DAVCO Fuel Processor Maintenance And Diagnostic Training

TRAINING SUMMARY

- This training program covers the operation, maintenance and diagnostic procedures for the DAVCO family of Fuel Processors.
- All forms can be downloaded from the DAVCO Web Site www.davco.com. Click the Search tab and enter the Form Number
- There is a quiz at the end of the program to reinforce important information. Hint: Look for underlined words and descriptions throughout the presentation.
- Please don't hesitate to contact DAVCO Customer Support or your DAVCO Regional Sales & Service Manager with any questions, suggestions or comments.

DAVCO FAMILY OF PRODUCTS

Fuel Processing and Fluid Level Management for Truck, Bus and Coach, Industrial, Marine and Stationary Markets

DAVCO

ON HIGHWAY PRODUCTS

CONSTRUCTION / INDUSTRIAL PRODUCTS

FUEL PROCESSOR CONCEPT

“ALL-IN-ONE SYSTEM”

Fuel Filter
Fuel rises up to the filter. The patented EleMax® design allows only a portion of the filter media to be used maximizing filter life.

Water Separator
Water and large contaminants fall to the bottom of the body and can be drained away.

Fuel Heater (Optional)
Fuel flows through the heated chamber and up into the ”SEEING IS BELIEVING”® clear cover filter area.

SEEING IS BELIEVING®
The patented clear cover allows the user to know when not to change the filter.

