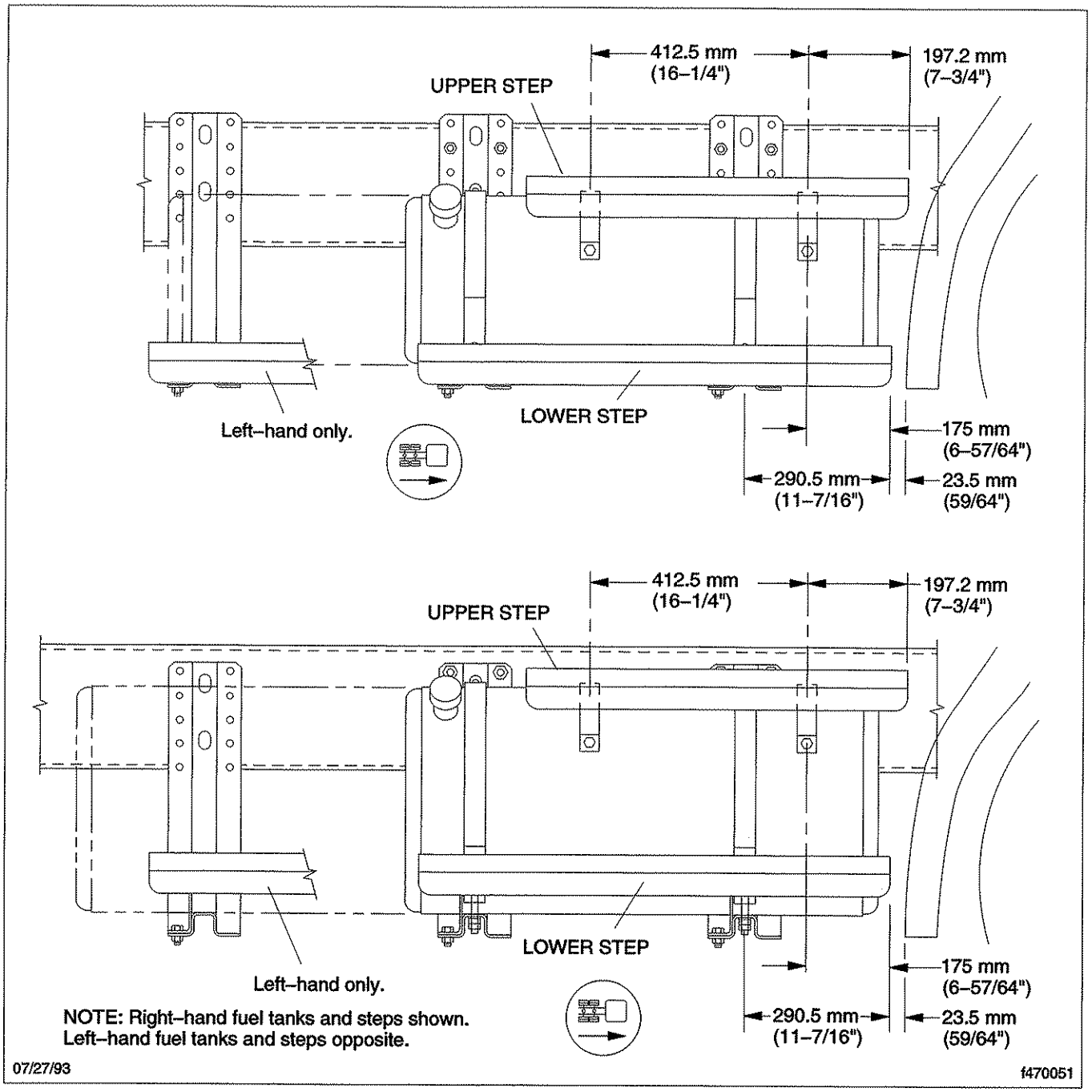
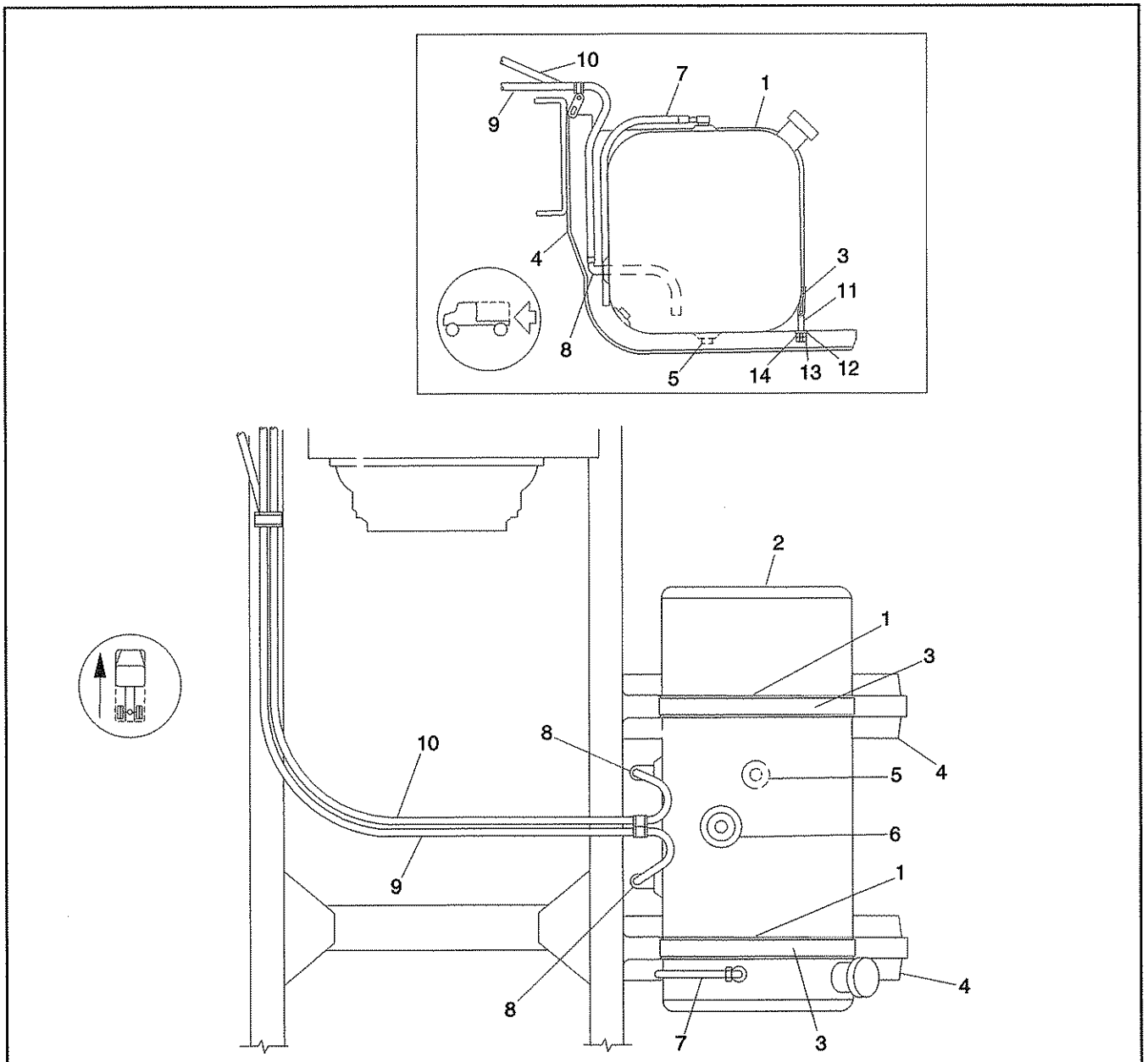


Fig. 4, Dual-Level Cab-Access Step Positioning



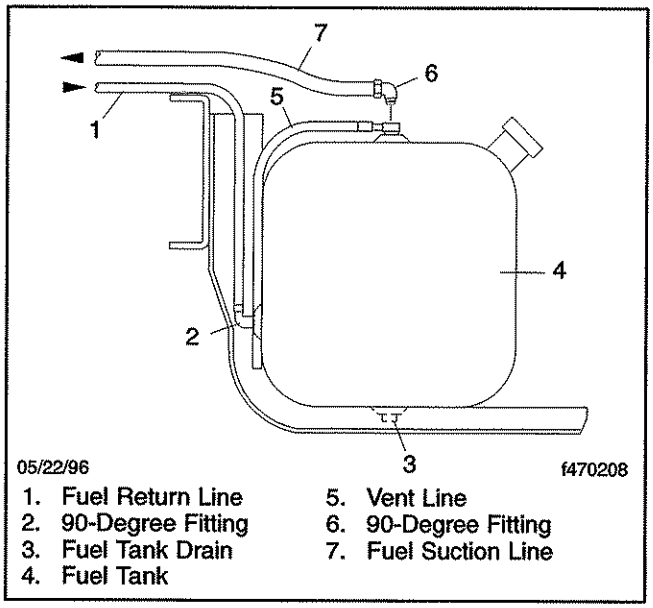
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1. Tank Strap Isolator
2. Primary Fuel Tank
3. Fuel Tank Strap
4. Fuel Tank Bracket
5. Fuel Tank Drain
6. Electric Fuel Level Gauge Sender
7. Vent Line
8. 90-Degree Elbow (08 nylon x 08 MPT)
9. Fuel Supply Line
10. Fuel Return Line
11. Tank Strap T-Bolt
12. Bearing Washer
13. 1/2–13 Jam Nut
15. 1/2–13 Hexnut

Fig. 4, Later-Style Fuel Tank Installation with Single Suction/Single Return Fuel System, (Typical)

Fuel Tank Removal and Installation



1. Fuel Return Line
2. 90-Degree Fitting
3. Fuel Tank Drain
4. Fuel Tank
5. Vent Line
6. 90-Degree Fitting
7. Fuel Suction Line

Fig. 5, Early-Style Fuel Tank Line Routing with Dual Suction/Dual Return Fuel System

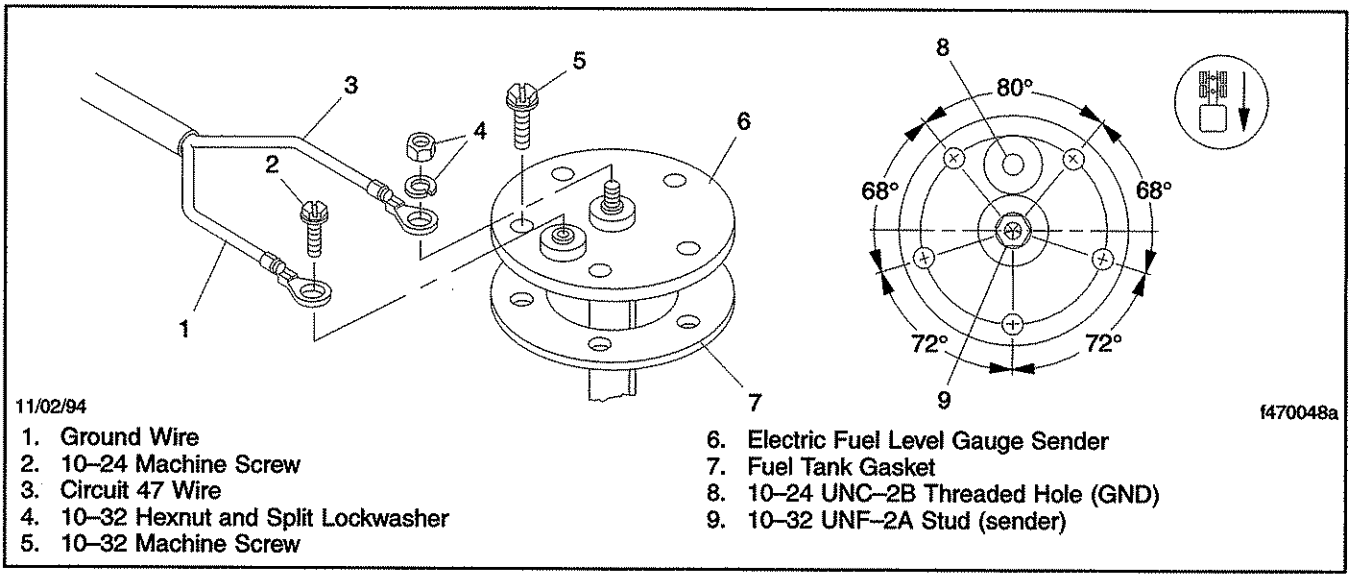
⚠ CAUTION

Do not overtighten the fuel tank straps. To do so could damage the fuel tanks.

2.2 Install a bearing washer and two nuts on each tank strap T-bolt. Tighten the first nuts 15 lbf·ft (20 N·m).

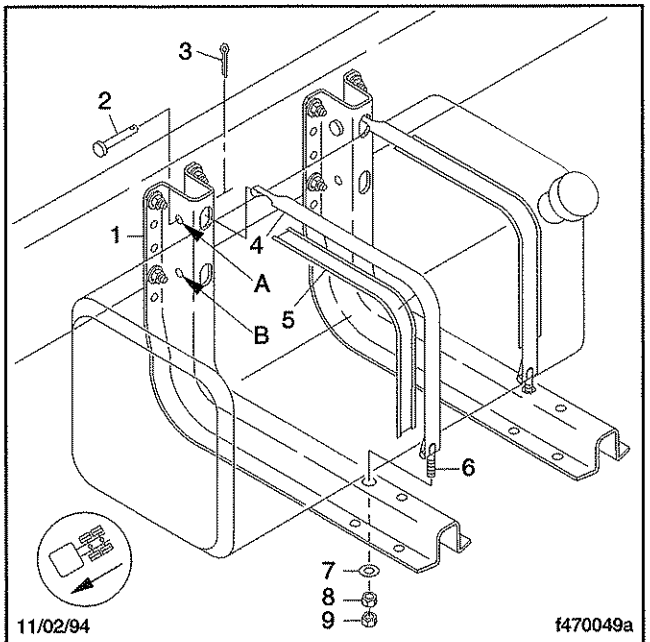
2.3 While holding the first nut stationary with a wrench, tighten each jam nut 30 lbf·ft (41 N·m).

3. Attach the wires to the fuel level gauge sender. Securely tighten the machine screw and hexnut.
4. Make certain the fuel lines are clean, then install them on their fittings on the fuel tank; see **Subject 150** for general guidelines. Coat all tapered pipe plug and fitting threads with Loctite 592, or an equivalent sealer. Install pipe plugs in any remaining open threaded holes.
5. Install the cab-access step(s); see **Subject 100**.
6. Add clean fuel to the fuel tank.
7. On a single suction/single return fuel system with dual fuel tanks, open the fuel shutoff valve.
8. Prime the engine fuel pump; see **Subject 160**.
9. Remove the tire chocks.



