Hi Pressure Fuel Air Separator
For Class 8 Trucks

INSTALLATION MANUAL
For Trucks Equipped with CATERPILLAR®
Model 3406 E, C13, C15, OR C16 Engines

PLEASE READ THESE INSTRUCTIONS THOROUGHLY BEFORE BEGINNING INSTALLATION

Kit No. A6HSCA600
Model No. HPAS-585

Fuel Preporator® Technology Inside
10 YEAR Limited Express Warranty

www.pureflowtechnologies.com
1-573-635-0555 OR
1-877-463-4373

Providing “Test Cell Performance” in “Real World Conditions” Since 1993!

PROTECTED UNDER THE FOLLOWING PATENTS

CANADA 2,108,391
UNITED STATES OF AMERICA 5,355,860; 5,746,184; 6,729,310
MEXICO 270409
NEW ZEALAND 532356
ITALY 1362177
AUSTRALIA 2005101054
HONG KONG 1061420
ECUADOR PL10-2021

Additional Foreign Patents Issued and Pending in Europe, South America, Japan, and China!
The new AirDog® Champ Final Filter Air Separator delivers all of the benefits of the original Fuel Preparator® and the AirDog® Fuel Air Separation System!

- No Fuel Pump • **10 Year Limited Express Warranty** • No Electrics •

**Positive Air Separation With Primary Air Discharge Port!**

**Receives Fuel Flow from Engine Transfer Pump. No Electric Fuel Pump Required!**

**Internal Check Valve Prevents Fuel Draining from Engine During Filter Change!**

**6 Micron Particulate Filters Long Lasting MicroGlass Media!**

**Amazing Simple Installation**
Mounts on frame, connects between the engine transfer (fuel) pump and engine. Air/Vapor return line connects to engine fuel return line.

**Amazing Simple Operation**
Operates in conjunction with the engine fuel flow. Separates and removes entrained air plus vapor from fuel pump cavitation and fuel line pressure drop before the fuel enters the engine!

**Shipping weight 9 Lbs.**
**SYSTEM OVERVIEW**

Welcome to the **“AirDog® Champ”** High Pressure Fuel Air Separation System for Class 8 Trucks

The AirDog®, Champ with *ADVANCED FUEL AIR SEPARATION* is a premium fuel air separator for the 3406E, C13, C15, C16 or C18 Model CATERPILLAR® engine.

The AirDog® Champ, installed between the secondary fuel filter and the engine fuel rail, removes all entrained air and vapor from the fuel flow to the engine. Diesel engines equipped with the AirDog® Champ can now perform as designed, delivering “test cell” performance while in “real world” use!

All AirDog® products are manufactured with a personal touch, unsurpassed attention to detail and the most stringent quality assurance!

**TYPICAL INSTALLATION LAYOUT!**

- **“A”** Fuel Flows from the Transfer pump to the secondary fuel filter.
- **“B”** Fuel Flows from the secondary fuel filter to the AirDog® Champ.
- **“C”** Air & Vapor separated from the fuel, flows from the AirDog® Champ to combine with the engine fuel return line at the secondary filter and then back to the fuel tank.
- **“D”** Fuel, free of virtually all air & vapor, flows from the AirDog® Champ to the engine head.
- **“E”** Return fuel from the engine, flows back to the fuel tank “F”.
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The installation of your AirDog® Champ 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.

3. Proper location of the AirDog® Champ on the vehicle is essential. Consider hazards presented to the equipment by road debris and the elements, as well as proximity to the engine.

4. The installation recommendations and guidelines contained herein are suggestions only. Individual installations may vary.

5. Use diesel compatible thread sealer when installing fittings with NPT threads. (Loctite® 545 Thread Sealer is diesel compatible.)

**DO NOT REMOVE FACTORY INSTALLED SECONDARY FUEL FILTERS. REMOVAL OF A FACTORY INSTALLED SECONDARY FUEL FILTER MAY VOID YOUR ENGINE WARRANTY.**

**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:** Do Not drill into or weld the top of the frame rail or within 1 ½” of the frame rail flange on the side of the frame rail.