DAVCO MARKETS











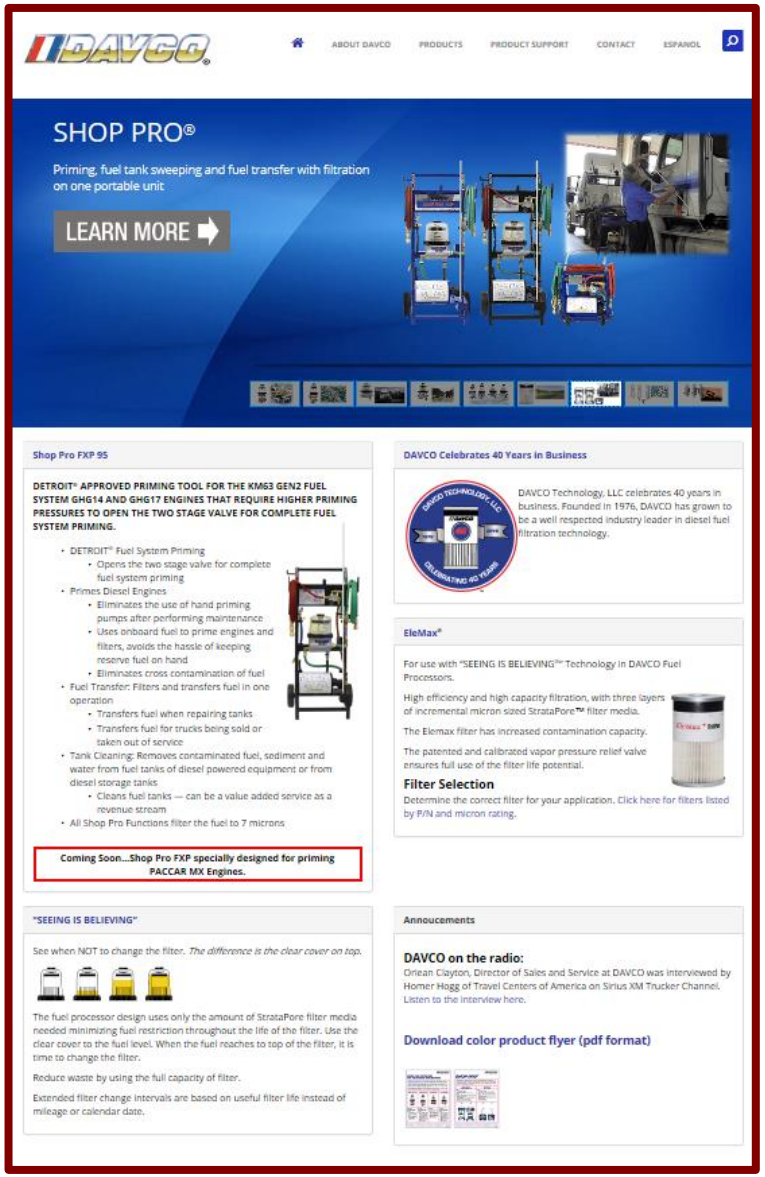




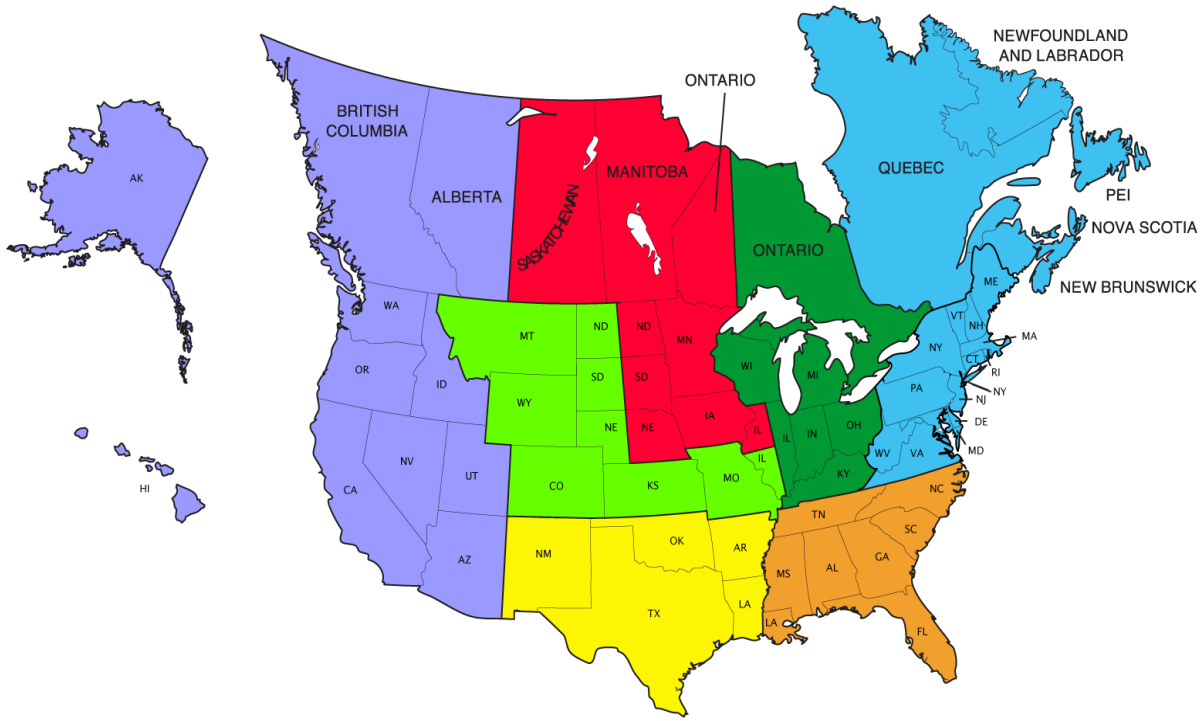


USER FRIENDLY WEBSITE

- Easy Navigation and Search
- Product Information
- Parts Information
- Diagnostic Procedures
- Contacts by Region
- OEM Sales Codes
- Fuel Filter Information



