AirDog® Champ II™

"SPIN-ON" For CAT Filters
High Pressure Fuel Air Separator

INSTALLATION MANUAL

For CATERPILLAR® 3406E, C10, C11, C12, C13, C15, & C16, C18 Engines

Using CAT 1R-0749 or 1R-0750 Fuel Filter

PLEASE READ THESE INSTRUCTIONS THOROUGHLY BEFORE BEGINNING INSTALLATION

Part No. A7SOCA701

Revised 10/18/22

Proudly Made in the USA

AirDog® HEAVY DUTY DIESEL FUEL SYSTEMS by PureFlow® Technologies, Inc.

www.airdogdiesel.com
1-573-635-0555 or
1-877-463-4373

Providing "Test Cell Performance" in "Real World Conditions" Since 1993!

PATENT
www.AirDogDiesel.com/patents

HEAVY DUTY & INDUSTRIAL
Fuel Systems by PureFlow™
Technologies, Inc.

Amazingly Simple Installation

Spins on between filter head and the fuel filter. Air/Vapor return line connects to engine fuel return line.

Amazingly Simple Operation

Operates in conjunction with the fuel flow and pressure created by the engines transfer pump. Separates and removes entrained air plus vapor from fuel pump cavitation before the fuel enters the engine.

The AirDog® Champ II is proudly made in the USA.

With PureFlow Technologies AirDog® Champ II system installed, your diesel engine can perform as designed even under the most extreme conditions.

- Improves Fuel Mileage
- Lengthens Injector Life
- Smoother Idle
- Improves Throttle Response
- Maximizes Torque
- Reduces Emissions

877-GO-DIESEL (877-463-4373)
airdogdiesel.com

TABLE OF CONTENTS

INSTALLATION GUIDELINES

The installation of your AirDog® Champ II can be made relatively easy by following the steps outlined in this manual, and:

1. Inventory the package components. Notify PureFlow® Technologies, immediately of any parts missing or damaged.

2. Read the installation manual completely. Understand how the system operates and the installation recommendations before beginning.

SAFETY GUIDELINES

CAUTION: Chock the vehicle's tires to prevent rolling.

CAUTION: Wear safety glasses when operating power tools such as drills and grinders or when using a punch or chisel.

CAUTION: Route the fuel lines and electrical harnesses keeping them away from hot exhaust components and/or moving parts. Properly secure the fuel lines and electrical harnesses to prevent chaffing.

If you are uncertain of any installation procedure, contact: PureFlow® Technologies, Inc. for technical assistance.

NOTE: The pictures used in this manual are for example only and may not depict the exact components as found on your truck.

Installation Parts List

QTY	Description	Part Number	Image
1	**Installation Manual**	207-7-0701	
1	**AirDog® Champ II High Pressure Air Separator**	A7SOCA701	
1	**#6 Hose w/end fittings 18" L Hose Assembly**	4C-1-06-06-18	

970-07-0701 Installation Fitting Kit

1 1 1	**#6M JIC x 3/8 M ORB 90º Elbow** **#6M JIC x 3/8 M ORB Straight Connector** **#6M JIC x #6F JICX 90° Swivel Nut Elbow** **Use Straight or 90°as needed for air/vapor return port.*	4A-2-01-06-06-S 4A-1-01-06-06-S 4A-2-04-06-06-S	
1	**#8M JIC x #8F JICX x 1/4 NPTF Port GagePort**	4A-1-11-08-08-4P	
1	**#6M JIC x #8F JICX x #6M JIC Tee**	4A-4-04-06-08-06-4-S	
1	**##6M JIC x 1/4 M NPTF Straight Connector**	4A-1-01-A-C-SZ	
1	**#8M JIC x 3/8 M ORB Straight Connector - Modified (Restrictor Fitting)**	4A-1-01-08-06-S-.16M	
1	**#10M JIC x 1/2 M ORB Straight Connector - Modified *(ACERT Pump Fitting)***	4A-1-02-10-08-S-.5M	
1	**#10M JIC x #10F JICX 90º Swivel Nut Elbow** *(Use as needed)*	4A-2-04-10-10-S	
1	**#8M JIC x #8F JICX 90º Swivel Nut Elbow** *(Use if needed)*	4A-2-04-08-08-S	
1	**CAT Fuel Pressure Shim Kit**	SHK-CAFP	
1	**#4M JIC x #4F JICX x #4M JIC Swivel Nut Run Tee**	4A-4-04-04-04-04-4-S	
1	**#4F JIC x #6M JIC Tube Reducer**	4A-1-21-9-04-06-S	

Section 4: System Overview

PureFlow® Technologies, Inc. addresses diesel engine efficiency and peak performance on the fuel side from the fuel tank to the tip of the injector. Removing entrained air and fuel vapor from the fuel flow to the engine is not enough if the internal conditions of the fuel system components are such to allow vapor to form in the injector, itself.

Specifically, if the fuel pressure/flow to the injector, even with entrained air and vapor removed, is insufficient to totally fill the injector barrel on the up stroke of the plunger, a void or low pressure will form that allows vapor to re-form within the injector. The results of "injector lag", which is just another name for "delayed injection timing", is increased fuel consumption, lost power, and increased exhaust emissions.

To overcome these concerns, PureFlow® Technologies has an "Upgrade Kit" available for the CATERPILLAR 3406E, C10 - C13, C15, C16 and C18 engines. The "Upgrade Kit" is NOT included with the Champ II installation kit, although the complete and detailed instructions are included.