1. Ground Wire
2. 10–24 Machine Screw
3. Circuit 47 Wire
4. 10–32 Hexnut and Split Lockwasher
5. 10–32 Machine Screw
6. Electric Fuel Level Gauge Sender
7. Fuel Tank Gasket
8. 10–24 UNC–2B Threaded Hole (GND)
9. 10–32 UNF–2A Stud (sender)

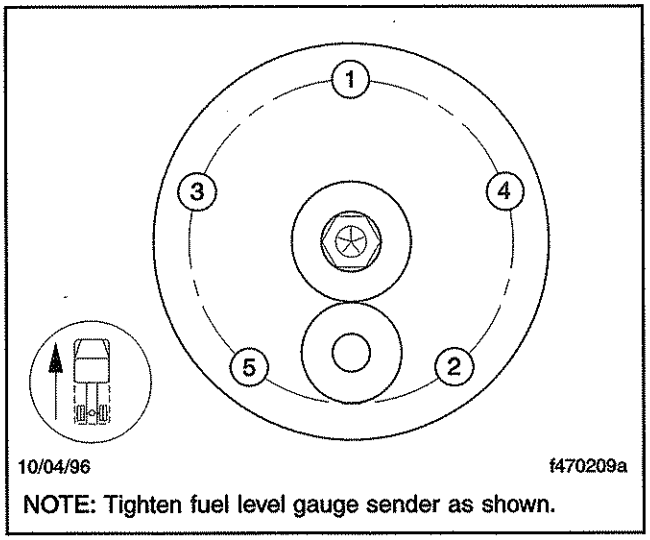
Fig. 6, Fuel Level Gauge Sender Installation



A. Use for 45-gallon short tank (shown) or 75-gallon tank.
B. Use for 45-gallon long tank or 30-gallon tank.

1. Fuel Tank Bracket
2. Tank Strap Clevis Pin
3. Clevis Pin, Cotter Pin
4. Fuel Tank Strap
5. Tank Strap Isolator
6. Tank Strap T-Bolt
7. Bearing Washer
8. 1/2–13 Hexnut
9. 1/2–13 Jam Nut

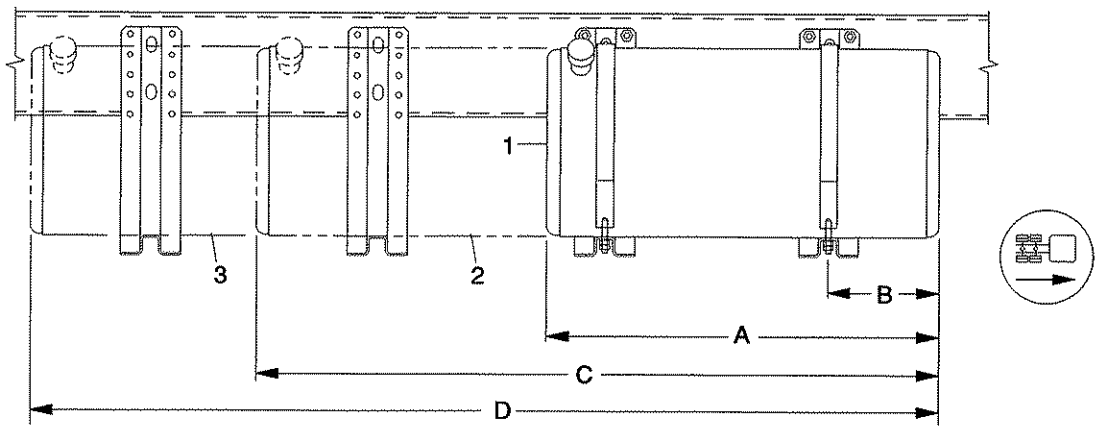
Fig. 7, Fuel Tank Brackets and Straps

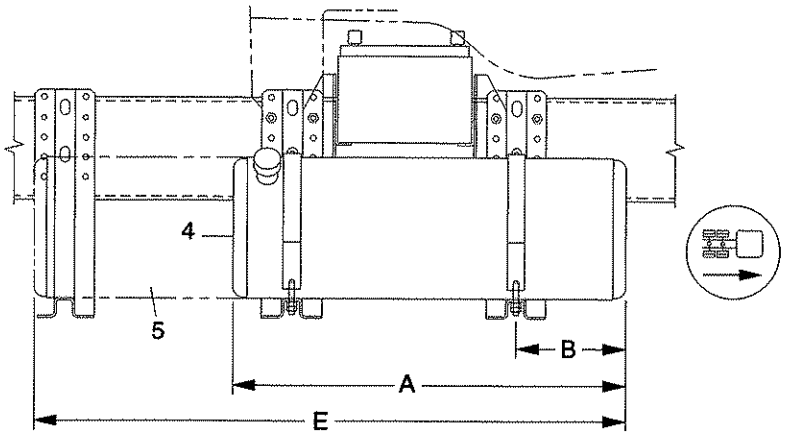


NOTE: Tighten fuel level gauge sender as shown.

Fig. 8, Electric Fuel Level Gauge Sender Tightening Sequence

Fuel Tank Removal and Installation





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A. 38 inches (965 mm)
B. 10-13/16 ± 3/16 inches (275 ± 5 mm)
C. 64 inches (1626 mm)
D. 85 inches (2166 mm)
E. 57 inches (1448 mm)

1. 45 Gallon Short Tank
2. 75 Gallon Tank
3. 100 Gallon Tank
4. 30 Gallon
5. 45 Gallon Long Tank

Fig. 9, Fuel Tank Positioning

Fuel Tank Strap Replacement

Replacement (Refer to Fig. 1)

1. Apply the vehicle parking brakes and chock the tires.
2. Remove the cab-access step(s); **refer to Subject 100.**
3. Remove the fuel tank strap and isolator (Refs. 4 and 5).
   - 3.1 Remove the nuts and washer (Refs. 9, 8, and 7) from the tank strap T-bolt (Ref. 6) at the outboard end of the tank bracket.
   - 3.2 Remove the cotter pin and clevis pin (Refs. 3 and 2) from the tank strap eye at the inboard end of the tank bracket.
4. Inspect the isolator and clevis pin for wear or damage; replace if needed.

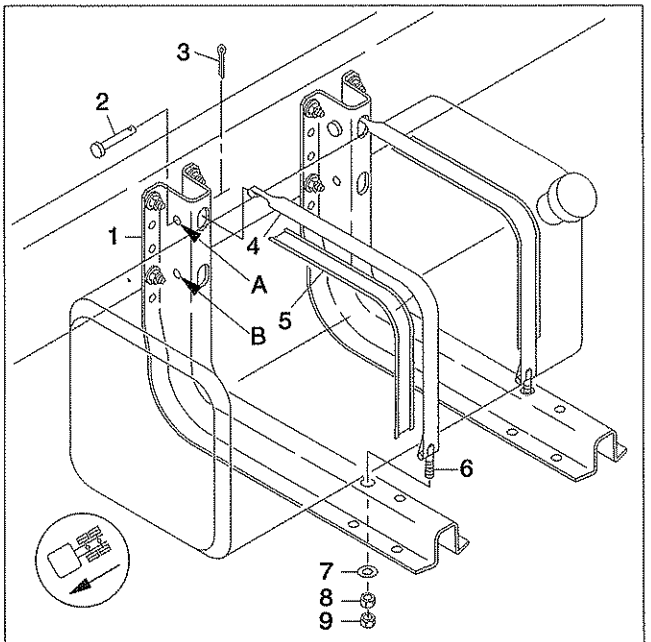
⚠ WARNING

WARNING: Failure to replace worn or damaged parts could result in loss of a fuel tank and spilling of fuel, which could cause property damage or personal injury.

5. Install the isolator and the new tank strap on the tank.
   - 5.1 Install the clevis pin (Ref. 2) through the inboard end of the tank bracket and tank strap. Install and lock a new cotter pin (Ref. 3) in the clevis pin.

   IMPORTANT: Fuel tanks can be damaged by overtightening the fuel tank straps.

   - 5.2 Install a bearing washer and two nuts on the tank strap T-bolt. Tighten the first nut 20 N·m (15 lbf·ft).
   - 5.3 While holding the first nut stationary with a wrench, tighten the jam nut 41 N·m (30 lbf·ft).
6. Install the cab-access step(s); **refer to Subject 100.**
7. Remove the tire chocks.



1. Fuel Tank Bracket
2. Tank Strap Clevis Pin
3. Clevis Pin Cotter Pin
4. Fuel Tank Strap
5. Tank Strap Isolator
6. Tank Strap T–Bolt
7. Bearing Washer
8. 1/2–13 Hexnut
9. 1/2–13 Jam Nut

A. Use for 45–gallon short tank (shown) or 75–gallon tank.

B. Use for 45–gallon long tank or 30–gallon tank.

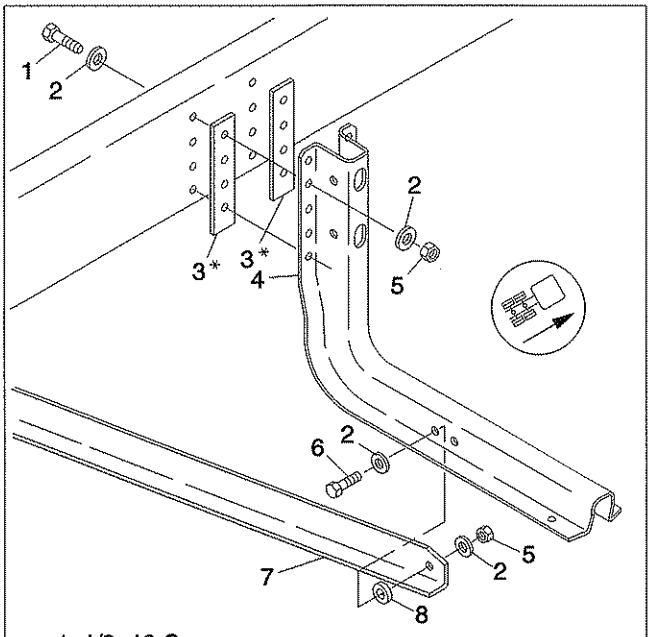
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Fig. 1

Fuel Tank Bracket Replacement

Replacement (Refer to Fig. 1)

1. Remove the fuel tank; **refer to Subject 110.**
2. If the fuel tank bracket has a compression brace (Ref. 7) attached, remove the locknut, washers, spacer (Ref. 8), and capscrew that attach the brace to the bracket.
3. Remove the locknuts, hardened washers, and capscrews that attach the fuel tank bracket to the frame rail. Remove the bracket, and if so equipped, the fuel tank bracket spacers (Ref. 3).
4. From inside the frame rail, install the two upper capscrews and hardened washers. If so equipped, install the fuel tank bracket spacers onto the outboard ends of the capscrews. Position the new tank bracket on the capscrews, then install the two upper hardened washers and locknuts, finger-tight.
5. Install the two lower sets of fasteners. Tighten all of the locknuts 92 N·m (68 lbf·ft).
6. If a compression brace (Ref. 7) was attached to the bracket, install the capscrew, hardened washers, spacer (Ref. 8), compression brace, and locknut, **as shown in Fig. 1.** Tighten the locknut 92 N·m (68 lbf·ft).
7. Install the fuel tank; **refer to Subject 110.**



1. 1/2–13 Capscrew
2. Bearing Washer
3. Fuel Tank Bracket Spacer *
4. Fuel Tank Bracket
5. 1/2–13 Locknut
6. 1/2–13 Capscrew
7. Compression Brace
8. Compression Brace Spacer

* Used with 14,000 and 16,000 lb front suspension when frame reinforcement isn't used.

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Fig. 1

Compression Brace Replacement

Replacement (Refer to Fig. 1)

1. Apply the vehicle parking brakes and chock the tires.
2. Remove the fasteners and clamps that attach the fuel crossover line to the compression brace.
3. Remove the locknuts, bearing washers, spacers (Ref. 6), and capscrews that attach the compres-

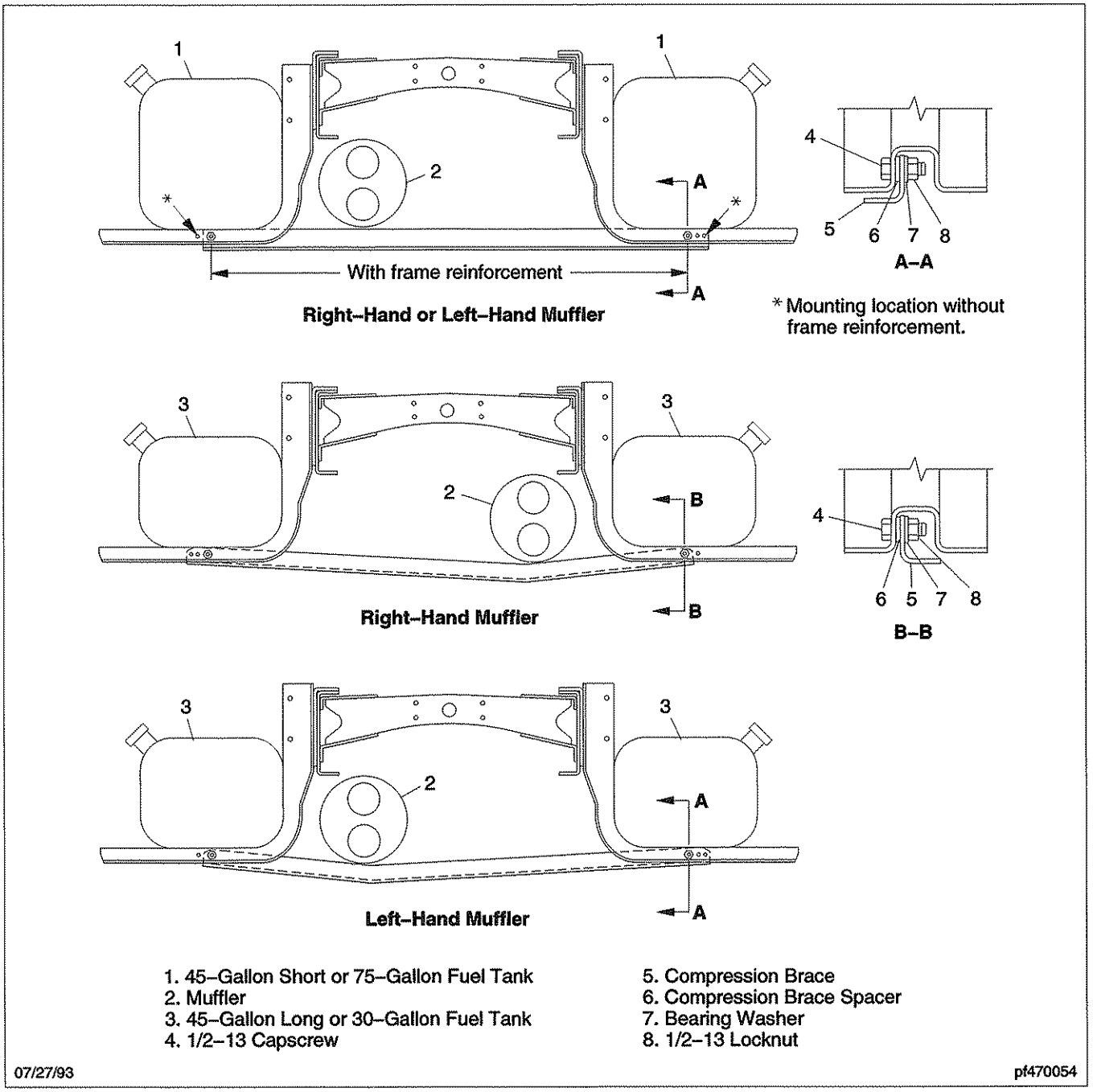


Fig. 1

Compression Brace Replacement

sion brace to the fuel tank brackets. Remove the compression brace.

4. Position the new compression brace, **as shown in Fig. 1.** Install the capscrews, bearing washers, spacers, and locknuts, in the indicated mounting holes.
5. Tighten the locknuts 92 N·m (68 lbf·ft).
6. Install the clamps and fasteners that attach the fuel crossover line to the compression brace. Tighten the fasteners snugly.
7. Remove the chocks.

Diesel Fuel Lines

GENERAL GUIDELINES

If diesel fuel lines are worn, damaged, or deteriorated, replace them. Use the following guidelines for installing and routing them.

- Fuel lines must be free of droops, sharp bends, and kinks in the lines.
- Fuel lines must not extend more than 2 inches (5 cm) below the fuel tank unless they are completely enclosed in a protective housing.
- Fuel lines must be routed in a continuous upward slope from the fuel tank to prevent high and low spots in the hoses.
- Fuel lines must be routed at least six inches (15 cm) from exhaust pipes
- Heat shields and/or hose insulation must be used to protect any section of fuel line that is less than six inches (15 cm) from a heat source.
- Fuel lines must be routed to allow routinely serviceable components such as dipsticks, filters, and water separators to be readily accessed without the need to disconnect the fuel lines.
- Fuel lines must be secured to prevent chafing, kinking, or other damage.
- Fuel lines must be long enough to allow movement of the parts to which they are attached.
- Coat all pipe threads (tapered threads) with Loctite® 592, or an equivalent.
- Finger-tighten pipe fittings; then tighten one and one half turns. Tighten more if necessary to seal.
- Fuel lines and fittings must be free of leaks, to prevent fuel loss or entry of air into the line, which may result in a loss of prime by the engine fuel system.
- Drains or other bottom fittings must not extend more than 3/4 inch (19 mm) below the lowest part of the fuel tank or sump.

Gasoline Fuel Lines and Clamps

GENERAL GUIDELINES FOR LINES AND CLAMPS

The gasoline-powered engines used on Freightliner vehicles use a fuel injection system. This system requires fuel lines, tubes and clamps of special construction.

The fuel lines and tubes must withstand higher fuel pressures and the possibility of contaminated fuel in this system. Only lines and tubes marked EFM/EFI may be used.

The hose clamps on fuel-injected vehicles are of a special rolled-edge construction. This prevents the edge of the clamp from cutting into the hose and causing leaks. Do not use other types of clamps.

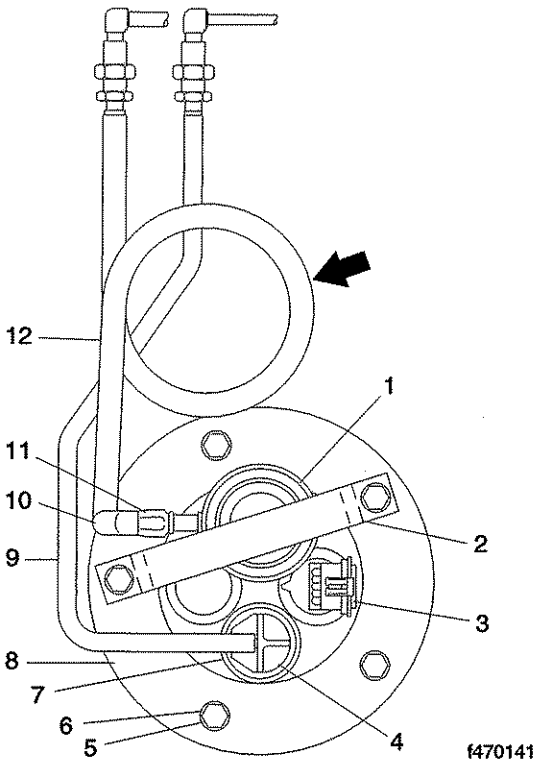
Inspect the fuel system using the following guidelines.