ON HIGHWAY SALES AND SERVICE



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	Richard Smallwood	734-585-6992	rsmallwood@davco.com
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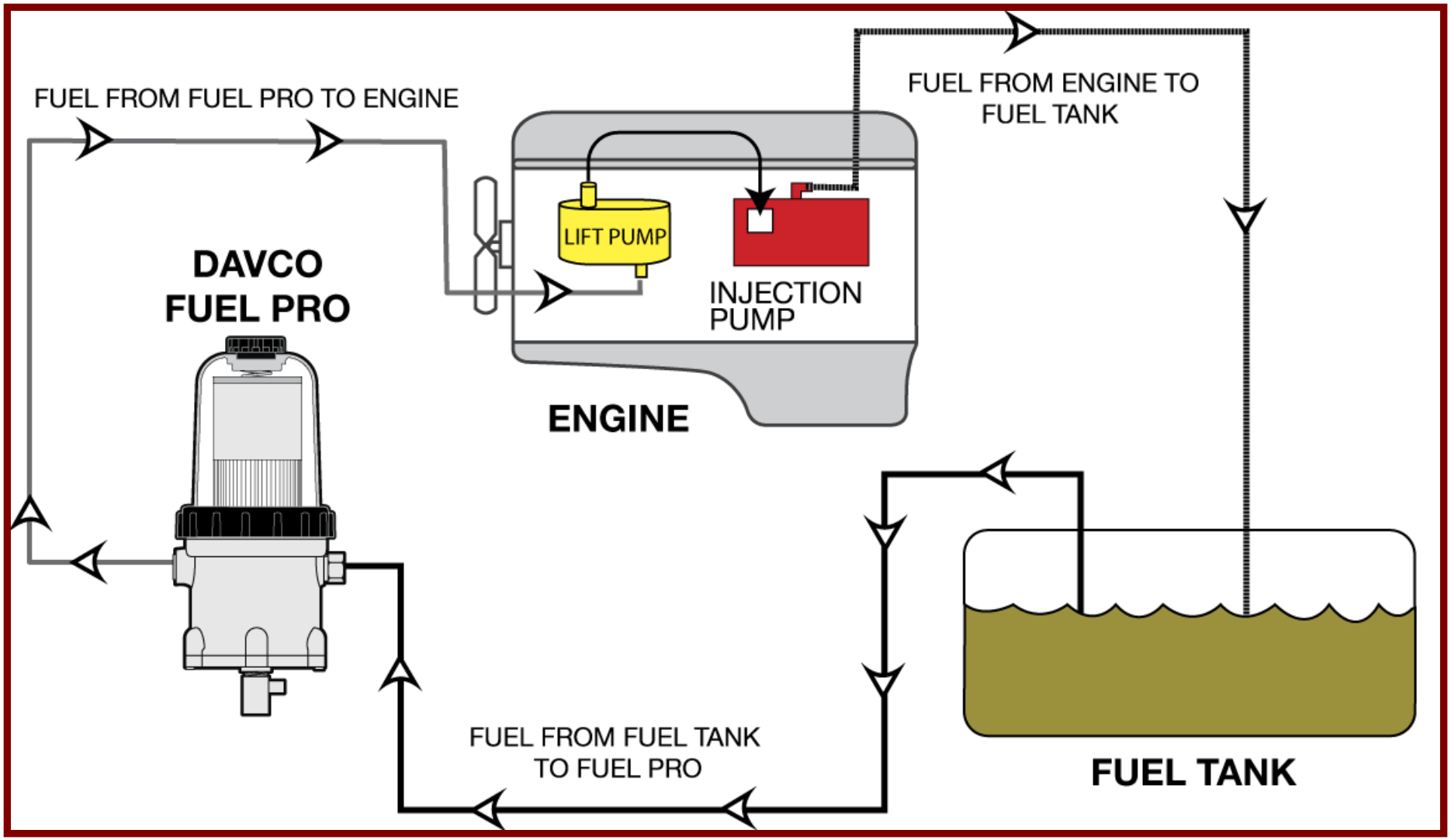
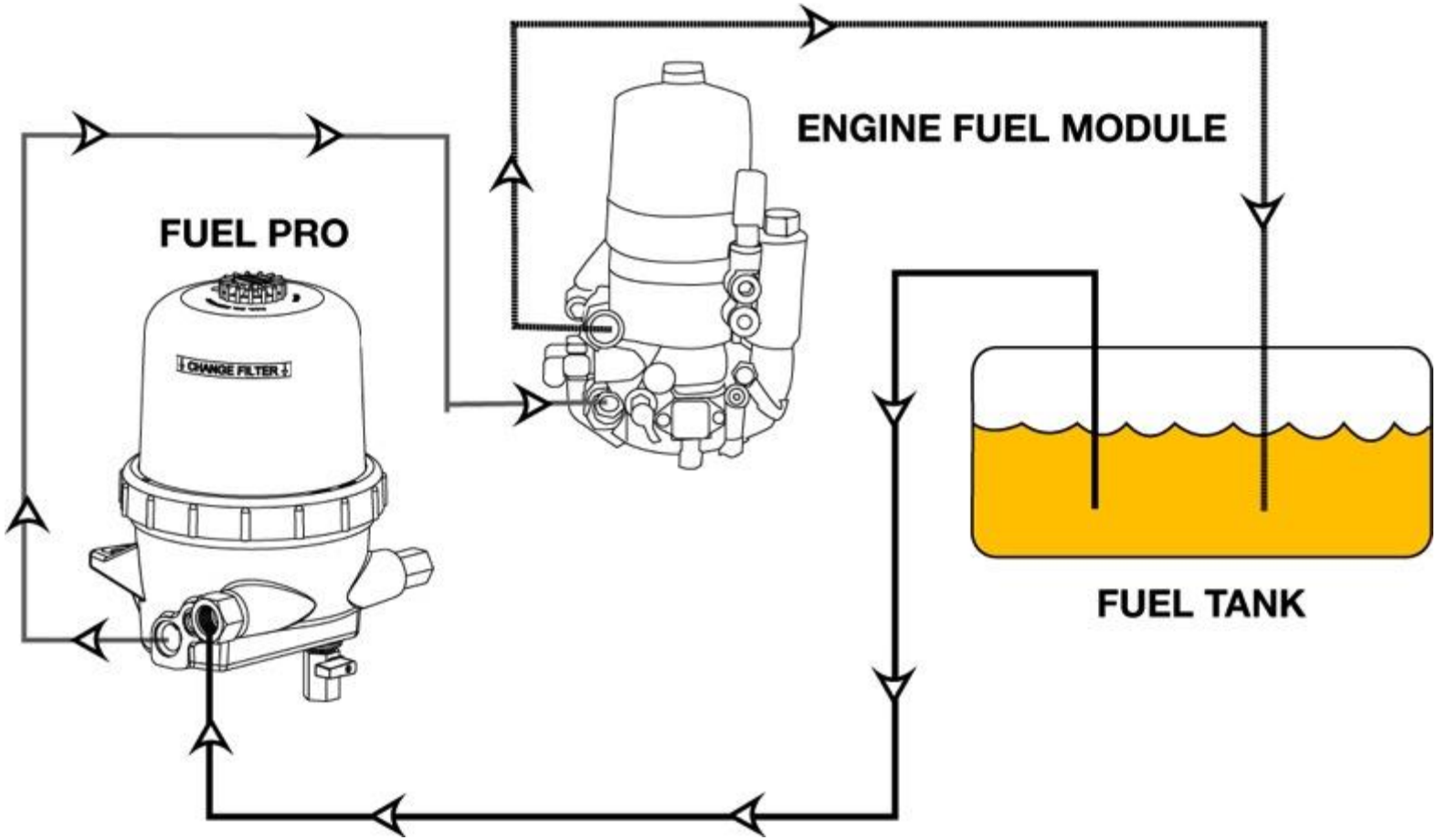
DAVCO SYSTEM