Contact PureFlow® Technologies at 1.573.635.0555 for additional information and ordering.

Section 5: Installing the AirDog® Champ II

Early Model 3406E CAT Secondary Fuel Filter Head

Figure 1

Later Model 3406E CAT Secondary Fuel Filter Head Also C13, C15, C16

Figure 2

Figure 3

5-1. Remove the CAT secondary fuel filter. (Figure 1 & 2)

5-2. Check the O-Ring seal to be sure that it is properly installed in the "Groove" in the top of the Champ II. (Figure 3)

5-3. Screw the Champ II onto the CAT secondary fuel filter head. (Figure 4)

NOTE: The Champ II is a "spin-on" unit and once it has been tightened we cannot determine the accessibility of the Air/Vapor return port. Therefore, we have machined two Air/Vapor return ports into the Champ II approximately 120° apart. One or the other air/vapor return ports should be accessible after tightening the Champ II. If not, please call Pureflow Technical Support at 573-230-8838. DO NOT OVERTIGHTEN.

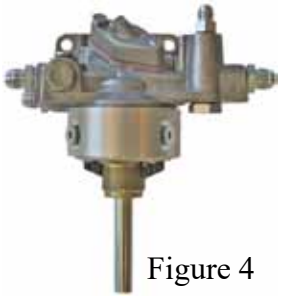


Figure 4

5-4. Hand tighten and then tighten with filter wrench up to 1/2 turn. IMPORTANT: DO NOT OVERTIGHTEN - as doing so could result in damage to the O-Ring seal.

5-5. After tightening the Champ II, remove the 9/16-18 ORB plug from the most accessible air/vapor return port. (Figure 5)

5-6. Install a #6 JIC x 3/8 ORB (9/16-18) (straight or 90° elbow) into the air/vapor return port. (Figure 5) Note: Both a straight and 90° fittings are provided in the kit for your convenience.

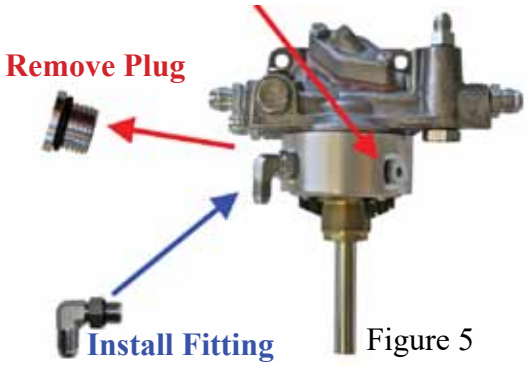


Figure 5

Section 6A: Installing the Air/Vapor Return Line

Early Model 3406E CAT Secondary Fuel Filter Head

The early model CAT 3406E engines have a fuel distribution casting mounted on the drivers side, upper front of the engine. (Figure 6)

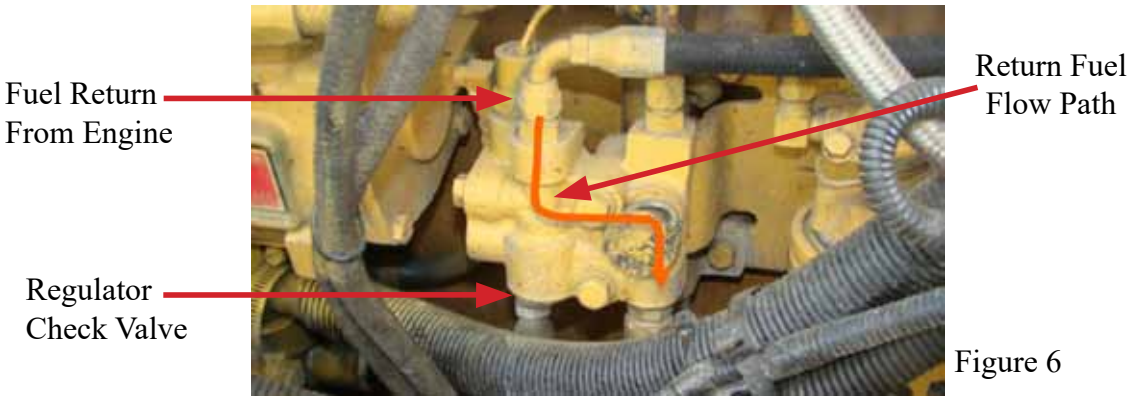


Figure 6

6A-1. Remove the original fuel return line and fitting and install the "Restrictor Fitting" into the fuel return port. (Figure 7)