⚠ WARNING

WARNING: Release the fuel system pressure before servicing any fuel system lines, tubes, or fittings. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire.

1. Release the fuel system pressure. For instructions, refer to **Subject 170**.
2. Inspect all fuel lines to be sure they are free from sharp bends or kinks, and are not in contact with other vehicle components so as to cause scuffing or abrasion. Replace any bent or kinked lines.
3. Secure all fuel lines to prevent chafing, kinking, or other damage.
4. Check the length of all fuel lines. They must be long enough to allow movement of the parts to which they attach. Check that the fuel supply line is looped correctly where it attaches to the fuel pump module. See **Fig. 1.**
5. Inspect all fuel lines, clamps, couplings, and fittings for leaks. Inspect all clamps, couplings, and fittings for security. Immediately replace any component that shows signs of failure, or damage that could lead to failure. Tighten new clamps 15 lbf·in (170 N·cm).

Fuel Line Routing



Loop the fuel supply line as shown.

1. Fuel Filter/Pressure Regulator
2. Fuel Pump Guard Bracket
3. Pump/Gauge Electrical Connector
4. Pressure Relief/Rollover Valve
5. 5/16–18 Clamp Ring Mounting Capscrew (Grade 8)
6. Hardened Flatwasher
7. Rollover Valve Grommet
8. Fuel Pump Mounting Clamp Ring
9. Evaporative Canister Line
10. 90° Elbow
11. Fuel Supply Line Fitting
12. Fuel Supply Line

Fig. 1, Fuel Supply Line

6. Be sure that all nylon fuel tubes are properly routed, not pinched, and far enough away from sources of heat. Replace as necessary.

IMPORTANT: Never attempt to repair a nylon fuel tube.

QUICK-DISCONNECT FITTINGS

Gasoline fuel lines are equipped with quick-disconnect fittings to allow easy and fast connections. These fittings contain a plastic retainer with two external tabs, one on each side of the fitting. See **Fig. 2.**

1. Disconnect the batteries.

⚠ WARNING

WARNING: Release the fuel system pressure before servicing any fuel system quick-disconnect fittings. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire.

2. Release the fuel system pressure. For instructions, refer to **Subject 170**
3. Clean the fitting of any foreign material such as grease or oil.
4. To disconnect the line at the fuel rail, squeeze the two tabs on the plastic retainer against the sides of the fitting, using finger pressure only. Remove the line and fitting body, leaving the retainer on the fuel rail.

NOTE: To remove the plastic retainer, if necessary, very carefully release it from the component using two small screwdrivers. Inspect the retainer after removal for cracks or damage.

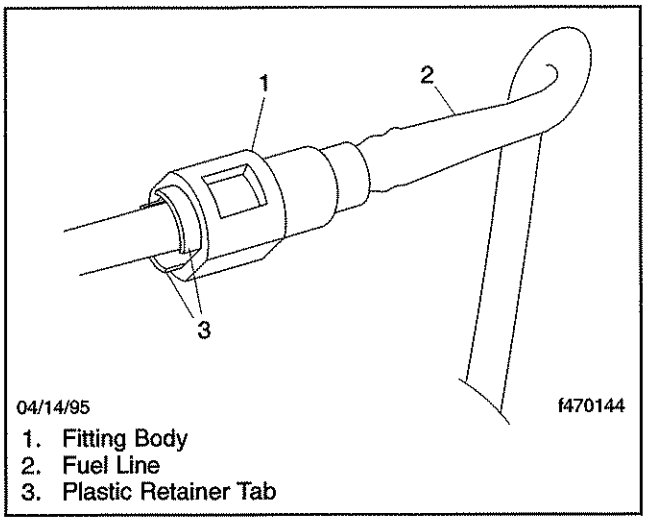
5. Inspect the plastic retainer and the body of the quick-connect fitting for damage. Replace if necessary.

IMPORTANT: Do not attempt to replace any interior components (O-rings, spacers) of the quick-disconnect fitting. If repair is needed, replace the complete fitting.

6. Check the condition of the fitting and the component. Clean all parts with a lint-free cloth. Lubricate them with clean engine oil.
7. To connect, insert the fitting into the component and into the plastic retainer. When you hear a click, the connection has been made. Pull firmly on the fuel tube to make sure the connection is locked.

NOTE: A locked fitting should resist a pull of approximately 15 to 30 lbf (65 to 130 N).

8. Connect the batteries.
9. Start the engine and check for leaks.



1. Fitting Body
2. Fuel Line
3. Plastic Retainer Tab

Fig. 2, Quick-Disconnect Fitting

Priming

Before priming the system, make sure there is enough fuel in the tank(s). Don't fill them to more than 95 percent of capacity.

⚠ WARNING

WARNING: Federal regulations prohibit filling a fuel tank to more than 95 percent of its capacity. A tank with air space is much less likely to rupture in an accident than one that has little or no air space. Fuel tank rupture could result in fuel spillage and a hazardous condition.

Don't crank the starter more than 30 seconds at a time during any of the following procedures; wait 2 minutes after each try to allow the starter to cool, or starter damage may occur.

1. If the engine is equipped with a priming pump, use it to prime the fuel transfer pump.
   - 1.1 Operate the priming pump plunger until there is resistance.
   - 1.2 Push the plunger in and tighten it by hand.
   - 1.3 Start the engine; if it doesn't start, more priming is needed. Once the engine has started, it may run rough; if so, run the engine at low idle until it runs smoothly.
2. If the engine isn't equipped with a priming pump, pressurize the fuel in the fuel tank, to prime the fuel transfer pump.
   - 2.1 Remove the fuel tank cap from the primary tank.
   - 2.2 Loosen the fuel supply line at the fuel transfer pump.
   - 2.3 While someone else looks for a constant fuel flow at the loosened fuel supply line, partially block the fuel tank opening with a clean rag, and use an air hose to apply no more than 35 kPa (5 psi) air pressure to the fuel tank.
   - 2.4 When the fuel flow is constant, remove the air hose and rag, and tighten the fuel supply line.

IMPORTANT: To prevent fuel loss or entry of air into a fuel line, make sure that all fuel line connections are tight.

- 2.5 Start the engine. Once the engine has started, it may run rough. If this occurs, run the engine at low idle until it runs smoothly.

Gasoline Fuel Tank Removal and Installation

Removal

If there is any damage to the fuel tank, *replace* it; *do not repair* fuel tanks.

⚠ WARNING

WARNING: Damaged fuel tanks must be replaced. A repaired fuel tank will not meet the strength, leakage, and venting standards required by U.S. Federal regulations for original and replacement fuel tanks. A repaired fuel tank may be more likely to rupture from impact, possibly causing fire and resulting in personal injury or property damage.

1. Apply the vehicle parking brakes and chock the tires.

IMPORTANT: The gasoline-powered engine uses a returnless fuel system. Even when the engine is shut down, the fuel system is under constant pressure.

2. Release the pressure on the fuel system.

   2.1 Disconnect the batteries.

   2.2 Remove the fuel tank filler cap. This releases fuel tank pressure.

   IMPORTANT: Do not allow gasoline to spill onto the engine intake or exhaust manifolds. To absorb the gasoline, place shop towels under and around the pressure port when the pressure is released from the fuel rail.

   2.3 Unscrew the protective plastic cap from the pressure test port on the fuel rail (**see Fig. 1**).

⚠ WARNING

WARNING: Always wear proper eye protection when releasing fuel system pressure. Fuel squirted or splashed into the eyes can cause injury.

   2.4 Obtain fuel pressure gauge tool set #5069. To order this tool set, call the Kent-Moore Tool Company at 1-800-328-6657. Remove the gauge from the hose. Place one end of the hose into an approved gasoline container. Place a shop towel under the test port. **See Fig. 2.**

   2.5 Screw the other end of the hose onto the fuel pressure test port and allow the gasoline to run into the container until the pressure is fully released.

   2.6 Remove the hose from the test port and return it to tool set #5069.

   2.7 Install the protective cap on the test port.

⚠ WARNING

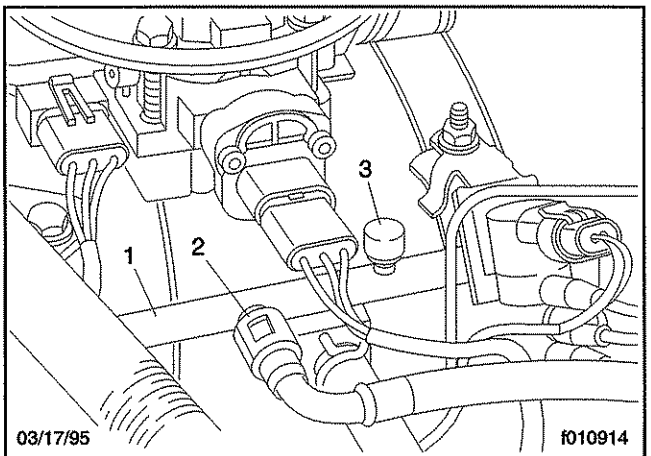
WARNING: Gasoline is highly flammable. Do not drain gasoline near, or expose gasoline vapor to, open flame or intense heat. This could lead to personal injury or property damage by fire.

3. Remove the drain plug (**see Fig. 3**, Ref. 6). Drain the fuel tank.

   If the gasoline is to be saved, store it in a clean container, and protect it from contaminants. Move the container away from the work area.

IMPORTANT: The removal of the fuel tank is affected by the configuration of the vehicle. The three configurations are:

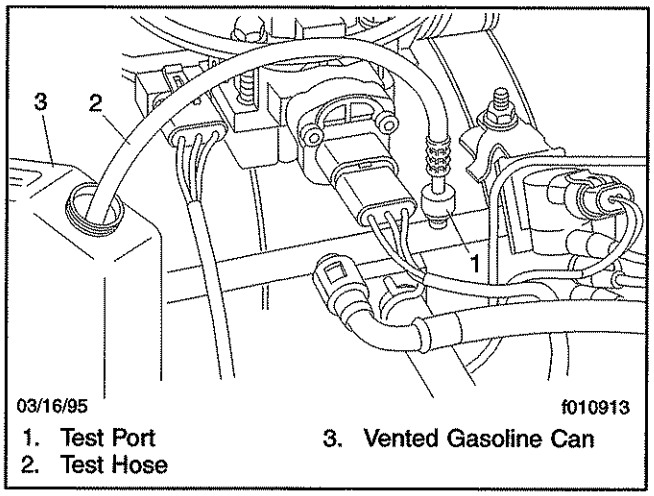
- open frame;
- box with a bolted tank assembly;
- box with Huckbolted tank assembly.



1. Fuel Rail
2. Fuel Line
3. Test Port Protective Cap

Fig. 1, Pressure Test Port

Gasoline Fuel Tank Removal and Installation



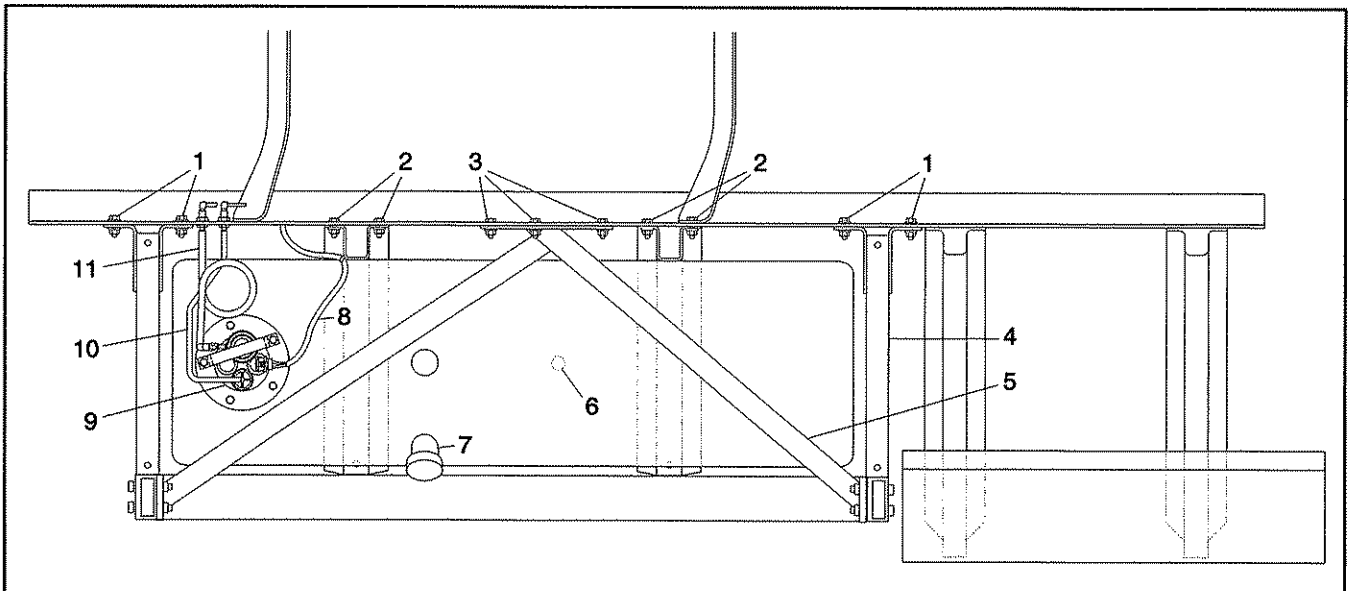
1. Test Port
2. Test Hose
3. Vented Gasoline Can

Fig. 2, Release Fuel System Pressure

First determine the vehicle's configuration, and then refer to the appropriate removal method below.

Vehicles with Open Frame

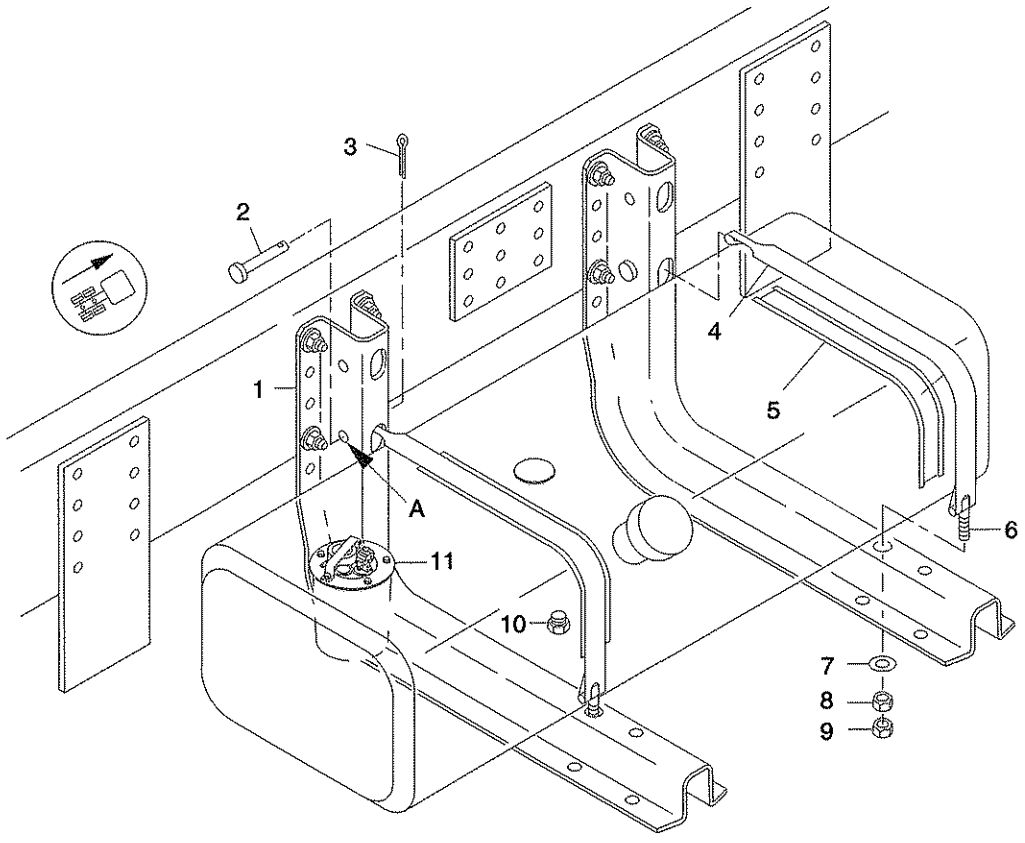
1. Disconnect the electrical connector and fuel lines from the fuel pump module. Then, remove the fuel pump module from the tank. For a detailed removal procedure, refer to **Subject 100** in the Chrysler fuel pump module section.
2. Remove the mounting locknuts and capscrews.
3. Remove the top brace bolts from the top brace bracket and the outboard end of each end bracket. Remove the top braces (upper cage assembly) from the vehicle.
4. Remove the tank straps and isolators. **See Fig. 4.**
   - 4.1 From each tank strap T-bolt (Ref. 6), fastened to the outboard end of the tank brackets, remove the nuts and bearing washers (Refs. 9, 8, and 7).
   - 4.2 Remove the cotter pins and clevis pins (Refs. 3 and 2) from the inboard end of each tank strap. Remove the tank straps and isolators.
5. Lift the fuel tank out of the fuel tank cage.
6. Inspect the tank straps, isolators, and brackets for wear and damage.