**CAUTION:** Route the fuel lines keeping them away from hot exhaust components and/or moving parts. Properly secure the fuel lines 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

<table>
<thead>
<tr>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>Part Number</th>
<th>IMAGE</th>
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<tr>
<td>1</td>
<td>Installation Manual</td>
<td>206-6-0600</td>
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<tr>
<td>1</td>
<td><strong>AirDog® Champ High Pressure Air Separator</strong></td>
<td>HPAS-585</td>
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<tr>
<td>2</td>
<td><strong>Mounting Bracket</strong></td>
<td>002-3C-0003 LH</td>
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<tr>
<td></td>
<td>Note: Unit is shipped with brackets attached.</td>
<td>002-3C-0004 RH</td>
<td></td>
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<tr>
<td>1</td>
<td><strong>Hardware Kit, Includes:</strong></td>
<td>1J-1-C20S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 ea 3/8” x 1-1/2” Hex Head Bolt,</td>
<td>1S-1CZ</td>
<td></td>
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<tr>
<td></td>
<td>4 ea 3/8” Nut,</td>
<td>1R-6-CSZ</td>
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<tr>
<td>1</td>
<td><strong>Hardware Kit, Includes:</strong></td>
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<tr>
<td></td>
<td>4 lock washers, 1/4”</td>
<td>1R-6-AC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 hex nuts, 1/4-20</td>
<td>1S-1-AC</td>
<td></td>
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<tr>
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<td><strong>4 Socket Head Cap Screws, 1/4-20 x 2” Lg.</strong></td>
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<td><strong>Unit Connection Fittings</strong></td>
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<tr>
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<td>#8 - JIC Flare x ¾” ORB Fitting</td>
<td>4A-1-02-08-08-S</td>
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<td>1</td>
<td>#6 - JIC Flare x ½” ORB Fitting (“Fuel In” fitting for engines with fuel through ECM Cooler Plate)</td>
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<td>1</td>
<td>#8 JIC Flare X - 90° JIC Swivel Fitting (Extra Part)</td>
<td>4A-2-04-08-08-S</td>
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<td><strong>Caterpillar Engine Specific Fittings</strong></td>
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<tr>
<td>1</td>
<td>#8 JIC x 9/16-18 AirDog® Return line Restrictor Fitting</td>
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<tr>
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<td>4</td>
<td>#8 JIC Flare x 9/16”-18 ORB Fuel Fittings (Ported)</td>
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<tr>
<td>1</td>
<td>Caterpillar Fuel Pressure Shim Kit</td>
<td>905-01-0100-1</td>
<td></td>
</tr>
</tbody>
</table>

**Purchase price DOES NOT include:**
Fuel lines, fuel line end fittings or special mounting brackets!

**PureFlow® Technologies does offer Universal Mounting Bracket Kits and Fuel Line Kits!**
Selecting the Best Location to Mount The AirDog® Champ

Installing the AirDog® Champ at the proper location on the vehicle is most important. When deciding where to locate the AirDog®, the following points should be considered:

• Best relationship to the secondary fuel filter and back of engine head.
• Protection from the elements and road debris.
• Accessibility for service.

Figures 2 and 3 show examples of different AirDog® Champ installations. There are many variations in the arrangements of the components on the various trucks. With a little ingenuity, the AirDog® Champ can be easily installed on any Class 8 Truck.

**Figure 2** shows the AirDog® Champ mounted on the frame under the steering column to the rear of the shock absorber. In this installation, the Universal Mounting Bracket was needed. **Figure 3**, in a different truck, shows the AirDog® Champ mounted under the steering column ahead of the shock absorber, directly on the frame.

NOTE: When mounting the AirDog® Champ at the Fig. 3 location, check for clearance with the tire turned toward the frame!
Section 5: MOUNTING THE AirDog® Champ ON THE TRUCK’S FRAME!

5-1. Hold the AirDog® Champ, with the brackets and filter attached, next to the frame at the selected mounting location. Check for clearance. If mounted between the frame and steer tire, turn the steering wheel fully to the left and right to check for tire clearance.

WARNING! DO NOT DRILL INTO OR DAMAGE ANY WIRING, AIR LINES OR OTHER COMPONENTS LOCATED BEHIND THE FRAME RAIL.

5-2. Mark and center punch the hole locations. Drill a 3/8” hole at each of the 4 locations and attach the AirDog® Champ brackets.

5-3. In this installation, the spring shackle bracket is in the way. Using PureFlow Technologies Universal Mounting Bracket & spacers, easily overcomes this obstacle!

5-4. Mark and center punch the selected hole locations. Drill the holes and attach the universal mounting bracket. Attach the AirDog® Champ brackets.
Section 5: MOUNTING THE AirDog® Champ ON THE TRUCK’S FRAME, cont’d!

5-5. With the brackets well secured to the truck’s frame, attach and secure the AirDog® Champ to the brackets. Properly tighten all of the fasteners.

Figure 9

Figure 10
FUEL LINE OVERVIEW

**Fuel Supply Line:** The fuel supply line from the secondary fuel filter to the AirDog® Champ should be a minimum size 8 (1/2”).