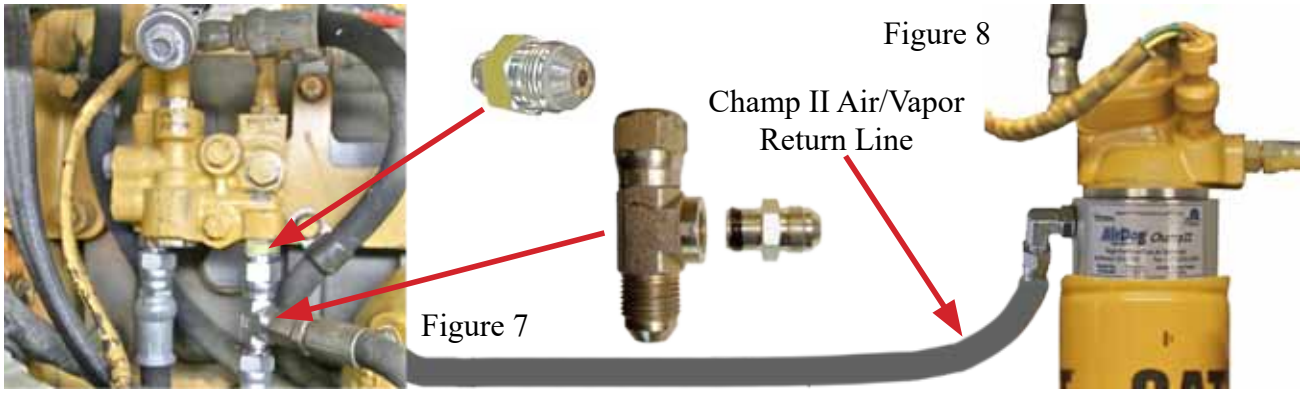


Figure 7

Figure 8

6A-2. Assemble and install the AirDog® Return tee. Reconnect the original fuel return line. (Figure 7)

6A-3. Install the Champ II Air/Vapor return line to connect to the engine fuel return line. (Figure 8)

Section 6B: Installing the Champ II Air/Vapor Return Line

Later Model CAT Secondary Fuel Filter Head

6B-1. Disconnect the fuel return line connected to the fuel return fitting on the secondary filter and remove the #6 fitting. (Figure 9)

NOTE: It is best NOT to remove the Hand Primer Pump.

Figure 9

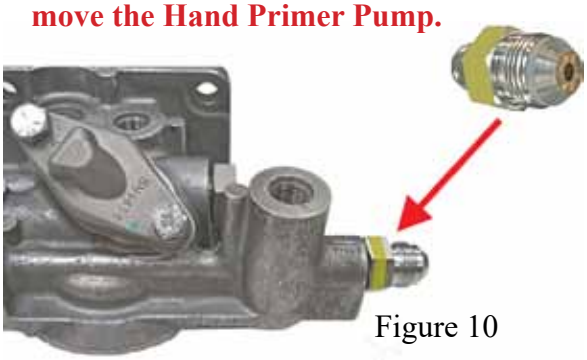


Figure 10

6B-2. Install the "Restrictor Fitting" in the "Return to Tank" port in the secondary filter head. (Figure 10)

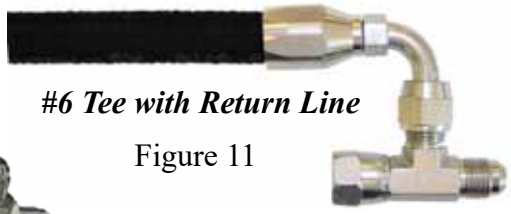
6B-3. Assemble the correct AirDog® return tee to the Restrictor fitting.
- If you have a #6 engine return line install the #8 Swivel x #6 x #6 tee (Figure 11)

OR

- If you have a #8 engine return line install the #8 tee and #6 M JIC x 1/4 M NPT fitting (Figure 12)

OR

- If you have a #4 engine return line install the #4M JIC x #4F JICX x #4M JIC tee and the #4F JIC x #6M JIC fitting



#6 Tee with Return Line

Figure 11

#8 Tee Components

Figure 12

6B-4. Re-attach the original engine fuel return line. (Figure 13)

Note: Use the 90° #8 F JIC Swivel x #8 M JIC elbow, as needed.

6B-5. Install the Champ II Air/Vapor return line. The return line is included in the installation kit. (Figure 13)

6B-6. Pre-fill the fuel filter with clean fuel and install the filter on the Champ II.

Figure 13

Section 7: Adjusting the Fuel Rail Pressure

For the CAT 3406E, C10 - C13, C15, C16 and C18 (with filter 1R-0749 or 1R-0750) engine to perform at peak efficiency, the fuel rail pressure must be adequate to completely fill the fuel injectors during the "up" stroke of the plunger. A minimum of 115 PSI to an absolute maximum of no more than 120 PSI at "high idle" is required.

There are three models of the CATERPILLAR® fuel transfer pump. The early model 1st generation (Figure 14) with a small diameter spring and hex head plug and the 2nd generation (Figure 15) and 3rd generation (Figure 16) with a larger diameter spring and socket head plug.

Temporarily install a 150 PSI Fuel Pressure Gauge.

It is important to know the original fuel pressure before you start.

NOTE: The first step to resetting the "Fuel Rail Pressure" has already been performed when the "Restrictor Fitting" was installed in Step 6A-1 or 6B-2. If your transfer pump is in good condition and not worn out, with the engine running the fuel rail pressure should be at approximately 118 PSI at high idle (1,900 to 2,100 RPM). If the fuel rail pressure is still low, follow the steps below.

Connect the Pressure Gauge Here

To adjust the rail pressure after the AirDog® Restrictor Fitting has been installed, reset the spring tension on the high pressure bypass regulator.

Note: The shim kit includes shims for each of the three generation pumps.

1st Generation Pump Shims + pin

2nd Generation Pump Shim Caps

3rd Generation Pump Shims

Adjusting the Rail Pressure for the 1st Generation CAT® Fuel Transfer Pump

7-1. Remove hex plug "A" on the side of the transfer pump. (Figure 14)

7-2. Take out spring "C" and the Stiffener Pin "B".

NOTE: The shim kit includes new stiffener pin with cap and three shims for the 1st generation transfer pump.