1. End Bracket Bolts
2. Fuel Tank Bracket Bolts
3. Top Brace Bolts
4. End Bracket
5. Top Brace
6. Drain Plug
7. Fuel Filler Neck
8. Electrical Cable
9. Fuel Pump Module
10. Evaporative Canister Line
11. Fuel Supply Line

Fig. 3, Rectangular Fuel Tank (installed)

Gasoline Fuel Tank Removal and Installation



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NOTE: Lower cage assembly removed for clarity.

A. Use the lower set of holes in the tank bracket for attaching the fuel tank straps.

1. Fuel Tank Bracket
2. Tank Strap Clevis Pin
3. Tank Strap Cotter Pin
4. Fuel Tank Strap
5. Tank Strap Isolator
6. Tank Strap T-Bolt
7. Bearing Washer
8. 1/2–13 Hexnut
9. 1/2–13 Jam Nut
10. Drain Plug
11. Fuel Pump Module

Fig. 4, Fuel Tank Removal and Installation

⚠ WARNING

WARNING: Replace worn or damaged parts. Failure to replace worn or damaged parts could result in loss of a fuel tank and spilling of fuel, which could cause personal injury or property damage.

7. If a fuel tank is being replaced, remove parts from the old tank that will be needed on the new tank. Inspect the parts, and replace them if necessary. Install them on the new tank. If necessary, install near the fuel filler neck a new decal reading "unleaded fuel only."

7.1 Remove and clean all pipe plugs and fittings, and transfer them to the new tank. Clean all parts with a lint-free cloth. Lubricate them with clean engine oil.

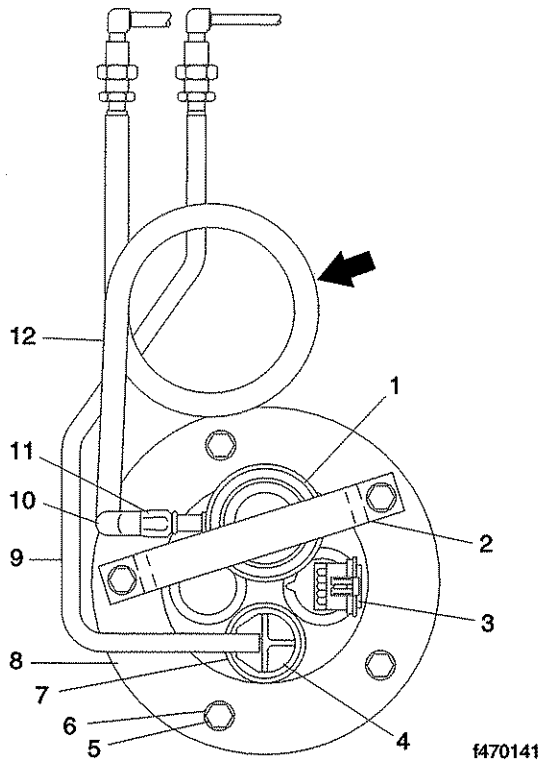
IMPORTANT: Loop the fuel supply line during the next step in the installation procedure. **See Fig. 5.**

7.2 Install the fuel pump module to the new tank. **See Fig. 5.** For a detailed installation procedure, refer to **Subject 100** in the Chrysler fuel pump module section. Securely and evenly tighten the clamp ring mounting capscrews 20 N·m (15 lbf·ft).

Gasoline Fuel Tank Removal and Installation

Vehicles With Box and Bolted Fuel Tank Assemblies Installed

1. Disconnect the electrical connector and fuel lines from the fuel pump module. Then, remove the fuel pump module from the tank. For a detailed removal procedure, refer to **Subject 100** in the Chrysler fuel pump module section.



NOTE: It is important to loop the fuel supply line as shown.

1. Fuel Filter/Pressure Regulator
2. Fuel Pump Guard Bracket
3. Pump/Gauge Electrical Connector
4. Pressure Relief/Rollover Valve
5. 5/16–18 Clamp Ring Mounting Capscrew (Grade 8)
6. Hardened Flatwasher
7. Rollover Valve Grommet
8. Fuel Pump Mounting Clamp Ring
9. Evaporative Canister Line
10. 90° Elbow
11. Fuel Supply Line Fitting
12. Fuel Supply Line

Fig. 5, Fuel Pump Module (Top View)

2. Remove the fuel tank cage. To do so, use the following instructions:
   - 2.1 Support the cage assembly with a forklift or other lifting device;
   - 2.2 Unbolt the cage assembly from the frame rail;
   - 2.3 Remove the cage from the vehicle.
3. Remove the tank straps and isolators. **See Fig. 4.**
   - 3.1 From each tank strap T-bolt (Ref. 6), fastened to the outboard end of the tank brackets, remove the nuts and bearing washers (Refs. 9, 8, and 7).
   - 3.2 Remove the cotter pins and clevis pins (Refs. 3 and 2) from the inboard end of each tank strap. Remove the tank straps and isolators.

NOTE: Do not remove the fuel tank brackets.

4. Remove the fuel tank from the vehicle.
5. Inspect the tank straps, isolators, and brackets for wear and damage.

⚠ WARNING

WARNING: Replace worn or damaged parts. Failure to replace worn or damaged parts could result in loss of a fuel tank and spilling of fuel, which could cause personal injury or property damage.

6. If a fuel tank is being replaced, remove parts from the old tank that will be needed on the new tank. Inspect the parts, and replace them if necessary. Install them on the new tank. If necessary, install near the fuel filler neck a new decal reading "unleaded fuel only."
   - 6.1 Remove and clean all pipe plugs and fittings, and transfer them to the new tank. Clean all parts with a lint-free cloth. Lubricate them with clean engine oil.
   - 6.2 Install the fuel pump module to the new tank. **See Fig. 5.** For a detailed installation procedure, refer to **Subject 100** in the Chrysler fuel pump module section. Securely and evenly tighten the clamp ring mounting capscrews 20 N·m (15 lbf·ft).

Gasoline Fuel Tank Removal and Installation

Vehicles With Box and Huckbolted Fuel Tank Assemblies Installed

1. Disconnect the electrical connector and fuel lines from the fuel pump module. Then, remove the fuel pump module from the tank. For a detailed removal procedure, refer to **Subject 100** in the Chrysler fuel pump module section.

NOTE: Use a gas cutting torch and a grinder to remove the Huckbolts.

2. To prepare the fuel tank and the vehicle for removal of the Huckbolts, use the following instructions:

   2.1 Flush the fuel tank with water for several minutes;

   2.2 Fill the fuel tank with water;

   2.3 Flush the adjacent portion of the vehicle and the surrounding area with water;

   2.4 Allow the water on the vehicle and the work area to dry.

⚠ WARNING

WARNING: Do not use a flame or a grinder near a gasoline tank unless the tank has been flushed and filled with water, and the surrounding area has been flushed with water. Otherwise, an explosion or fire could result, causing serious person injury or death.

   2.5 Burn and grind seven of the nine Huckbolts attaching the fuel tank brackets. (Leave one Huckbolt holding each bracket). Work on either side of the frame rail, whichever offers the best access;

   2.6 Install a nut and bolt to hold each bracket before removing the last Huckbolts;

   2.7 Remove the last Huckbolts with the torch and grinder;

   2.8 Drain the water from the tank, and position a forklift or other lifting device under the tank.

3. Remove the tank straps and isolators. **See Fig. 4.**

   3.1 From each tank strap T-bolt (Ref. 6), connected to the outboard end of the tank brackets, remove the nuts and bearing washers (Refs. 9, 8, and 7).

   3.2 Remove the cotter pins and clevis pins (Refs. 3 and 2) from the inboard end of each tank strap. Remove the tank straps and isolators.

   3.3 Remove the temporary bolts holding the brackets.

4. Lower the fuel tank out of the fuel tank cage. Remove the fuel tank from the vehicle.

NOTE: During the lowering procedure, the fuel tank may need to be rotated slightly so that the filler tube clears the cage assembly.

5. Inspect the tank straps, isolators, and brackets for wear and damage.

⚠ WARNING

WARNING: Replace worn or damaged parts. Failure to replace worn or damaged parts could result in loss of a fuel tank and spilling of fuel, which could cause personal injury or property damage.

6. If a fuel tank is being replaced, remove parts from the old tank that will be needed on the new tank. Inspect the parts, and replace them if necessary. Install them on the new tank. If necessary, install near the fuel filler neck a new decal reading "unleaded fuel only."

   6.1 Remove and clean all pipe plugs and fittings, and transfer them to the new tank. Clean all parts with a lint-free cloth. Lubricate them with clean engine oil.

   6.2 Transfer the fuel pump module to the new tank. **See Fig. 5.** For a detailed installation procedure, refer to **Subject 100** in the Chrysler fuel pump module section. Securely and evenly tighten the clamp ring mounting capscrews 20 N·m (15 lbf·ft).

7. If the old tank, which was filled with water, is to be installed, ensure that it is dry before installation. Mop out the interior of the tank with shop towels, and then direct shop air into the tank until dry.

Gasoline Fuel Tank Removal and Installation

Installation

1. Depending on the vehicle's configuration, lower or lift the fuel tank into its approximate installed position. **See Fig. 3.**

   Make sure the fuel filler neck is outboard.

   On vehicles where the Huckbolts and the brackets were removed, install the brackets along with the fuel tank. Replace the Huckbolts with fuel tank bracket mounting locknuts and Grade 8 capscrews. Tighten each nut 68 lbf·ft (92 N·m).

2. Install the isolators and tank straps. **See Fig. 4.**

   2.1 Install a clevis pin (Ref. 2) through the inboard end of each tank bracket and tank strap. Use the lower hole in the tank bracket. Install and lock a new cotter pin (Ref. 3) in each clevis pin.

   IMPORTANT: Fuel tanks can be damaged by overtightening the fuel tank straps.

   2.2 Install a bearing washer and two nuts on each tank strap T-bolt. Tighten the first nuts 20 N·m (15 lbf·ft).

   2.3 While holding the first nut stationary with a wrench, tighten each jam nut 41 N·m (30 lbf·ft).

3. On open-framed vehicles, install the top braces onto the fuel tank cage end brackets and the frame rail. Install all bolts with the nuts facing toward the fuel filler cap. Tighten the bolts 68 lbf·ft (92 N·m). **See Fig. 3.**

   On vehicles with a box or container (bolted cage), install the fuel tank cage to the frame rail. Use a forklift or other lifting device to support the cage during installation. Tighten the bolts 68 lbf·ft (92 N·m).

4. Attach the wires to the electrical connector on the fuel pump module. Check the connector for tightness.

5. Make certain the fuel lines are clean. Loop the fuel supply line as shown **in Fig. 5.** Then connect the fuel lines to their fittings on the fuel tank. For general guidelines, refer to **Subject 150.**

6. Add clean unleaded gasoline to the fuel tank. Be sure the fuel tank has a decal reading "Unleaded fuel only" located near the fuel filler neck. Replace the filler cap.

7. Remove the tire chocks.

Specifications

This subject contains the following table:

•Fastener Torques

Refer to Fig. 1 for fuel tank positioning. Refer to Fig. 2 for single-level cab-access step positioning. Refer to Fig. 3 for dual-level cab-access step positioning.

Description	Size	Grade	Torque N·m (lbf·ft)
Cab-Access Step Bracket-to-Fuel Tank Bracket Locknut	3/8–16	C	38 (28)
Cab-Access Step Bracket-to-Fuel Tank Weldnut Capscrew	3/8–16	5	35 (26)
Cab-Access Step-to-Step Bracket Locknut	1/4–20	B	10 (7)
Chassis-Access Step Clamp Capscrew	3/8–16	5	35 (26)
Fuel Tank Strap T-Bolt:			
Hexnut	1/2–13	B	20 (15)
Jam Nut	1/2–13	B	41 (30)
Fuel Tank Bracket Mounting Locknut	1/2–13	C	92 (68)
Compression Brace Mounting Locknut	1/2–13	C	92 (68)