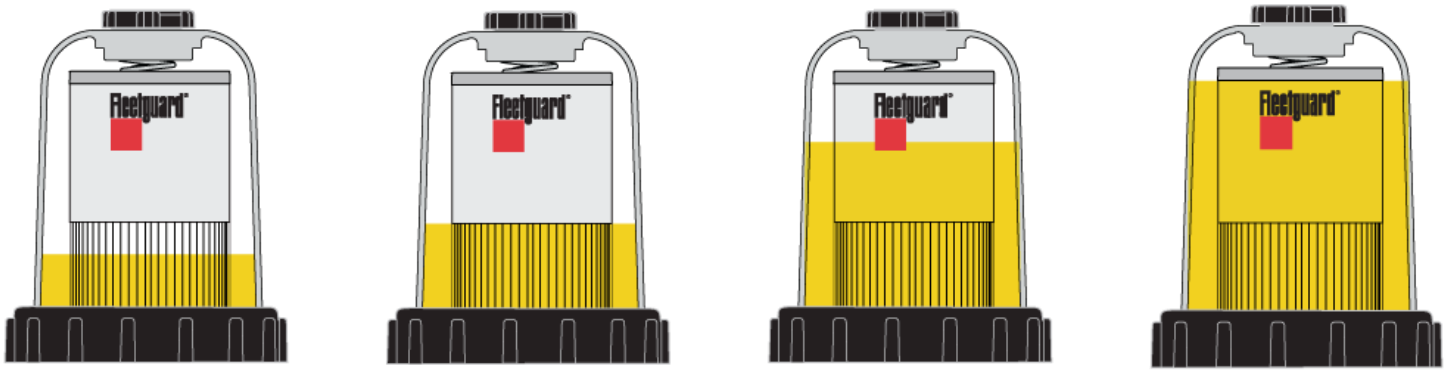
DESIGNED FOR THE <u>SUCTION (VACCUM)</u> SIDE OF THE FUEL SYSTEM

DAVCO FUEL PRO® 482 SYSTEM



WHEN A DAVCO FUEL PRO 482 IS INSTALLED ON THE DETROIT DIESEL DD15 FAMILY OF ENGINES, THE ENGINE FUEL MODULE FILTERS ONLY NEED TO BE REPLACED AT 150K MILE INTERVALS.

ELEMAX® FILTER TECHNOLOGY



Fuel level rises as the filter media becomes contaminated, the fuel filter doesn't need replaced until fuel level is at the Top Of The Filter.

The Elemax filter can be identified by the half wrap and a Vapor Pressure Relief Valve on top of the filter element. The combination of Elemax filter design and StrataPore™ media extend filter change intervals.

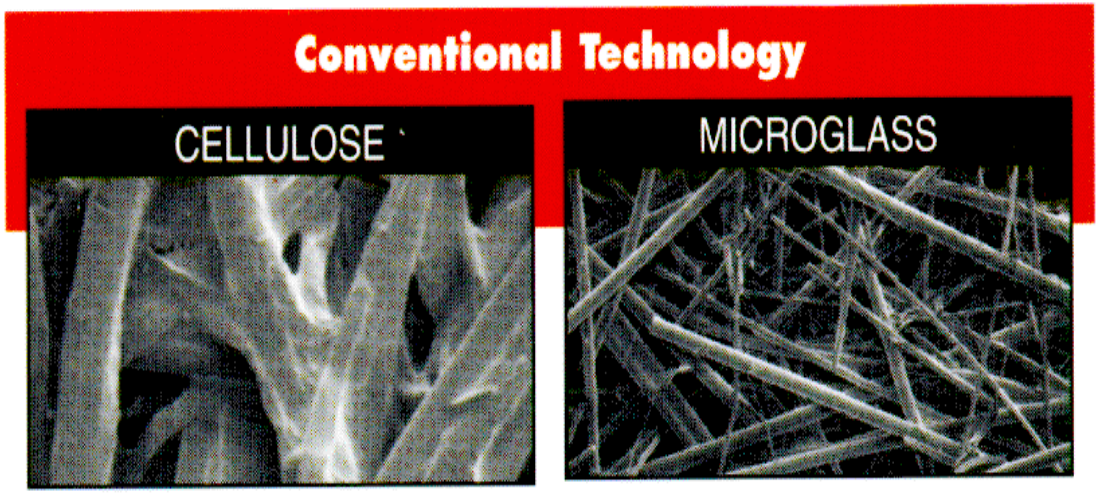
View Animation of "SEEING IS BELIEVING"® at www.davco.com

FILTER MEDIA

Laminated Melt Blown Filter Media

STRATAPORE™ does not require chemical treatment for water separation.