7-3. Put the new stiffener pin w/cap "D" into the spring and re-install in transfer pump.

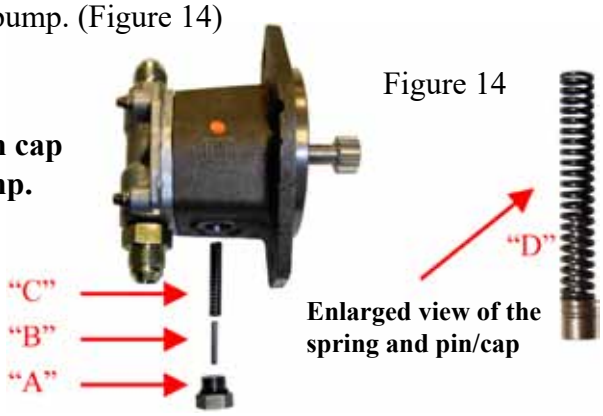


Figure 14

7-4. Start the engine. Run the RPM up slowly until high idle is reached. High idle is 1,900 to 2,100 RPM. Read the fuel rail pressure. If the rail pressure does not reach 118 PSI, add a shim and repeat until at least 118 PSI, but not more than 120 PSI, is reached. All three shims may be required to reach 118 PSI.

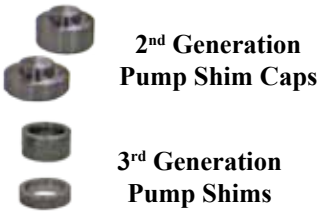
WARNING: Do Not exceed 120 PSI fuel rail pressure. High rail pressure, 130 PSI and above will void your factory engine warranty and may cause engine damage!

Adjusting Rail Pressure for the 2nd & 3rd Generation CAT® Fuel Transfer Pump

7-5. Remove hex plug "A" on the side of the transfer pump. (Figure 15 & 16)

NOTE: The Shim Kit includes:

- **Two shim caps, one 0.25" thick and one 0.125" thick, for the 2nd generation pump.**
- **Two shims, one 0.25" thick and one 0.125" thick, for the 3rd generation pump.**



7-6. Hold the 0.125" shim cap "C" (2nd Generation) or 0.125" shim "D" (3rd Generation) on the end of the plug "A" and re-install the spring, shim cap or shim, and plug into the transfer pump.

Figure 15

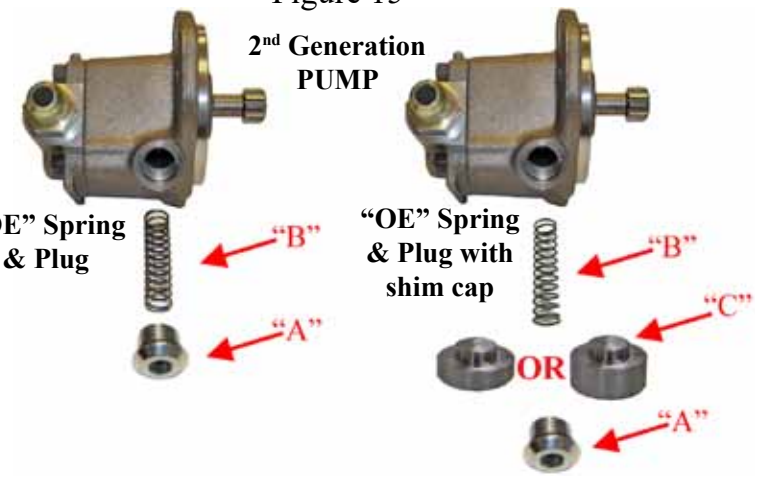
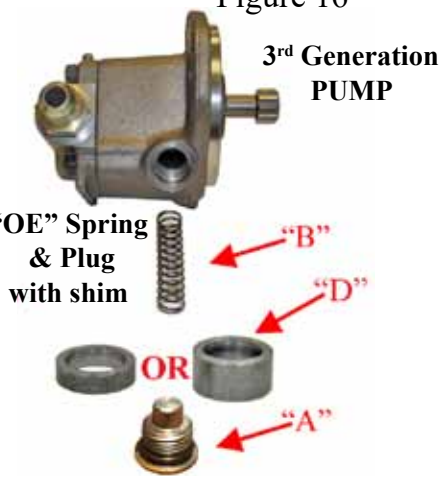


Figure 16



7-7. Start the engine. Run the RPM up slowly until high idle is reached. High idle is 1,900 to 2,100 RPM. Read the fuel rail pressure. If the rail pressure does not reach 118 PSI, remove the .125 shim and replace with the .250 shim and repeat until at least 118 PSI is achieved, but not more than 120 PSI.

7-8. When you have completed adjusting the fuel rail pressure, remove the pressure gauge from the secondary fuel filter head and replace the plug.