**Fuel Line to Engine Head:** The fuel supply line from the AirDog® Champ to the engine head should be a minimum size 8 (1/2”). Ported 9/16-18 x #8 JIC fittings are supplied in the Kit.

**Air/Vapor Return Line:** The AirDog® Champ Air/Vapor return line should be connected to the engine’s return line. A size 6 is adequate for the Air/Vapor return line. Special fittings are supplied with the AirDog® Champ to facilitate this.

**Secondary Fuel Filters:** DO NOT REMOVE SECONDARY FUEL FILTERS. This is the filter between the transfer pump and the engine. Removing a secondary fuel filter could void your engine warranty.

---

**Installing the fuel line from the secondary fuel filter to the AirDog® Champ!**

6A-1. Disconnect the fuel line connected to the secondary fuel filter port marked “To Head”. Remove the #6 fitting, as well.

![Figure 11](image1.png)

6A-2. Follow the same fuel line disconnected in step 6-1 to the fuel manifold shown in figure 13. Disconnect and remove the line from the engine.

6A-3. Install one of the ported 9/16-18 ORB x #8 JIC fittings supplied with the Installation Kit in the “Out to engine” port of the Cat secondary fuel filter.

![Figure 12](image2.png)

![Figure 13](image3.png)
Installing the fuel line from the secondary fuel filter to the AirDog® Champ, cont’d!

6A-4. Measure and cut the length of #8 fuel line required, when properly routed, to connect the AirDog® Champ fuel inlet port to the new 9/16 x #8 JIC fitting installed in the secondary fuel filter head in Step 6-3. Assemble the fuel line and end fittings per standard procedures.

6A-5. Install the 1/2” Orb x #8 JIC fitting in the AirDog® Champ inlet port.

6A-6. Connect the new fuel line to the secondary fuel filter. Route and connect the line to the AirDog Champ inlet port. Properly tighten the connections. Secure the fuel line to prevent chaffing.

Section 6B: Installing the fuel line from the AirDog® Champ to the engine head!

6B-1. Install the 1/2” Orb x #8 JIC fitting in the AirDog® Champ “Fuel Out” to engine port, as shown.

6B-2. At the back of the engine head, disconnect the fuel return line and remove the 9/16” x #6 fuel fitting. Install a 9/16”-18 x #8 ported fitting from the AirDog® Champ kit.

6B-3. Re-route the engine fuel return line, just disconnected, to the front of the engine. Connect the fuel return line to the #6 JIC fitting in the fuel manifold referenced in Step 6A-2, fig 12. This is much easier than trying to install a 9/16” ORB x #8 JIC in the front of the engine head. This reverses the fuel flow through the head.
Installing the fuel line from the AirDog® Champ to the engine head, cont’d!

6B-4. Measure and cut the length of #8 fuel line required, when properly routed, to connect the #8 fitting in the AirDog® Champ “Out to Engine” Port to the new #8 JIC fitting installed in the back of the engine head.

![Figure 18](image1)

![Figure 19](image2)

6B-5. Assemble the proper fuel line ends per standard procedures. Connect the new fuel line to the AirDog® Champ and the new #8 fitting in the back of the head. Properly tighten the connections.

Section 6C: Installing the AirDog® Champ air/vapor return!

6C-1. Disconnect the fuel return line connected to the fuel return fitting on the secondary filter and remove the #6 fitting. Install the Special AirDog® 9/16-18 ORB X #8 Restrictor Fitting in the “Return to Tank” port in the secondary filter head.

![Figure 20](image3)

![Figure 21](image4)

6C-2. Install the Special AirDog® 9/16-18 ORB X #8 Restrictor Fitting in the “Return to Tank” port in the secondary filter head.

![Figure 22](image5)

![Figure 23](image6)

![Figure 24](image7)

6C-3. Assemble the correct AirDog® Champ return “T” to the Restrictor fitting. Install the #8 Swivel X #6 X #6 T”, if you have a #6 engine return line. Install the #8 “T” and fitting if you have a #8 engine return line.
Installing the fuel line from the AirDog® Champ to the engine head, cont’d!

6C-4. Install the 9/16-18 ORB x #6 Air Vapor return fitting in the port on top of the AirDog® Champ marked “Air Return”.

6C-5. Measure and cut the length of fuel line required, when properly routed, to connect the AirDog® Champ Air/Vapor return port to the new return “T” installed on the secondary fuel filter head. Assemble the fuel line per standard procedures.

6C-6. Route and connect the AirDog® Champ Air/Vapor return line. Properly tighten all fittings.

SECTION 6D: Fuel System Upgrade
Modifying the Transfer Pump Inlet Fitting!