Cellulose requires chemical treatment to separate water.



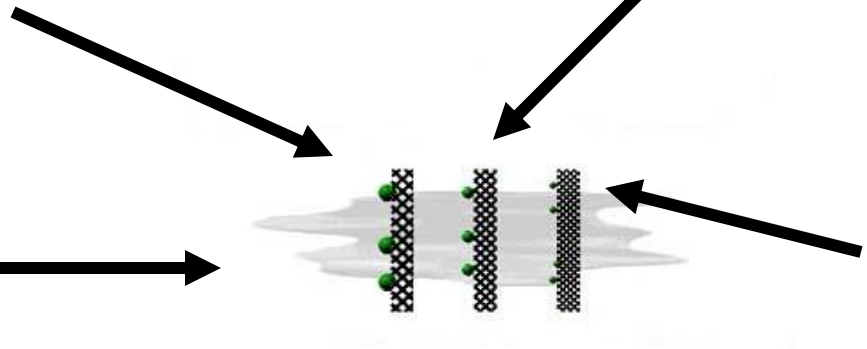
Microglass generally is not acceptable with current high pressure common rail injection systems.

STRATAPORE™

Laminated Melt Blown Media

Larger debris is captured by the coarse layer.

Smaller debris is captured by the middle layer.



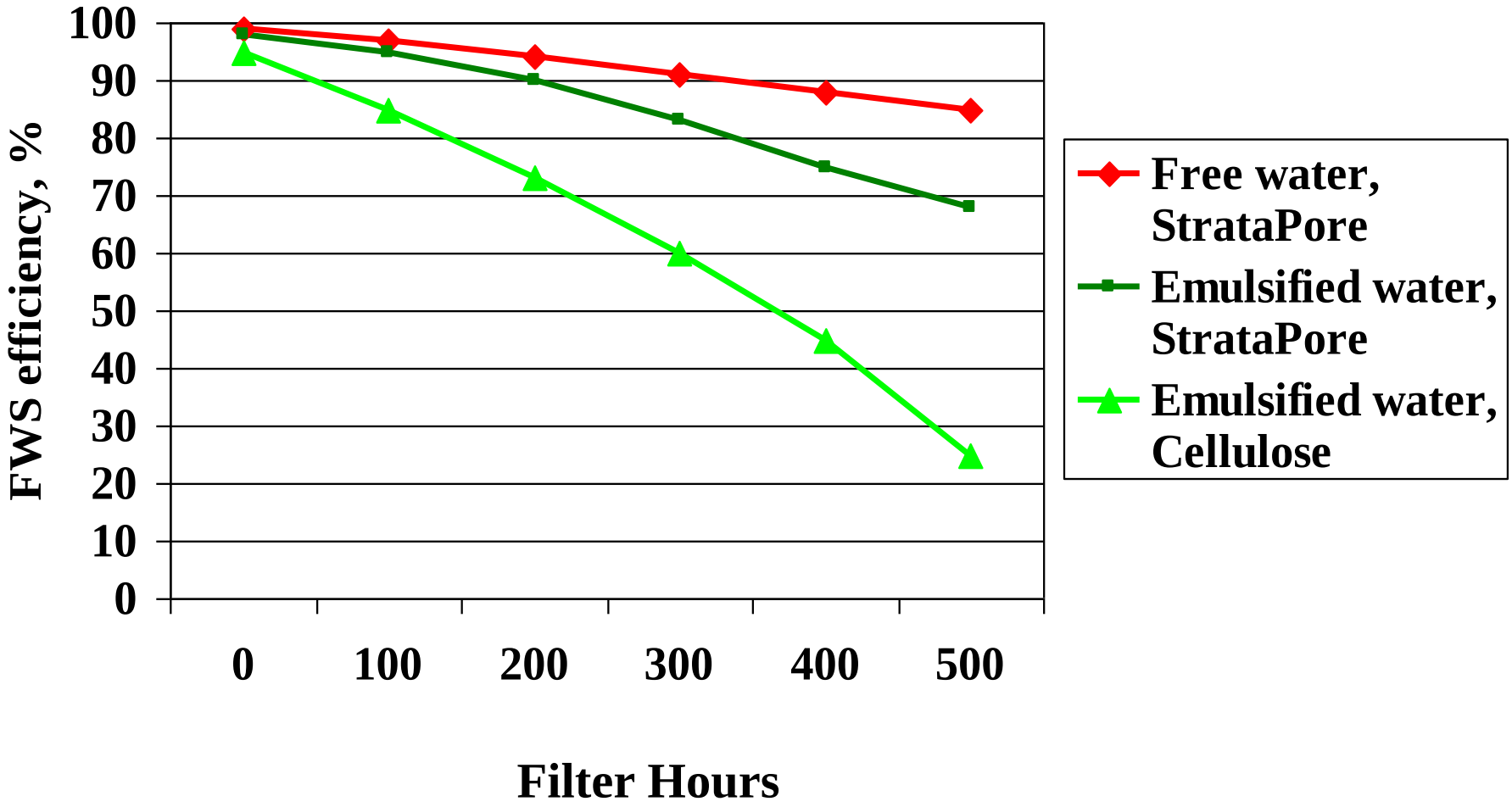
Fluid Flow

Fine particles are captured by the fine layer.