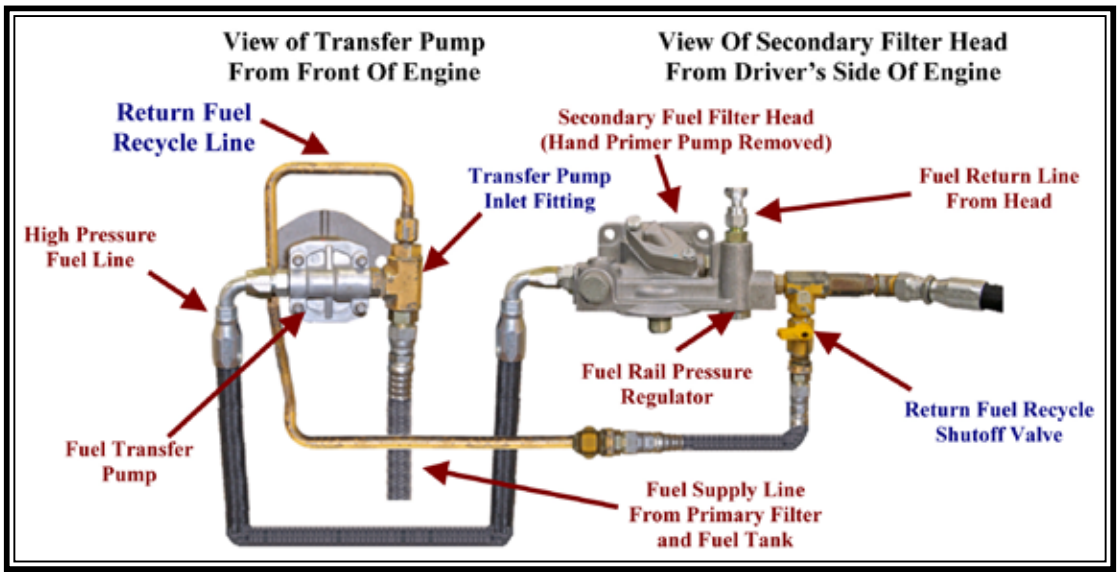
VERY IMPORTANT: After the adjustments have been performed and the rail pressure does not reach 118 PSI ±3, it would be wise to have the fuel pump checked for excessive wear. Your fuel pump may be worn out and need replacing!

Section 8: CATERPILLAR® ACERT Fuel Recycle Line (CAT ACERT Engines)

For Non ACERT engines, see Section 9C

CATERPILLAR® ACERT Engines have a "Return Fuel Recycle Line". This fuel line recycles "HOT" fuel, coming directly from the engine head, back to the fuel inlet port of the transfer pump.

For BEST FUEL ECONOMY and MAXIMUM ENGINE EFFICIENCY the "Return Fuel Recycle Line" must be removed.



8-1. Disconnect the "Return Fuel Recycle Line" from the top of the inlet fitting at the transfer pump.

8-2. Disconnect the "Return Fuel Recycle Line" from the bottom of the Return Line shutoff valve.

8-3. There is a bracket on the "Return Fuel Recycle Line" that secures the line to the block. Remove the bolt holding the bracket. Remove the "Return Fuel Recycle Line" from the engine.

8-4. Disconnect the fuel supply line from the bottom of the inlet fitting at the transfer pump.

85. Remove the Transfer Pump inlet fitting.

8-6. Install the #10 M JIC x 1/2 M ORB fitting in the Transfer Pump Inlet Port.

8-7. Reconnect and tighten the fuel supply line removed earlier.

Note: Use the 90° #10 F JIC Swivel x #10 M JIC elbow, as needed.

Section 9A:The CATERPILLAR® Secondary Fuel System Upgrade

Optional Kit available from PureFlow Technologies, Inc. - this kit is NOT included but recommended for optimal fuel system performance.

PureFlow® Technologies, Inc. addresses diesel engine efficiency and peak performance on the fuel side from the fuel tank to the tip of the injector. Removing entrained air and fuel vapor from the fuel flow to the engine with the AirDog®FPII 4G, Champ, and Champ II is not enough if the internal conditions of the fuel system components are such to allow vapor to re-form in the injector itself.

Specifically, if the fuel pressure/flow to the injector, even with entrained air and vapor removed, is insufficient to totally fill the injector barrel on the up stroke of the plunger, a void or low pressure will form that allows vapor to re-form within the injector. The resulting "injector lag" is just another name for "delayed injection timing" and leaves the engine with increased fuel consumption, lost power, and increased exhaust emissions.

To overcome the concerns, upgrading the CAT® secondary fuel system is simple. Replace the small #6 fuel lines "**A** & **B**" with #8 lines and replace the 9/16-18 x #6 JIC fittings with ported 9/16-18 x #8 JIC fittings, port the secondary fuel filter head and reset the fuel "Rail Pressure".

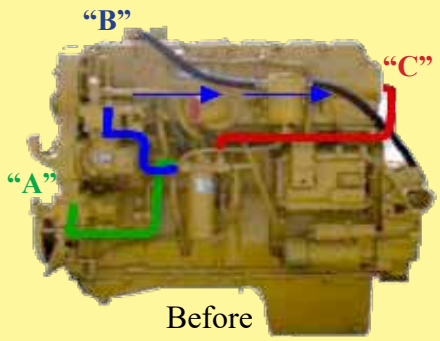
Step 1: Port The Secondary Filter head.

Step 2: Replace the restrictive #6 fuel fittings and lines with #8 fittings and #8 lines.

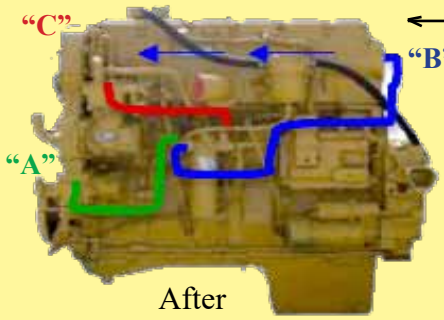
- **A.** Replace fuel line from transfer pump to secondary filter **(Green)**
- **B.** Replace fuel line from secondary filter to head **(Blue)** *Refer to "After" Figure*
- **C.** Fuel return line from engine **(Red)**

Step 3: Reset the Fuel Rail Pressure

Note: Due to space restrictions around the fuel inlet fitting at the front of the engine and ease of procedure, it may be necessary to switch and re-route the connection points on the engine for fuel inlet line "B" & return line "C". This will reverse the fuel flow through the rail. Other than that, it has no effect on the engine performance.