Table 1, Fastener Torques

Specifications

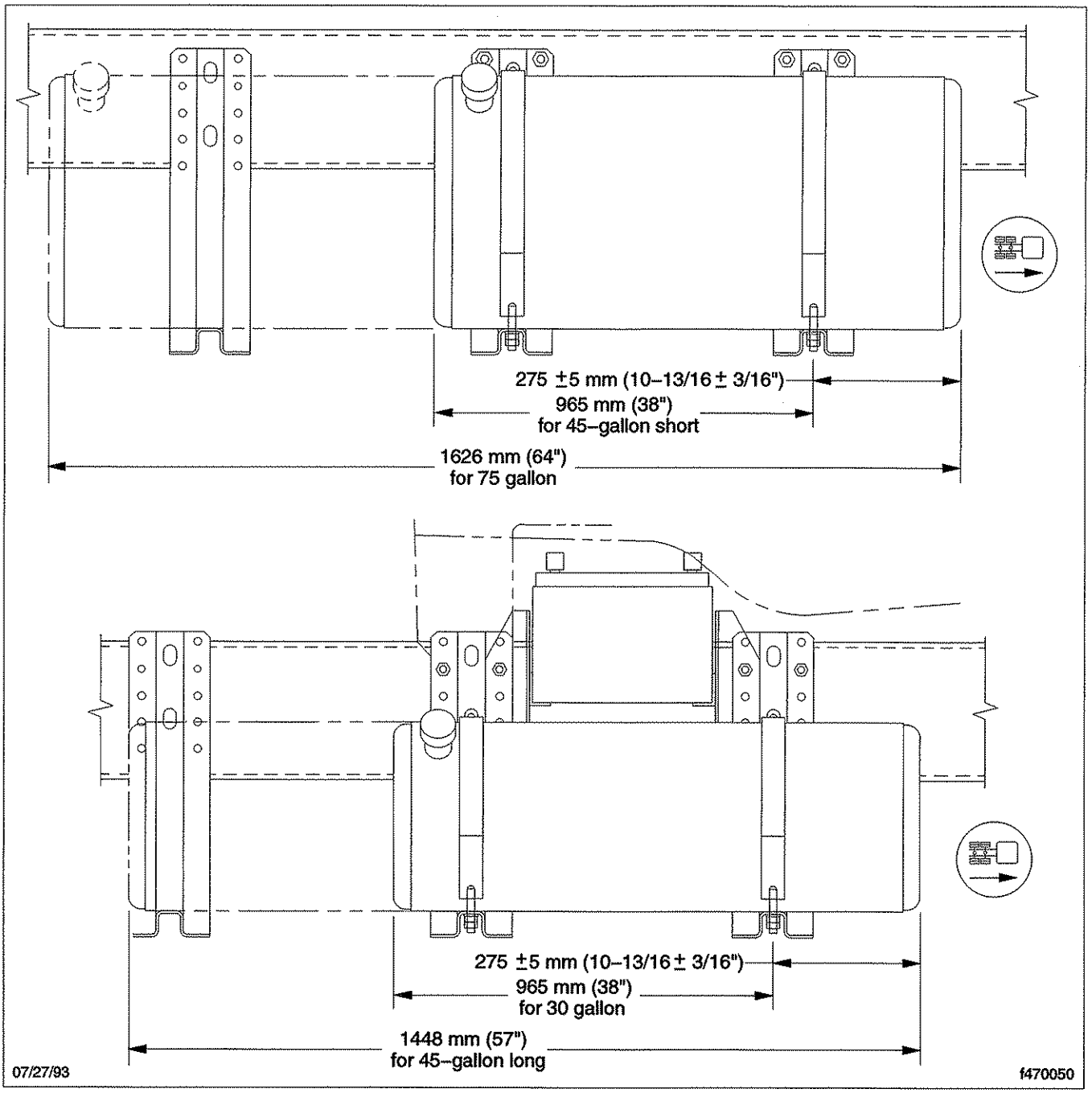


Fig. 1, Fuel Tank Positioning

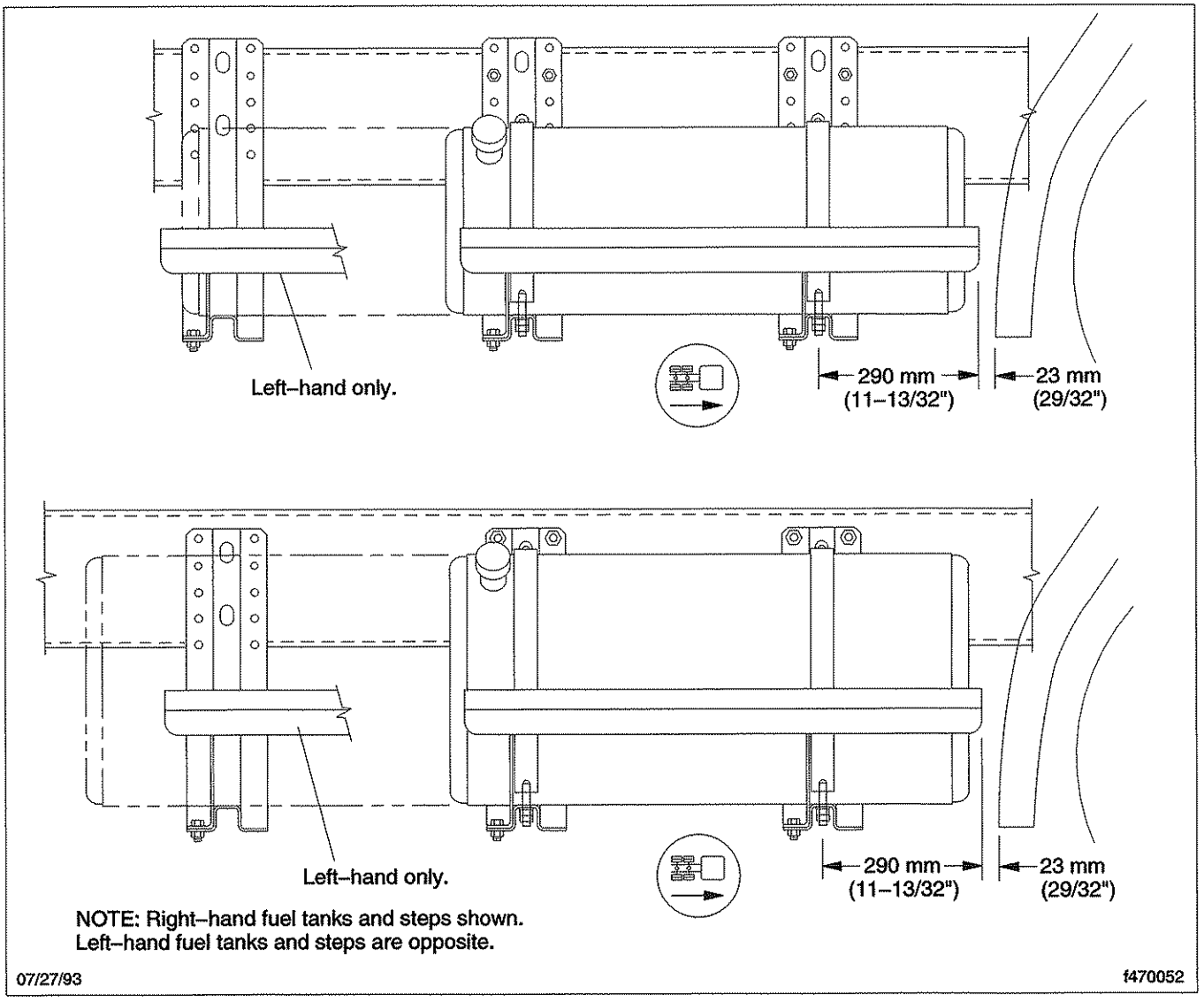


Fig. 2, Single-Level Cab-Access Step Positioning

Specifications

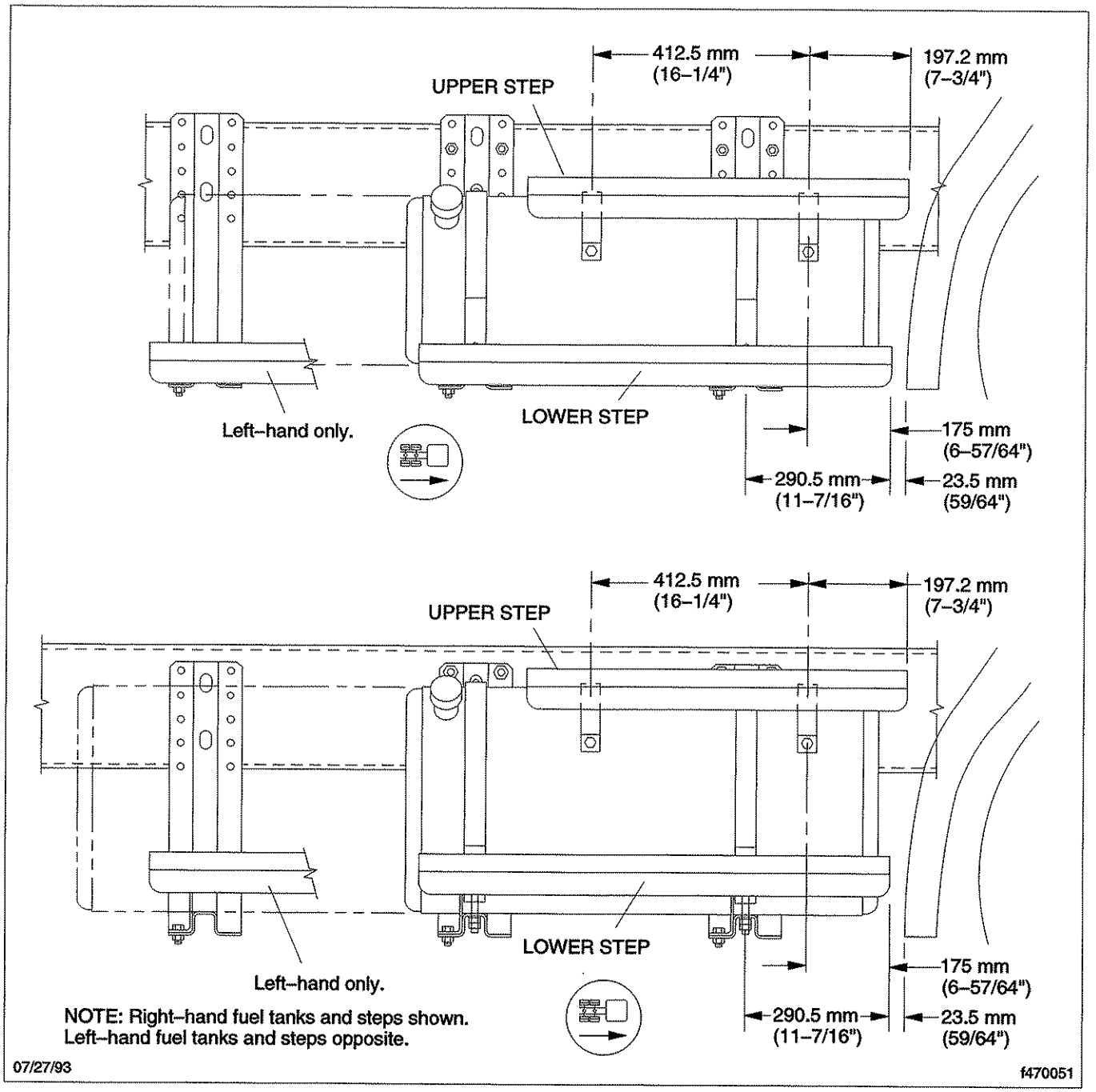


Fig. 3, Dual-Level Cab-Access Step Positioning

Contents

Subject	Subject Number
General Information	050
Service Operations	
Filter Element Replacement	100
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Fuel/Water Separator Replacement	120
Troubleshooting	300
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General Description

The Freightliner/Racor fuel/water separator (**Fig. 1**) removes water and solid contaminants from diesel fuel. Installed between the fuel tank and the fuel transfer pump, the separator has an optional ignition-controlled fuel heater to prevent ice and wax in the diesel from clogging fuel filters.

The separator is mounted on the frame rail.

Principles of Operation

Diesel fuel enters at the top of the separator (**Fig. 2**), flowing down past the heater element (if so equipped), and on to the top of the filter element. As the fuel flows down the sides of the element, the heavier contaminants and some water fall directly to the collection bowl below the element. The filter element itself contains a resin that repels water, forcing any remaining water to bead against or within the element and fall to the collection bowl. As the fuel passes from the outside to the inside of the filter element, the last traces of water collect on the inner surface of the element and fall to the collection bowl.

The filtered fuel is drawn out through the top of the separator, and the water and solid contaminants remain in the collection bowl. As the water collects, it completes the circuit between the two prongs of the water sensor probe. A warning light in the cab alerts the operator to drain the bowl.

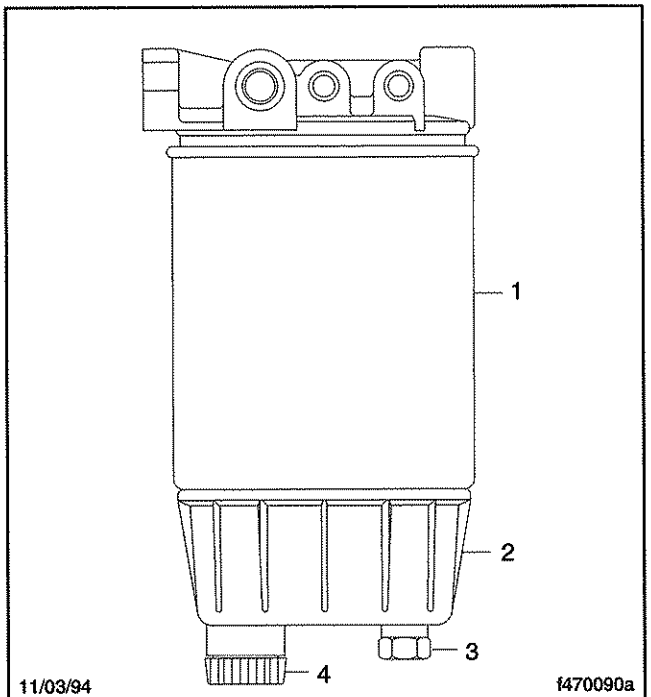


Fig. 1, Fuel/Water Separator

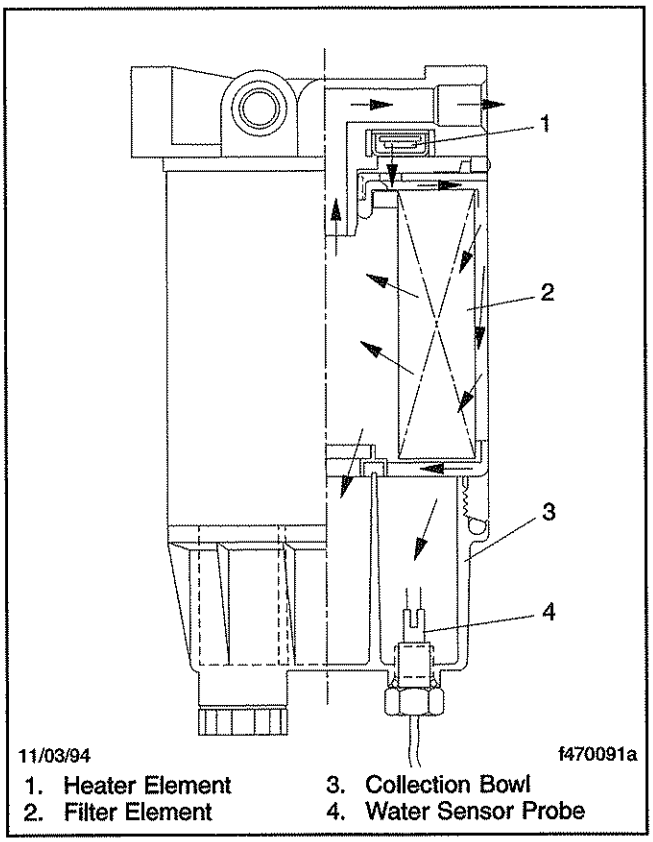


Fig. 2, Fuel Flow Through the Separator

Filter Element Replacement

Replacement (See Fig. 1)

1. Apply the parking brakes, chock the tires, and tilt the hood.
2. Drain the fuel/water separator.
   - 2.1 Place a suitable container under the separator.
   - 2.2 Turn the drain counterclockwise to remove it.

   IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container, and dispose of it properly. Many states now issue fines for draining fuel/water separators onto the ground. On all types of separators, stop draining fluid when you see fuel come out of the separator drain valve.
3. Disconnect the wiring connector from the water sensor probe.
4. Remove the bowl from the element.
5. Remove the element from the adapter fitting and the mounting head.
6. Install the bowl on the bottom of the new filter element.
7. Install the drain by turning it clockwise into the bottom of the bowl.
8. Lubricate the O-ring in the top of the filter element with clean motor oil or diesel fuel.
9. Fill the element and bowl assembly with clean fuel.
10. Install the new filter element on the mounting head. Tighten the element 72 lbf·in (820 N·cm).
11. Connect the wiring connector to the water sensor probe.
12. Start the engine and check for leaks. Repair any leaks.
13. Lower the hood, and remove the chocks from the tires.

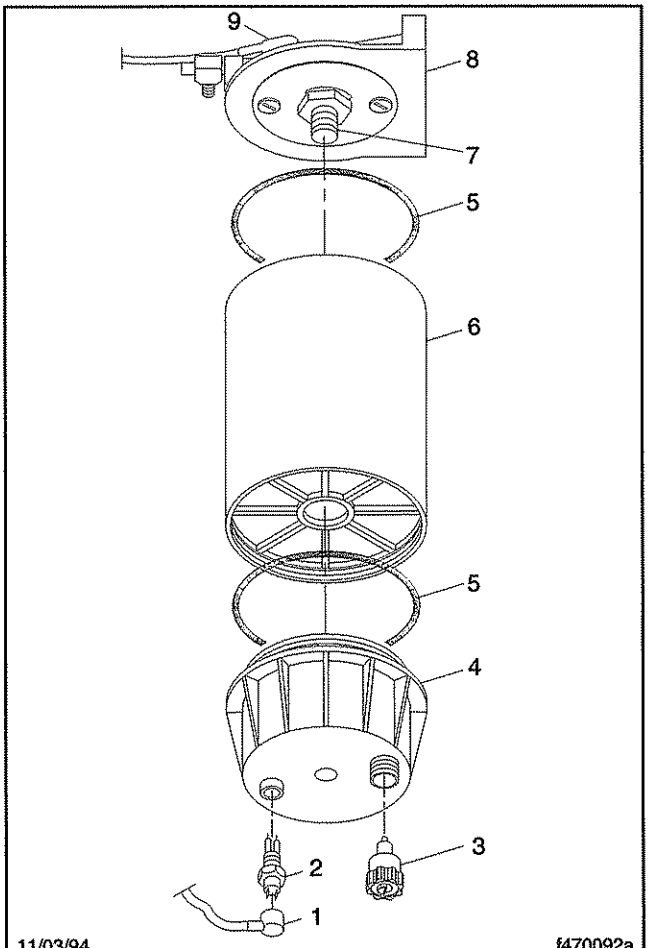
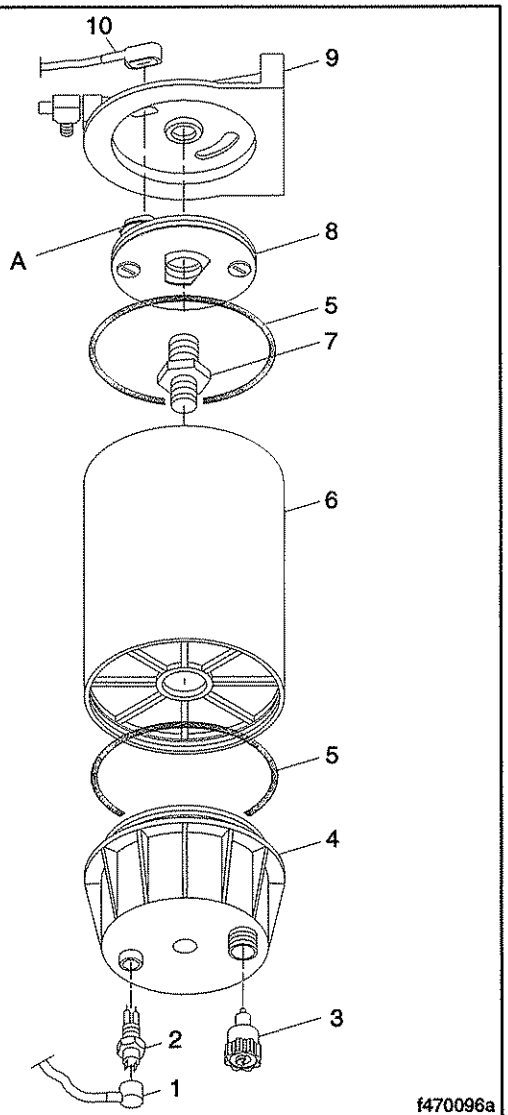


Fig. 1, Fuel/Water Separator Assembly

Replacement (See Fig. 1)

1. Apply the parking brakes, chock the tires, and tilt the hood.



A. Install the heater element O-ring here.

1. Wiring Connector	6. Filter Element
2. Water Sensor Probe	7. Adaptor Fitting
3. Self-Venting Drain	8. Heater Element
4. Bowl	9. Mounting Head
5. Filter Element O-Ring	10. Wiring Connector

Fig. 1, Fuel/Water Separator Assembly With Heater

2. Drain the fuel/water separator.
   - 2.1 Place a suitable container under the separator.
   - 2.2 Turn the drain counterclockwise to remove it.

   IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container, and dispose of it properly. Many states now issue fines for draining fuel/water separators onto the ground. On all types of separators, stop draining fluid when you see fuel come out of the separator drain valve.
3. Disconnect the wiring connector from the water sensor probe.
4. Remove the bowl from the element.
5. Remove the element from the adapter fitting and the mounting head.
6. Remove the brass adapter fitting from the mounting head.
7. Disconnect the wiring connector from the heater element.
8. Remove the heater element from the mounting head.
9. Clean the inside surface of the mounting head, and install the new heater element with a new, lubricated element O-ring.
10. Apply Loctite 271 (or equivalent) to the adapter fitting threads, and install the adapter on the mounting head. Tighten the adapter 30 lbf·ft (40 N·m).
11. Connect the wiring connector to the element.
12. Install the bowl on the bottom of the replacement filter element.
13. Screw the drain into the bottom of the bowl.
14. Lubricate the O-ring in the top of the filter element with clean motor oil or diesel fuel.
15. Fill the element and bowl assembly with clean fuel.
16. Install the replacement filter element on the adaptor fitting. Tighten the element 72 lbf·in (820 N·cm).
17. Connect the wiring connector to the water sensor probe.

Heater Element Replacement

18. Start the engine and check for leaks. Repair any leaks.
19. Lower the hood, and remove the chocks from the tires.

Fuel/Water Separator Replacement

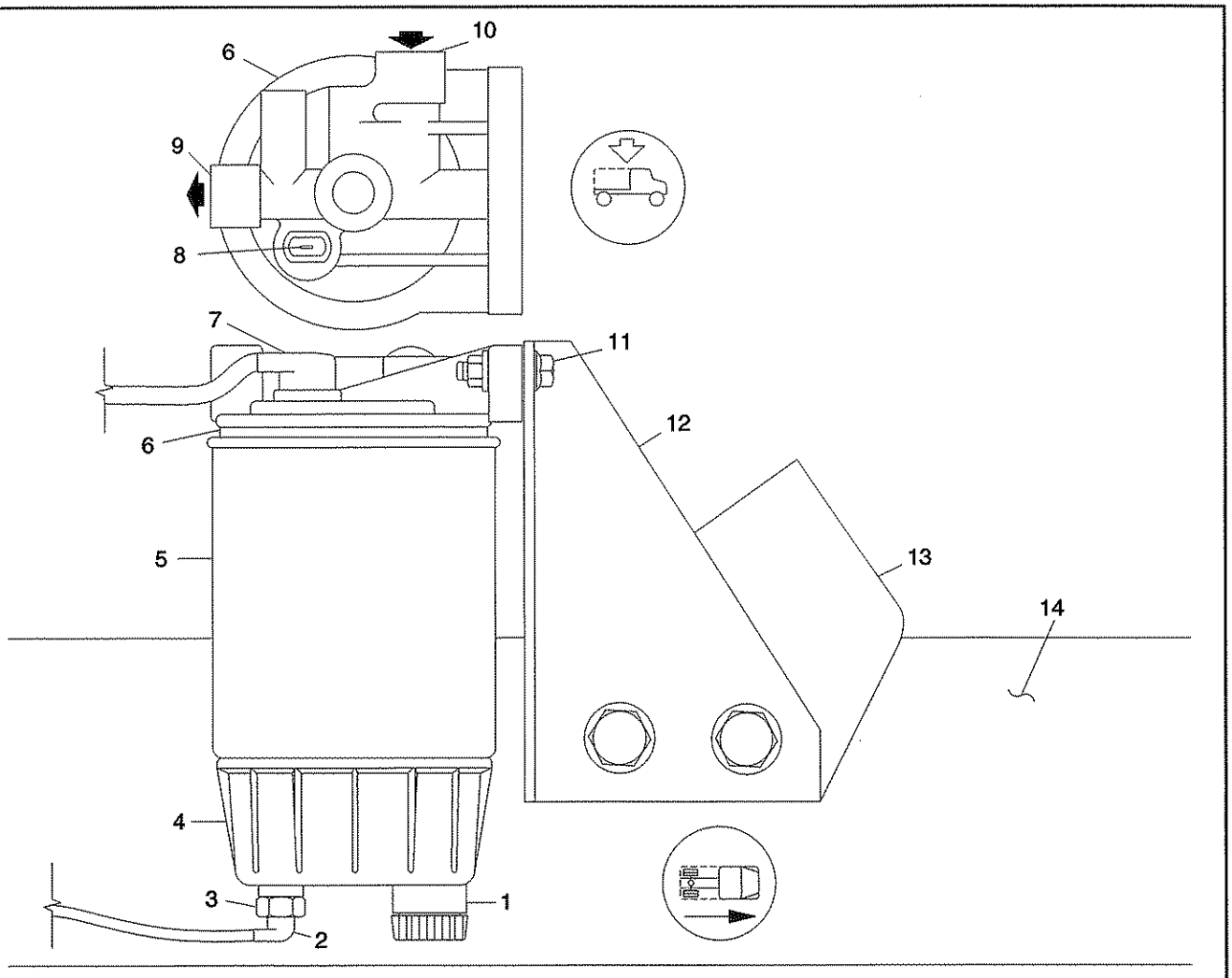
Replacement (See Fig. 1)

1. Apply the parking brakes, chock the tires, and tilt the hood.
2. Drain the fuel/water separator.

2.1 Disconnect the fuel lines from the separator, and mark the lines for reassembly.

2.2 Place a suitable container under the separator.

2.3 Turn the drain counterclockwise to remove it.



06/25/96 f470093a

1. Self-Venting Drain
2. Wiring Connector
3. Water Sensor Probe
4. Bowl
5. Filter Element
6. Mounting Head
7. Wiring Connector
8. Heater Element
9. Outlet Port
10. Inlet Port
11. Fuel/Water Separator Mounting Bolts
12. Fuel/Water Separator Mounting Bracket
13. Radiator Strut Bracket
14. Frame Rail

Fig. 1, Fuel/Water Separator Mounting

Fuel/Water Separator Replacement

IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container, and dispose of it properly. Many states now issue fines for draining fuel/water separators onto the ground. On all types of separators, stop draining fluid when you see fuel come out of the separator drain valve.

3. Remove the wiring connectors from the water sensor probe and the heater element.
4. Remove the fuel/water separator mounting bolts, and remove the separator from its mounting bracket.
5. Place the new separator against the mounting bracket, and secure it with the mounting bolts. Tighten the bolts 40 lbf·ft (55 N·m).
6. Remove the bowl and the filter element, as a unit, from the new separator.
7. Using clean motor oil or diesel fuel, lubricate the O-ring in the top of the filter element.
8. Make sure the drain in the bowl is closed, then fill the filter element and bowl assembly with clean fuel.
9. Install the element on the mounting head, and tighten the element 72 lbf·in (820 N·cm).
10. Connect the fuel lines to the separator.
11. Connect the wiring connectors to the water sensor probe and the heater element.
12. Prime the fuel system. With the filter element and bowl assembly full of clean fuel, crank the engine until it starts. This serves to prime the fuel system.
13. Start the engine and check for leaks. Repair any leaks.
14. Lower the hood, and remove the chocks from the tires.

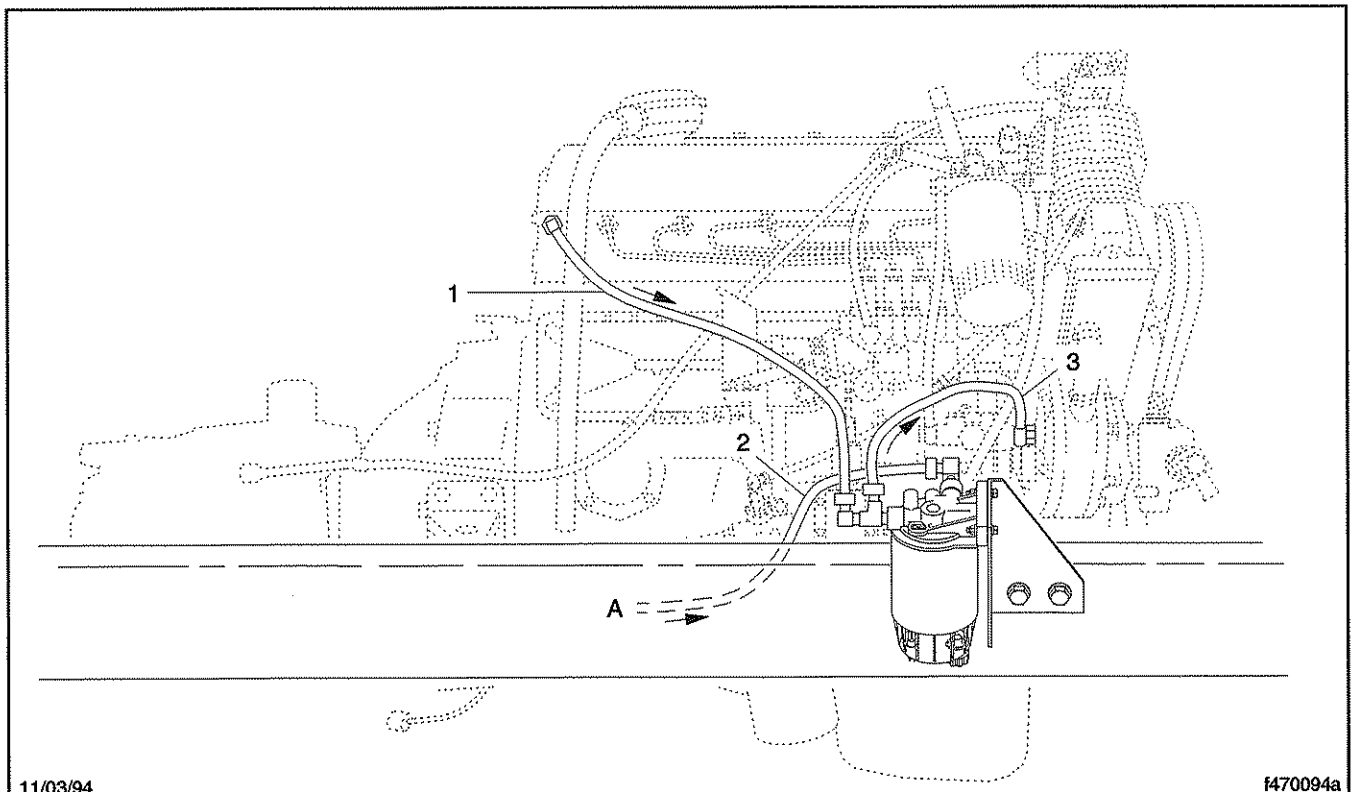
Troubleshooting

1. Turn the ignition to "Accessory." The high water light should come on for 2 to 5 seconds, then go off.
2. With the ignition still on, disconnect the wiring connector from the water sensor probe, and run a jumper wire from one connector terminal to the other. The high water light should come on. If it does not, check all wiring connections. Check that power is on, and that the separator is grounded. Check for damaged wiring in the sensor probe circuit. For a diagram of the sensor circuit, see **Specifications, 400**. If the circuit is intact and undamaged, replace the sensor probe.
3. Repeat the above steps to test the new sensor probe.
4. Connect the wiring connector to the sensor probe.

Specifications

Fastener Torques				
Description	**Grade**	**Size**	**Torque**	
			lbf·ft (N·m)	**lbf·in (N·cm)**
Adaptor Fitting	—	—	30 (40)	—
Filter Element	—	—	—	72 (820)
Separator Mounting Bolts	8	3/8-16	40 (55)	—

Table 1, Fastener Torques

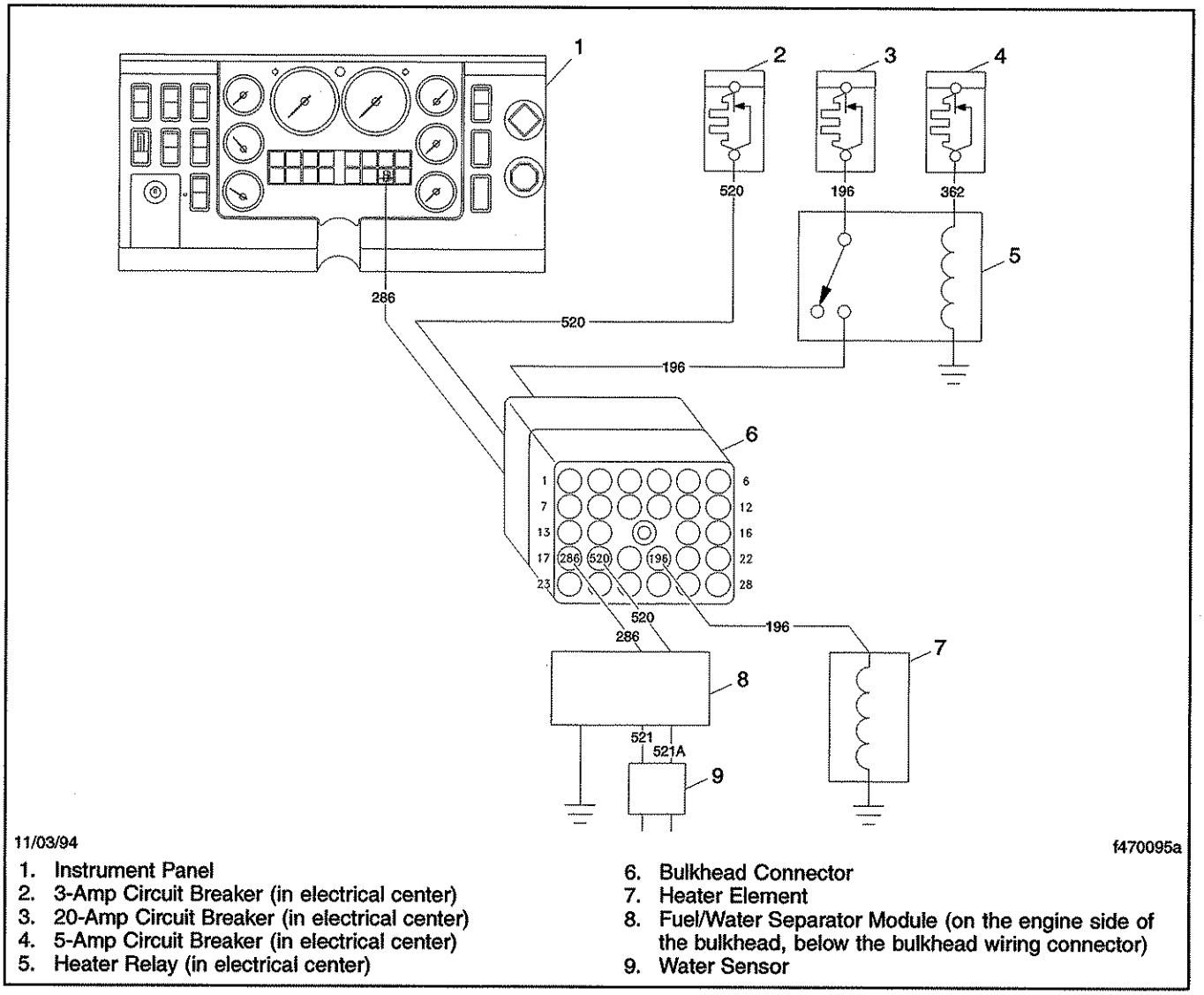


NOTE: On Cummins B or C Series engines, no fuel injector bleed line is used.