Stratapore™ Advantages

- High Efficiency
- High Capacity (Three Layers)
- Best Fuel Water Separation Efficiency (Media Doesn't Have to Be Treated)
- Stronger than Cellulose and Glass Media
- Longer Life

STRATAPORE™ VS CELLULOSE

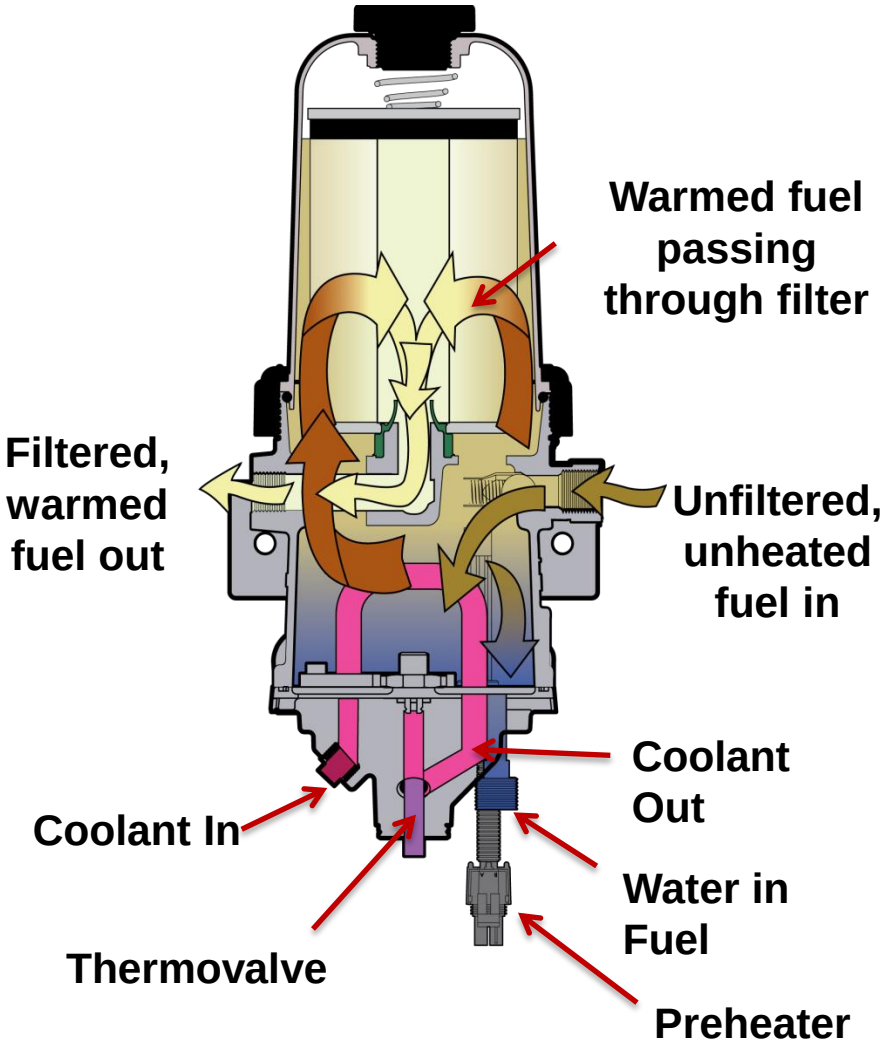


FUEL PRO®