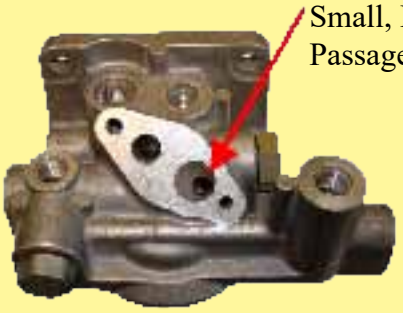
Before



After

Section 9B: Porting the Secondary Fuel Filter Head

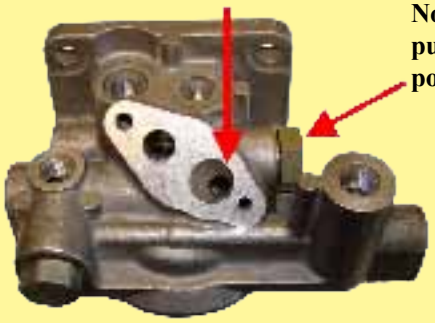
All CATERPILLAR® diesel engines are equipped with a secondary fuel filter mounted on the engine. The filter head usually includes an attached Hand Primer Pump, to make it easier to prime and start the engine after filter changes. However, the fuel passages in the filter head, and the valves in the Hand Primer Pump, are restrictive to the flow of fuel through the system, and the restriction negatively affects engine performance. The passages should be enlarged to improve fuel flow through the filter head; see below.



NOTE: Perform the following steps to improve fuel flow and engine performance. In most cases, the filter head can be drilled out without removing it from the engine.

9B-1. Remove the hand primer  pump and  fuel filter from the filter head.

9B-2. Using a 3/8 bit, carefully drill out the passageway that carries the fuel from the primer pump into the fuel filter.



Note: Remove the primer pump bypass valve before porting this passageway.

NOTE: Be careful not to drill into the fuel filter gasket seat in the underside of the filter head.

Section 9B: Porting the Secondary Fuel Filter Head, cont'd

9B-3. Remove all burrs and shavings from the filter head.

9B-4. Install the hand primer pump ported replacement cap and gasket on the filter head in place of the hand primer pump. Re-install the fuel filter.

NOTE: The primer pump replacement cap (included in the kit) cross passage has been ported to 3/8 to increase fuel flow for better engine performance.

IMPORTANT: It is recommended that you keep the hand primer pump on board, in the event it is needed to prime the system.

The engine pictured above has a "self priming" AirDog FP-II system installed.

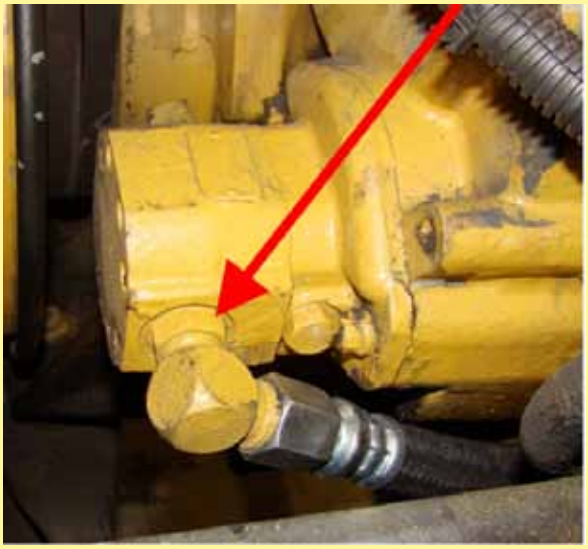
Section 9C: Replacing the Transfer Pump Fuel Inlet Fitting (Non ACERT Engines)

(For ACERT engines, see Section 8)

NOTE: The small hole in the ORB side of the fitting, opening into the larger-volume section of the inlet to the transfer pump creates a vacuum, therefore a pressure drop, which can cause vapor to form. The remedy for this is porting the fuel inlet fitting.

9C-1. Disconnect the fuel line from the fitting and remove the fuel fitting from the transfer pump.