A. From the fuel tank
1. Fuel Injector Bleed Line
2. Fuel Inlet Line
3. Fuel Outlet Line

Fig. 1, Fuel Line Routing (Mercedes-Benz OM 366LA engine shown)

Specifications



1. Instrument Panel
2. 3-Amp Circuit Breaker (in electrical center)
3. 20-Amp Circuit Breaker (in electrical center)
4. 5-Amp Circuit Breaker (in electrical center)
5. Heater Relay (in electrical center)
6. Bulkhead Connector
7. Heater Element
8. Fuel/Water Separator Module (on the engine side of the bulkhead, below the bulkhead wiring connector)
9. Water Sensor

Fig. 2, Fuel/Water Separator Wiring Diagram

Fuel Pump Module, Chrysler

47.02

Contents

Subject	Subject Number
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Fuel Pump Module Removal and Installation and In-Tank Fuel Filter Replacement	100
Fuel Filter/Pressure Regulator Removal and Installation	110
Pressure Relief/Rollover Valve Removal and Installation	120
Fuel System Pressure Release	130
Troubleshooting	300
Specifications	400

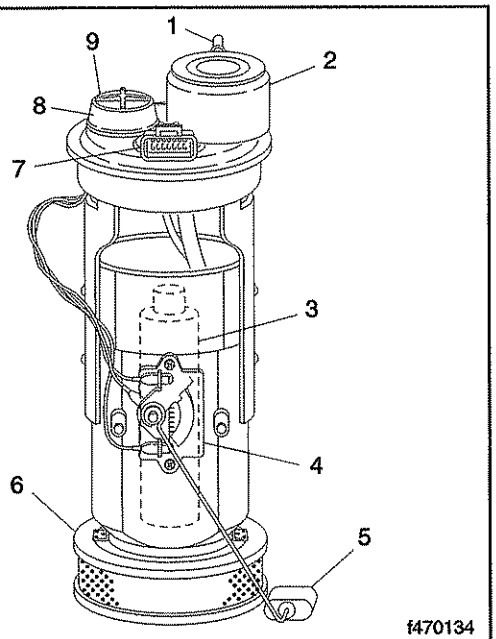
General Information

On all gas-powered engines, the fuel pump module is installed in the top of the fuel tank. **See Fig. 1.**

The fuel pump module contains the following:

- A combination fuel filter and pressure regulator
- An electric fuel pump
- A separate in-tank fuel filter
- A fuel gauge sensing unit and float
- A fuel supply line connection

Also mounted in the fuel pump module is a pressure relief/rollover valve that is designed to prevent fuel leakage during a rollover. Molded on the ribbed cover of this valve is a barbed connection. A flexible line attaches this barb to the evaporative canister.



1. Fuel Supply Line Connection
2. Fuel Filter/Pressure Regulator
3. Electric Fuel Pump
4. Sensing Unit
5. Float
6. In-Tank Fuel Filter
7. Electrical Connector
8. Pressure Relief/ Rollover Valve
9. Ribbed Cover

Fig. 1, Fuel Pump Module

The fuel pump module is suspended in fuel inside the fuel tank. Fuel is drawn in through the separate in-tank filter in the base of the module.

The electric fuel pump is located inside the fuel pump module. It is equipped with a permanent magnet electric motor which pushes the fuel into the filter/ pressure regulator.

The fuel pump is located inside a 1-liter (1.1-quart) plastic reservoir that remains full while the engine is running. In the bottom of the reservoir, there is a valve that closes whenever the fuel level in the tank drops below approximately 25 mm (1 inch). This will supply fuel from the reservoir to prevent cavitation of the pump.

A check valve installed in the fuel outlet prevents pressure drain-back through the pump. This maintains constant fuel pressure even when the engine is not running and helps to start the engine more easily.

IMPORTANT: The fuel system is under constant pressure. Before performing any service on the fuel pump module, be sure to release the fuel system pressure. For procedures, refer to **Subject 130.**

The electric fuel pump is not serviceable. If the fuel pump needs replacement, replace the entire fuel pump module. For procedures, refer to **Subject 100.**

The fuel filter/pressure regulator is a mechanical device not controlled by the Powertrain Control Module. It is calibrated to maintain fuel system pressure at approximately 240 to 310 kPa (35 to 45 psi) and contains an internal diaphragm, calibrated springs, a fuel return valve, and an internal fuel filter.

The electric fuel pump supplies fuel through a fuel inlet in the base of the pressure regulator. If fuel pressure exceeds 310 kPa (45 psi), the internal diaphragm closes, forcing the excess fuel back into the tank. No separate fuel return line is needed.

The fuel filter/pressure regulator and the pressure relief/rollover valve can be replaced without removing the fuel pump module. For procedures, refer to **Subject 110** and **Subject 120.** If the fuel pump module has to be removed for any reason, replace the entire module. Do not attempt to disassemble the sensing unit, float, or in-tank fuel filter.

Fuel Pump Module Removal and Installation and In-Tank Fuel Filter Replacement

Removal

1. Apply the parking brakes and chock the tires. Disconnect the batteries.

⚠ WARNING

WARNING: Release the fuel system pressure before removing the fuel pump module. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire. Always wear proper eye protection when releasing the fuel system pressure. Fuel squirted into the eyes can cause serious injury, including blindness.

2. Release the fuel system pressure and drain the fuel tank. For instructions, see **Subject 130**.

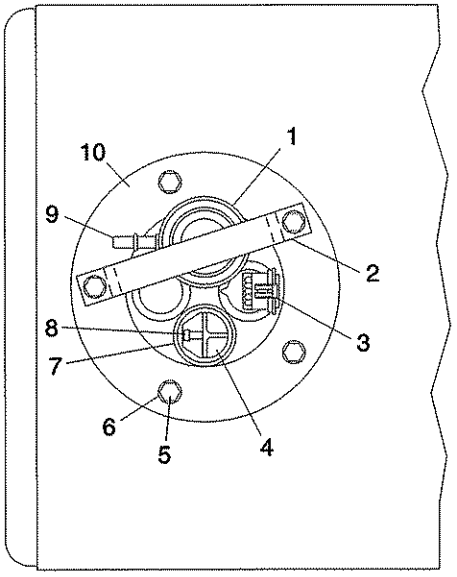
⚠ WARNING

WARNING: Gasoline is flammable and can ignite if exposed to open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame, intense heat, or other ignition source could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

3. Disconnect the fuel supply line from the filter/pressure regulator, and the evaporative canister line from the rollover valve. Disconnect the electrical connector. See **Fig. 1**.
4. Remove the fuel pump module from the fuel tank.
   - 4.1 Clean the top of the fuel pump module to prevent dirt from falling into the fuel tank.
   - 4.2 Remove the two 5/16–18 grade 8 capscrews holding the fuel pump guard bracket in place. Remove the guard bracket, capscrews and hardened flatwashers.
   - 4.3 Remove the other three 5/16–18 grade 8 capscrews holding the fuel pump clamp ring in place. Remove the capscrews and hardened flatwashers.
   - 4.4 Remove the fuel pump module from the fuel tank. See **Fig. 2**.
   - 4.5 Remove the fuel pump module gasket from the fuel tank. See **Fig. 3**. Discard the old gasket.
5. Replace the in-tank fuel filter on the fuel pump module. See **Fig. 2**.
   - 5.1 Use an appropriate tool to pry back the retaining tabs.
   - 5.2 Remove the in-tank fuel filter.
   - 5.3 Install the new filter into the retaining tabs until the filter is firmly seated.

Installation

1. Check that the sensing unit, the electrical wires, the float, and the in-tank fuel filter are properly installed. See **Fig. 2**.

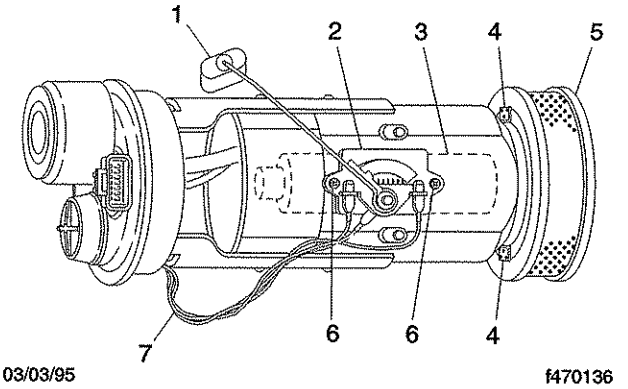


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1. Fuel Filter/Pressure Regulator
2. Fuel Pump Guard Bracket
3. Pump/Gauge Electrical Connector
4. Pressure Relief/Rollover Valve
5. 5/16–18 Clamp Ring Mounting Capscrew (Grade 8)
6. Hardened Flatwasher
7. Rollover Valve Grommet
8. EVAP Canister Connection
9. Fuel Supply Line Connection
10. Fuel Pump Mounting Clamp Ring

Fig. 1, Fuel Pump Module (top view)

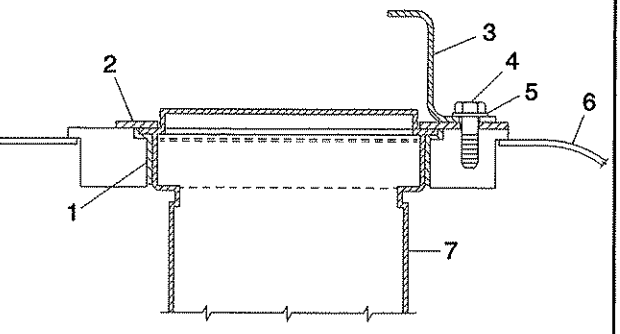
Fuel Pump Module Removal and Installation and In-Tank Fuel Filter Replacement



03/03/95 f470136

1. Float
2. Fuel Gauge Sensing Unit
3. Electric Fuel Pump
4. Retaining Tab
5. In-Tank Fuel Filter
6. Mounting Screw
7. Electrical Wiring

Fig. 2, Fuel Pump Module (side view)



03/03/95 f470137

1. Fuel Pump Module Gasket
2. Fuel Pump Mounting Clamp Ring
3. Fuel Pump Guard Bracket
4. 5/16–18 Clamp Ring Mounting Capscrew (Grade 8)
5. Hardened Flatwasher
6. Fuel Tank
7. Fuel Pump Module

Fig. 3, Fuel Pump Module Mounting (cutaway view)

2. Install a new fuel pump module gasket in the opening in the fuel tank. See **Fig. 3.**

3. Position the fuel pump module in the opening in the fuel tank. Make sure the filter/pressure regulator is on the side facing the frame rail (see **Fig. 1**). Apply a light coat of silicone spray to the gasket, if necessary to ease installation.

NOTE: Using silicone spray on the mounting gasket will prevent the gasket from bunching, or deforming. The spray will evaporate and not affect the fuel.

4. Secure the fuel pump module in the fuel tank.

   IMPORTANT: Use only grade 8 capscrews.

   4.1 Install the fuel pump clamp ring over the fuel pump module. To hold it in place, install three capscrews with hardened flatwashers. Use the holes not intended for the guard bracket. Do not tighten the capscrews yet.

   4.2 Install the fuel pump guard bracket over the filter/pressure regulator. Fasten it in place with the remaining two capscrews and hardened flatwashers.

   4.3 Tighten all five capscrews 15 lbf·ft (20 N·m).

5. Connect the fuel lines to the fittings on the filter/pressure regulator and the rollover valve. Attach the electrical connector. See **Fig. 1.**

6. Return clean unleaded gasoline to the fuel tank.

7. Connect the battery, start the engine, and check for fuel leaks. Also check that the fuel gauge is working properly. Correct any fuel leaks with the engine OFF.

8. Remove the chocks from the tires.

Fuel Filter/Pressure Regulator Removal and Installation

Removal

It is not necessary to remove the fuel pump module to replace the fuel filter/pressure regulator.

1. Apply the parking brakes and chock the tires. Disconnect the batteries.

⚠ WARNING

WARNING: Release the fuel system pressure before removing the fuel filter/pressure regulator. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire.

2. Release the fuel system pressure. For instructions, refer to **Subject 130.**
3. Remove the fuel supply line from the fuel filter/pressure regulator. If necessary for convenient access, remove the evaporative canister line from the rollover valve and disconnect the electrical connector. **See Fig. 1.**
4. Remove the fuel pump guard bracket.
   - 4.1 Unscrew the two 5/16–18 grade 8 capscrews holding the fuel pump guard bracket in place.
   - 4.2 Remove the guard bracket, the two capscrews, and the two hardened flatwashers.
5. Remove the filter/pressure regulator from the fuel pump module.

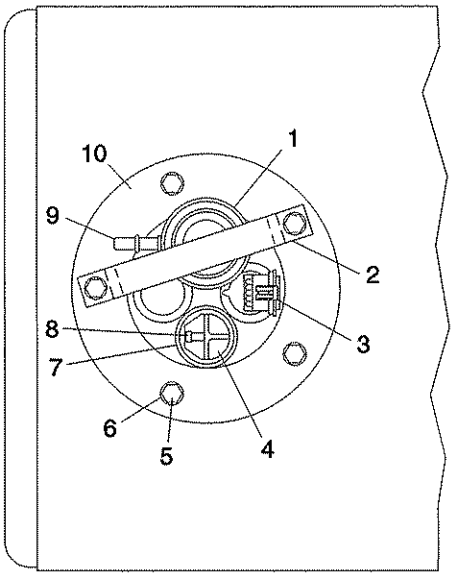
⚠ CAUTION

CAUTION: Do not pull up the filter/regulator more than 7.5 centimeters (3 inches) from the fuel pump module. Pulling it any further could cause damage to the coiled fuel tube.

- 5.1 Twist the filter/regulator and pull straight up to free it from the rubber grommet attaching it to the fuel pump module. **See Fig. 2.**
- 5.2 Release the snap ring holding the convoluted fuel tube cover. Slide the fuel tube cover away from the plastic fuel tube until the fuel tube clamp is exposed. **See Fig. 3.**
- 5.3 Gently cut the fuel tube clamp, taking care not to damage the fuel tube. Discard the fuel tube clamp.
- 5.4 Pull downward gently on the fuel tube to remove it from the filter/regulator. Remove the filter/regulator unit from the fuel pump module.

Installation

1. Slide a new clamp onto the plastic fuel tube.
2. Attach the filter/regulator to the fuel tube. Be sure the fuel supply line fitting near the top of the filter unit is positioned to allow easy attachment of the fuel supply line.

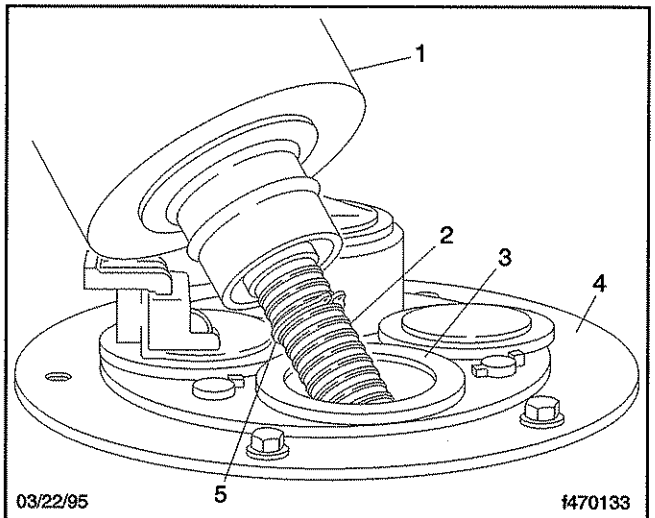


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1. Fuel Filter/Pressure Regulator
2. Fuel Pump Guard Bracket
3. Pump/Gauge Electrical Connector
4. Pressure Relief/Rollover Valve
5. 5/16–18 Clamp Ring Mounting Capscrew (Grade 8)
6. Hardened Flatwasher
7. Rollover Valve Grommet
8. Evaporative Canister Barb
9. Fuel Supply Line Connection
10. Fuel Pump Mounting Clamp Ring

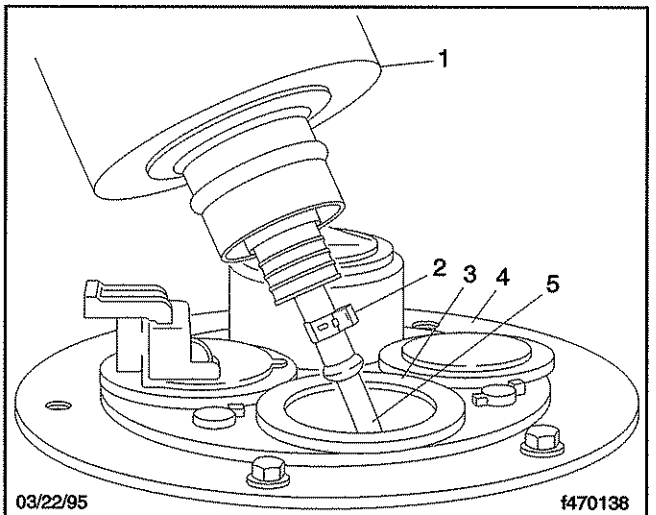
Fig. 1, Fuel Pump Module (Top View)

Fuel Filter/Pressure Regulator Removal and Installation



1. Fuel Filter/Pressure Regulator
2. Fuel Tube Cover
3. Rubber Grommet
4. Fuel Pump Mounting Clamp Ring
5. Snap Ring

Fig. 2, Snap Ring and Fuel Tube Cover



1. Fuel Filter/Pressure Regulator
2. Fuel Tube Clamp
3. Rubber Grommet
4. Fuel Pump Mounting Clamp Ring
5. Nylon Fuel Tube

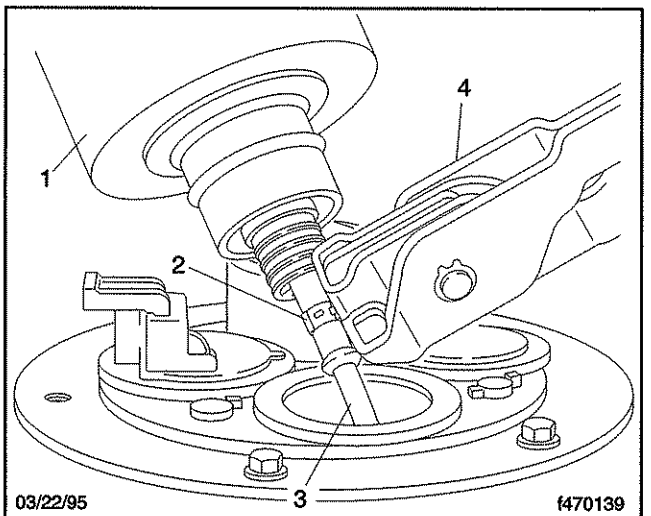
Fig. 3, Fuel Tube and Clamp

3. Tighten the fuel tube clamp using the special hose clamp pliers, Kent Moore tool number C-4124, or equivalent. To order this tool, call the Kent-Moore Tool Company at 1-800-328-6657. **See Fig. 4.** Do not use conventional side cutters to tighten this type of clamp.
4. Slide the fuel tube cover into place and install the snap ring.
5. Press the filter/regulator by hand into the rubber grommet. As you do, check the positioning of the fuel supply fitting.
6. Connect the fuel lines to the fittings on the fuel filter/pressure regulator and the rollover valve. Attach the electrical connector. **See Fig. 1.**
7. Install the fuel pump guard bracket.