For Engine Flow Rates up to 180 GPH

DAVCO

FUEL HEATER OPTIONS



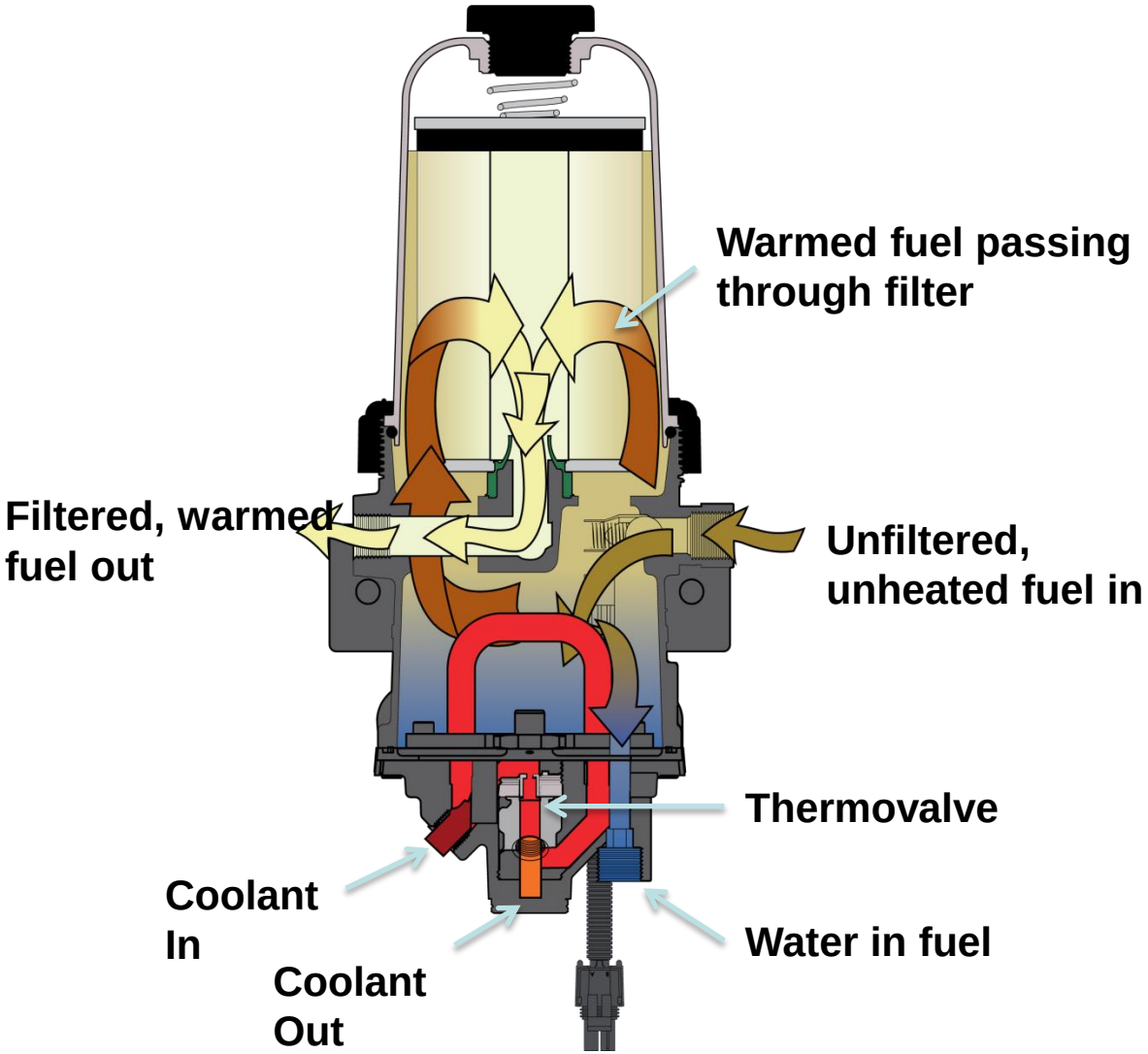
PREHEATERS
12vdc Preheater
120vac Preheater

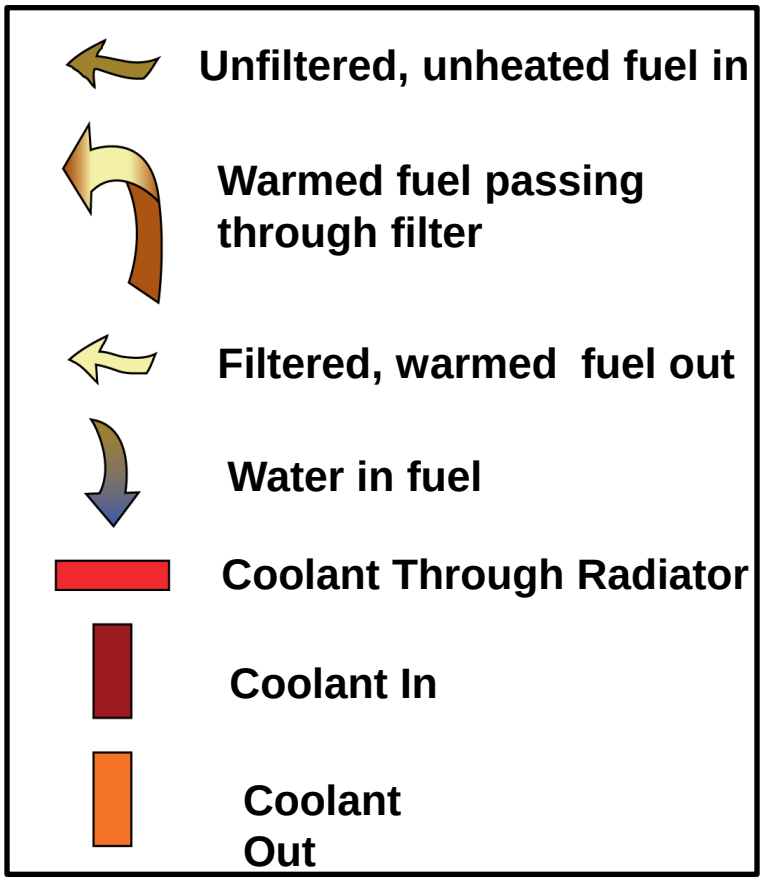
FLUID HEAT
Fuel Flows Through the Heated Chamber and Up Into the "SEEING IS BELIEVING"® Clear Cover.