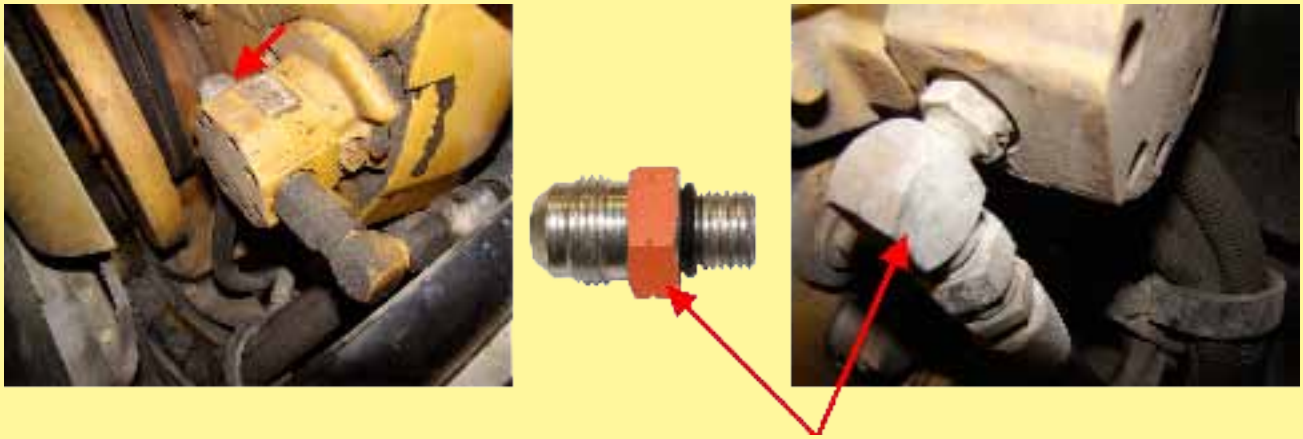
9C-2. Replace the fuel inlet fitting with the #10 M JIC x 1/2 M ORB modified fitting. If needed, attach the 90° #10 F JIC Swivel x #10 M JIC fitting.



9C-3. Connect the fuel line originally connecting the primary fuel filter to the transfer pump to the AirDog® "Out to Engine" port. If the fuel line is in poor condition or too short to make the connection, replace it with a new fuel line.

Section 9D: Upgrading the Fuel Line from the Transfer Pump to the Secondary Fuel Filter

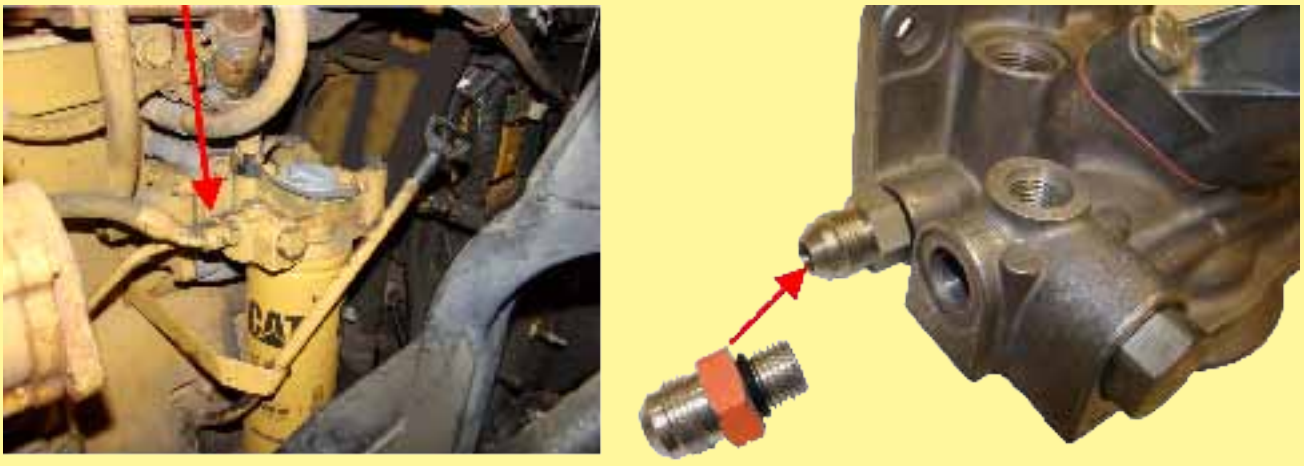
NOTE: The passageways in the original 9/16 – 18 x #6 fuel fittings and #6 lines are small and restrictive to the fuel flow and performance. Upgrading the system with ported #8 fittings and installing #8 fuel lines increases fuel flow and performance.



9D-1. Disconnect the fuel line from the discharge side (high pressure side) of the transfer pump.

9D-2. Remove the #6 fuel fitting in the transfer pump and install the #8 M JIC x 3/8 M ORB ported fitting.

9D-3. Remove the other end of the fuel line from the inlet fitting on the secondary filter marked "From Pump". Remove the fuel line from the engine.



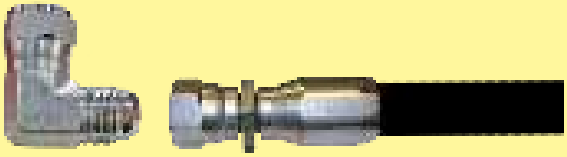
9D-4. Remove the #6 "From Pump" fitting in the secondary filter head and install the #8 M JIC x 3/8 M ORB ported fitting.

Section 9D: Upgrading the Fuel Line from the Transfer Pump to the Secondary Fuel Filter, cont'd

9D-5. Measure and cut the length of fuel line required, when properly routed, to connect the new #8 ported fitting in the transfer pump to the new fitting installed in the secondary fuel filter head inlet fitting. Attach the proper ends. Assemble the fuel line per standard procedures.

Figure 17

9D-6. Connect the end with the 90º fitting to the transfer pump. DO NOT position the fitting and fuel line too close to the harmonic balancer - see Figure 17. Be sure to have adequate clearance.



9D-7. Route the fuel line to the secondary fuel filter and connect the other end to the "From Pump" fitting. Use the 90º fitting if necessary. Properly tighten the fuel lines to the fittings.

Section 9E: Replacing the Fuel Line from the Secondary Fuel Filter to the Engine Head

9E-1. Disconnect the fuel line fitting from the secondary fuel filter head "To Head" port and remove the #6 fitting. Install a new #8 M JIC x 3/8 M ORB Ported fitting in the filter head in place of the fitting just removed.