   IMPORTANT: Use only grade 8 capscrews.

   7.1 Install the fuel pump guard bracket over the filter/pressure regulator. Fasten it in place with two 5/16–18 grade 8 capscrews and hardened flatwashers.

   7.2 Tighten both capscrews 15 lbf·ft (20 N·m).
8. Fill the fuel tank with unleaded gasoline.
9. Connect the batteries. Then remove the chocks from the tires and release the parking brake.



1. Fuel Filter/Pressure Regulator
2. Fuel Tube Clamp
3. Nylon Fuel Tube
4. Hose Clamp Pliers, Tool C-4124

Fig. 4, Tightening the Fuel Tube Clamp

Pressure Relief/Rollover Valve Removal and Installation

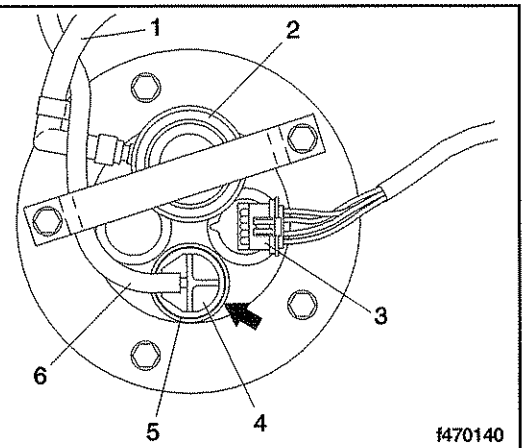
Removal

1. Apply the parking brakes and chock the tires. Disconnect the batteries.

⚠ WARNING

WARNING: Release the fuel system pressure before removing the pressure relief/rollover valve. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire.

2. Release the fuel system pressure. For instructions, refer to **Subject 130.**
3. Remove the evaporative canister line from the rollover valve. **See Fig. 1.**
4. Remove the pressure relief/rollover valve from the fuel pump module.



Remove the evaporative canister line. Wedge a screwdriver at the arrow, between the fuel pump module and the grommet. Do not wedge anything between the rollover valve and the grommet.

1. Fuel Supply Line
2. Fuel Filter/Pressure Regulator
3. Electrical Connector
4. Pressure Relief/Rollover Valve
5. Rollover Valve Grommet
6. Evaporative Canister Line

Fig. 1, Fuel Pump Module, Top View

⚠ CAUTION

CAUTION: Do not wedge anything between the rollover valve and the grommet. This may cause damage to the valve unit.

4.1 Wedge the blade of a standard screwdriver between the rubber rollover valve grommet and the surface of the fuel pump module. **See Fig. 1.**

4.2 Using a second screwdriver as a support, pry both the valve and the grommet out of the fuel pump module.

5. Remove the grommet from the rollover valve.

5.1 Place the valve upright on a flat surface. Push down on the grommet.

5.2 Peel the grommet off the valve. Discard the old grommet.

Installation

1. Install a new rollover valve grommet in the fuel pump module. Work it around the curled lip on the surface of the module.
2. Lubricate the grommet, using power steering fluid.
3. Push the valve downward through the grommet and into the fuel pump module.
4. Be sure the evaporative canister line fitting on the rollover valve is positioned to allow easy attachment of the evaporative canister line. If necessary, twist the valve into a better position.
5. Connect the fuel supply line to the fitting on the fuel filter/pressure regulator and the evaporative canister line to the fitting on the rollover valve. Connect the electrical connector. **See Fig. 1.**
6. Fill the fuel tank with unleaded gasoline.
7. Connect the batteries. Remove the chocks from the tires and release the parking brake.

Release

1. Disconnect the batteries.
2. Remove the fuel tank filler cap. This releases fuel tank pressure.
3. Unscrew the protective plastic cap from the pressure test port on the fuel rail (**see Fig. 1**).

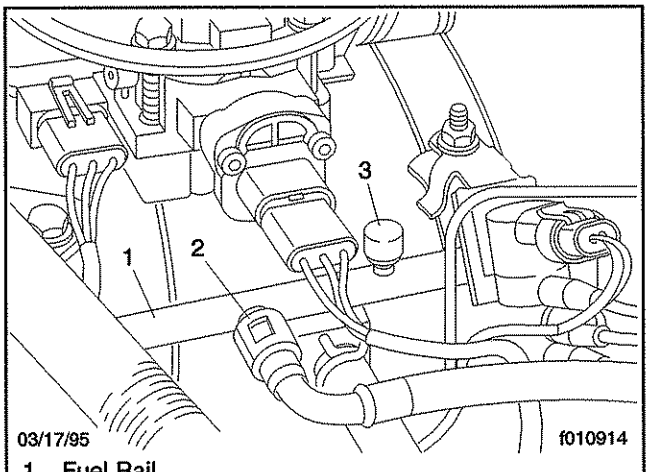
⚠ WARNING

WARNING: Always wear proper eye protection when releasing the fuel system pressure. Fuel squirted or splashed into the eyes can cause injury.

4. Obtain Kent-Moore fuel pressure gauge tool set #5069. To order this tool set, call the Kent-Moore Tool Company at 1-800-328-6657. Remove the gauge from the hose. Place one end of the hose into an approved gasoline container. Place a shop towel under the test port. **See Fig. 2.**

IMPORTANT: Do not allow fuel to spill onto the engine intake or exhaust manifolds. To absorb fuel, place shop towels under and around the pressure port when the pressure is released from the fuel rail.

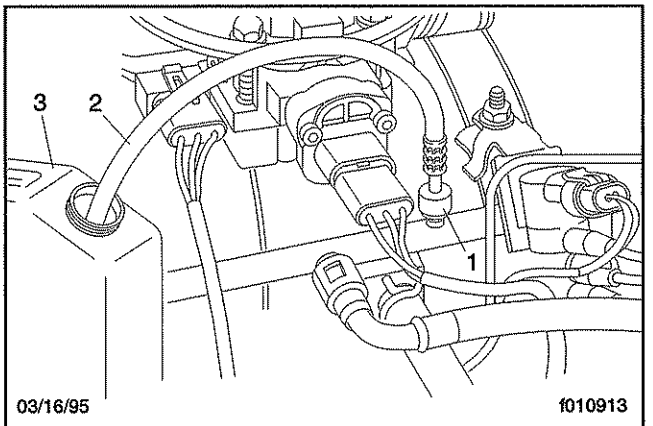
5. Screw the other end of the hose onto the fuel pressure test port and allow the fuel to run into the container until the pressure is fully released.



1. Fuel Rail
2. Fuel Supply Line
3. Test Port Protective Cap

Fig. 1

6. Remove the hose from the test port and return it to tool set #5069.
7. Install the protective cap on the test port.
8. Install the filler cap on the fuel tank.



1. Test Port
2. Test Hose
3. Vented Gasoline Can

Fig. 2

Troubleshooting Tests

To test fuel system pressure, do tests NTC-3A and -B in the Chrysler Powertrain Diagnostic Procedures Manual.

For additional fuel pump module troubleshooting procedures, see tests NS-4A through -C and NS-5A and -B in the Chrysler Powertrain Diagnostic Procedures Manual.

FUEL PUMP CAPACITY TEST

NOTE: Before running this test, verify fuel pump pressure by doing fuel system pressure test NTC-3A in the Chrysler Powertrain Diagnostic Procedures Manual.

⚠ WARNING

WARNING: Release the fuel system pressure before testing the fuel pump capacity. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire.

1. Release the fuel system pressure. For instructions, refer to **Subject 130**. Do not drain the fuel tank.
2. Connect Kent-Moore special tool part #6631, the fuel line pressure test adapter. **See Fig. 1.** To order this tool, call the Kent-Moore Tool Company at 1-800-328-6657.

   NOTE: Use Kent-Moore special tool part #6631 only with 3/8-inch i. d. hose.

   2.1 Disconnect the fuel supply line at the fuel rail. Squeeze the plastic retainer tabs against the sides of the quick-connect fitting, using fingers only.

   2.2 Into the disconnected end of the fuel supply line, insert the hose attached to one end of Kent-Moore special tool part #6631, the fuel line pressure test adapter. Insert the hose attached to the other end of special tool #6631 into an approved vented gasoline container, at least 7.5 liters (two gallons) in capacity.

   NOTE: Be sure the "T" end of special tool #6631 is capped.
3. Activate the fuel pump and pressurize the system using the DRB scan tool. For procedures, refer to the Chrysler Powertrain Diagnostic Procedures manual.
4. Check that the fuel pump delivers at least 2 liters (2.1 quarts) per minute.

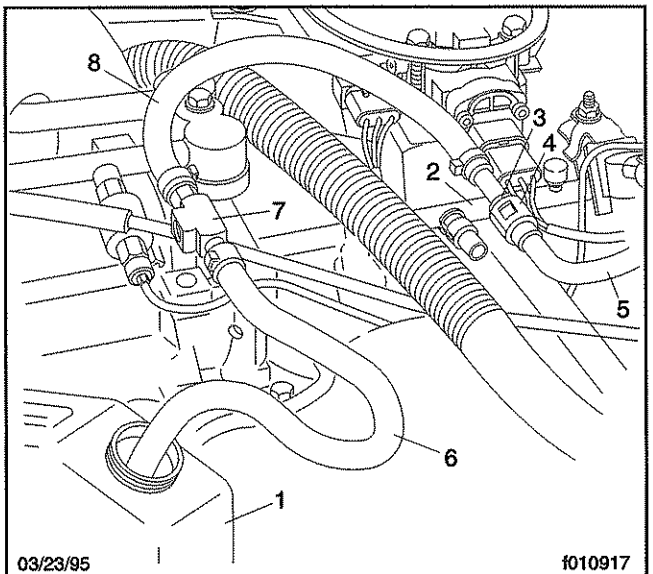
FUEL PRESSURE LEAKDOWN TEST

Use this test to diagnose low fuel pressure when a hot engine that has been shut down only a short time requires an abnormally long period of cranking to restart it. Low fuel pressure may be caused by leaks in the fuel injectors or fuel rail, fuel lines, or the check valve in the fuel pump module.

⚠ WARNING

WARNING: Release the fuel system pressure before testing fuel pressure leakdown. Otherwise fuel could spray out, possibly resulting in severe personal injury and property damage, including fire.

1. Release the fuel system pressure. For instructions, refer to **Subject 130**. Do not drain the fuel tank.



1. Vented Gasoline Can
2. Fuel Rail
3. Plastic Retainer Tab
4. Quick-Connect Fitting
5. Fuel Supply Line
6. Test Hose (to Vented Gas Can)
7. Kent-Moore Special Tool Part #6631
8. Test Hose (to Fuel Supply Line)

Fig. 1, Fuel Pump Capacity Test

Troubleshooting

2. Connect Kent-Moore special tool part #6631, the fuel line pressure test adapter. **See Fig. 2.**

   NOTE: Use special tool #6631 only with 3/8-inch i. d. hose.

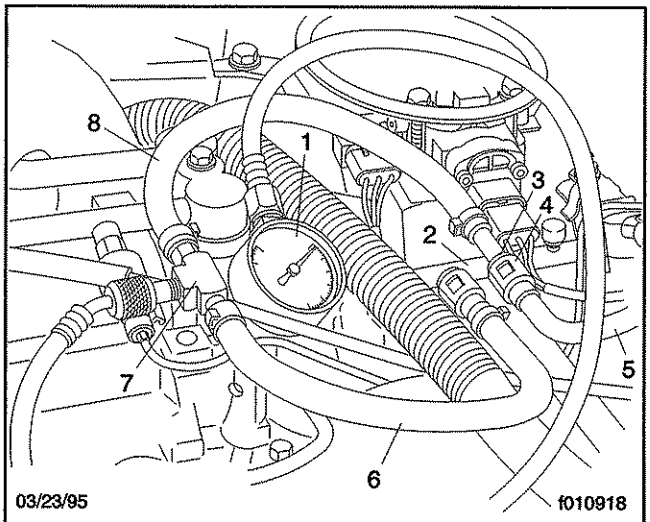
   2.1 Disconnect the fuel supply line at the fuel rail. Squeeze the plastic retainer tabs against the sides of the quick-connect fitting, using fingers only.

   2.2 Into the disconnected end of the fuel supply line, insert the hose attached to one end of Kent-Moore special tool part #6631. Insert the hose attached to the other end of special tool #6631 into the fuel rail.

3. Connect the fuel pressure test gauge from Kent-Moore gauge set, part #5069, to the test port on Kent-Moore special tool part #6631.

IMPORTANT: To ensure the accuracy of the test results, check that the fittings on special tool #6631 and gauge set #5069 are in good condition and do not leak.

4. Check the fuel system for pressure leakdown.



1. Fuel Pressure Test Gauge (from Gauge Set #5069)
2. Fuel Rail
3. Plastic Retainer Tab
4. Quick-Connect Fitting
5. Fuel Supply Line
6. Test Hose (to Fuel Rail)
7. Kent-Moore Special tool part #6631
8. Test Hose (to Fuel Supply Line)

Fig. 2, Fuel Pressure Leakdown Test

   4.1 Start the engine and bring it to the normal operating temperature of 82°C (180°F).

   4.2 Check that the test gauge climbs to normal operating pressure of 240-310 kPa (35-45 psi).

   4.3 Shut down the engine.

   4.4 Check the test gauge. If the pressure falls below 165 kPa (24 psi) in less than five minutes, go to the next step.

5. Check the fuel injectors and fuel rail for leakage.

   5.1 Again, start the engine and bring it to the normal operating temperature of 82°C (180°F).

   5.2 Shut down the engine.

   5.3 Clamp off the rubber hose leading from special tool #6631 to the fuel rail. If the pressure now holds at or above 165 kPa (24 psi), check the fuel injectors and the fuel rail for leaks. If the pressure continues to fall, go to the next step.

6. Check the fuel lines and the fuel pump module for leakage.

   6.1 Now clamp off the rubber hose leading from the fuel supply line to special tool #6631. If the pressure now holds at or above 165 kPa (24 psi), check the fuel lines for leaks.

   6.2 If no leaks are found in the fuel lines, replace the fuel pump module.

Specifications

Description	Torque N·m (lbf·ft)
Clamp Ring Mounting Capscrews	20 (15)

Table 1, Fastener Torques

Description	Pressure kPa (psi)
Operating Pressure	240–310 (35–45)
Bypass Pressure	620 (90)

Table 2, Fuel System Pressures