NOTE: The ORB end of the fuel fitting has a much smaller bore than the JIC flare end. The small hole in the ORB portion of the fitting, opening into the greater volume area at the inlet to the transfer pump, creates a “Vacuum Chamber” and a pressure drop that can cause vapor to form.

To facilitate fuel flow and eliminate the “Vacuum Chamber” affect, the ORB end of the fitting must be enlarged.

6D-1. Disconnect the fuel line from the fitting and remove the fuel fitting from the transfer pump.

6D-2. Drill out the passage way in the ORB end of the fuel fitting to 15/32”. Clean out all burrs and re-install the fitting in the transfer pump. Reconnect the fuel line.
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!

**Figure 30**

6D-3. Disconnect the “Return Fuel Recycle Line” from the top of the inlet fitting at the transfer pump.
6D-4. Disconnect the “Return Fuel Recycle Line” from the bottom of the Return Line shutoff valve
6D-5. 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.
6D-6. Disconnect the fuel supply line from the bottom of the inlet fitting at the transfer pump.
6D-7. Remove the Transfer Pump inlet fitting.

**Figure 31**

6B-8. Install the ORB X #10 JIC flare fitting in the Transfer Pump Inlet Port.

**Figure 32**

6B-9. Reconnect and tighten the fuel supply line removed in step 7A-4.

Note: Use the 90° #10 Swivel X #10 JIC Flare fitting, as needed!
Section 6E: Secondary Fuel Filter Head Modification

All Caterpillar® diesel engines are equipped with a secondary fuel filter mounted on the engine. The filter head usually has a Hand Primer Pump attached to make priming and starting the engine easier after filter changes.

However, the passageway in the filter head, ref. Fig. 33, and the valves in the hand primer pump are restrictive to the fuel flow through the system and to the engine head and negatively affect engine performance. The passageway in the secondary should be enlarged to allow better fuel flow through the filter head.

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!

6E-1. Remove the hand primer pump and fuel filter from the filter head.

6E-2. Using a 3/8” bit, carefully drill out the passageway that carries the fuel from the primer pump into the fuel filter.

6E-3. Replace the hand primer pump.

Note: Be careful not to drill into the fuel filter gasket seat on the underside of the filter head.
Adjusting the Fuel Rail Pressure

For the Cat 3406E, C15, and C16 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.

NOTE: The first step to resetting the “Fuel Rail Pressure” has already been performed when the AirDog® Champ 9/16-18 ORB X #8 Special Restrictor Return Fitting was installed in Step 6C-1, Figure 21. 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.

There are two models of the Caterpillar® fuel transfer pump. The earlier model transfer pump, with a small diameter spring and hex head plug, as shown in Figure 39, and the later version, with a larger diameter spring and socket head plug, as shown in Figure 41.

Temporarily, install a 150 PSI fuel pressure gauge. It is important to know the original fuel pressure before you start!

To adjust the rail pressure it is necessary to reset the spring tension on the high pressure bypass regulator.
Section 7

Adjusting Fuel Rail Pressure

To Adjust the Earlier Style Cat Fuel Transfer Pump

7-1. Remove hex plug “A” on the side of the transfer pump.

7-2. Take out spring “C” and Stiffener Pin “B”.

NOTE: The shim kit includes new stiffener pin with cap and three shims for the early version transfer pump.

Figure 42

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

Adjusting Rail Pressure for the Later Style Cat Fuel Transfer Pump.

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.

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

7-5. Remove socket head plug “A” on the side of the transfer pump.

NOTE: The Shim Kit includes two shims, one 0.25” thick and one 0.125” thick.

Figure 43

7-6. Hold the 0.125” shim “C” on the end of the plug “A” and re-install the spring, shim, and plug into the transfer pump.

Figure 44
Adjusting the Fuel Rail Pressure, cont’d

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 115 PSI, replace the 0.125” shim with the 0.25” and repeat adjusting shims until 115 PSI, but not more than 120 PSI is reached at high idle.

WARNING: Do Not exceed 120 PSI fuel rail pressure. Excessively high rail pressure, 130 PSI and above will void you factory engine warranty and can cause severe engine damage!

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: If you are unable to adjust the fuel rail pressure to 118 PSI, it is possible that your transfer pump is worn out and should be replaced. To obtain PEAK PERFORMANCE and fuel economy from your Caterpillar engine, all components must be in good to excellent operating condition.
Servicing the AirDog® Champ Fuel Filter

It is recommended to replace the fuel filter at 25,000 miles of service. When replacing the fuel filter, be sure to clean the under side of the AirDog® Champ base. Follow the instructions on the filter for proper tightening procedures.

Dispose of waste fuel and used filters properly to protect OUR environment!