9E-2. Disconnect the other end of the fuel line to the engine and remove the line completely.

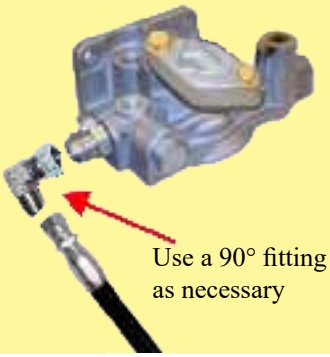
Section 9E: Replacing the Fuel Line from the Secondary Fuel Filter to the Engine Head, cont'd

9E-3. Follow the #6 engine fuel return line from the secondary filter head to the back of the engine head. Disconnect the fuel line from the fitting in the back of the head and remove the #6 fitting.

9E-4. Replace the original #6 fitting with a #8 M JIC x 3/8 M ORB ported fitting. You will connect the new fuel line from the secondary fuel filter to the engine head here.

9E-5. Re-route the fuel return line disconnected from the engine in Step 8E-3 and reconnect it where the fuel line to the engine was connected before, as shown above. This reverses the fuel flow through the engine and is only done to make it easier to connect the larger fuel supply line to the back of the engine.

9E-6. Measure and cut the length of #8 fuel line required, when properly routed, to connect the new #8 ported ORB fitting in the secondary fuel filter head to the new #8 fitting installed in the back of the engine head. Attach the proper ends and assemble per standard procedures.



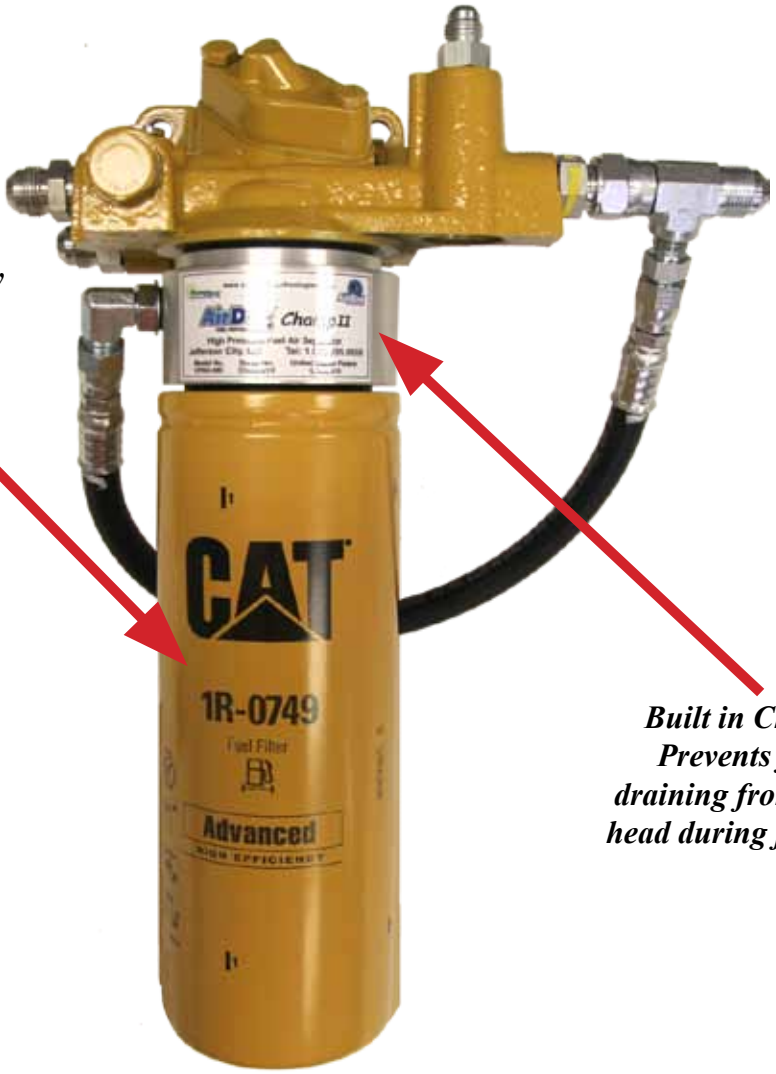
9E-7. Connect the 90º end of the new #8 fuel line to the fitting in the "TO HEAD" port in the secondary fuel filter head.

9E-8. Connect the other end of the new #8 fuel line to the ported #8 fitting in the back of the head. Properly tighten all fuel line connections.

Section 10: Servicing the AirDog® Champ II Fuel Filter

Replace the fuel filter as recommended by CATERPILLAR.

When replacing the fuel filter, be sure to clean the under side of the AirDog® Champ II base. Follow the instructions on the filter for proper tightening procedures



AirDog® Champ II uses the CAT® High Efficiency 2 Micron Fuel Filter

Built in Check Valve Prevents fuel from draining from the engine head during filter changes

NOTE: Due to the fact that fuel filters are often OVER TIGHTENED and difficult to remove, it is suggested to carry a second filter wrench to use as a backup wrench when changing the fuel filter.

Dispose of waste fuel and used filters properly to protect our environment.

World Headquarters

AirDog

FUEL PREPORATOR

www.airdogdiesel.com

1-877-463-4373 or

1-573-635-0555

Bulletin No. 207-7-0701
Revised Oct 18, 2022