Common Rail Return Fuel Flow Rates and Temperatures Are Much Lower Than Pre-2010 Emission Engines. Engine Coolant Must Be Used as Fluid Heat Source to the Fuel Pro.

As with all things there are exceptions, the DD 13,15 &16 Engine does not require any fluid heat option due to higher Return Fuel Flow Rates and Temperatures

Fuel Pro® 382 Fuel Flow with Coolant Heat





DAVCO FORM F3029

Converting Fuel Pro 382 From Return Fuel to Coolant Heat

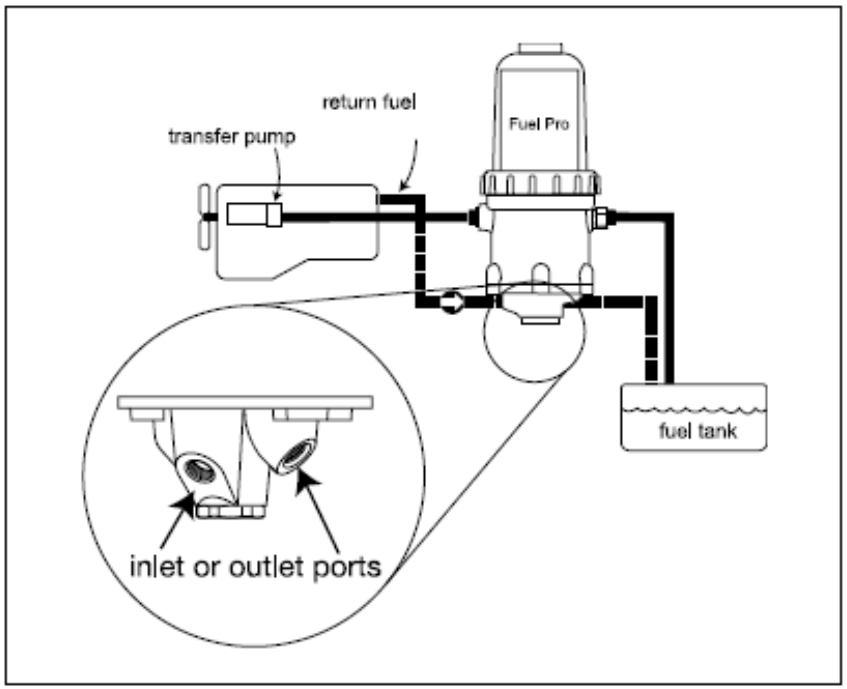


Figure 1: Return Fuel Heat

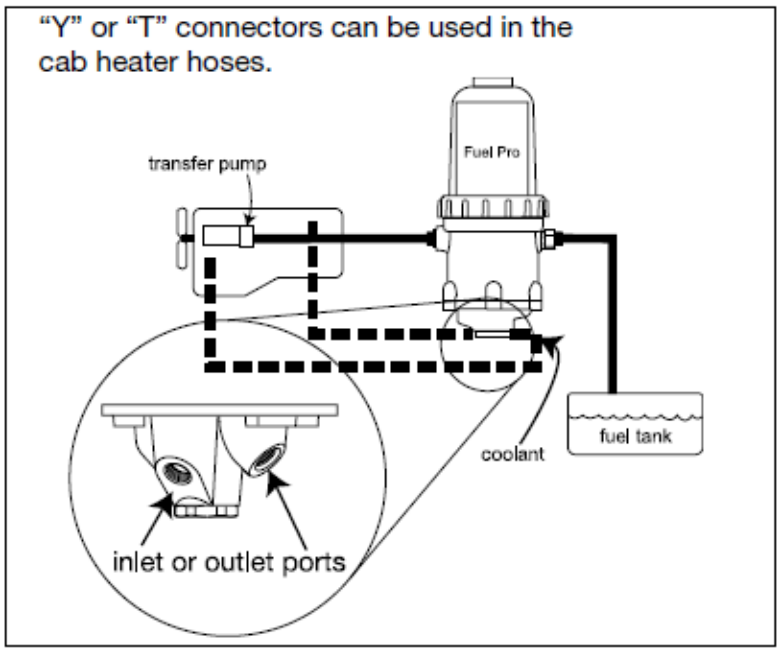


Figure 2: Coolant Heat

DAVCO FORM F1823

Upgrading Fuel Pro 382 to Coolant Heat

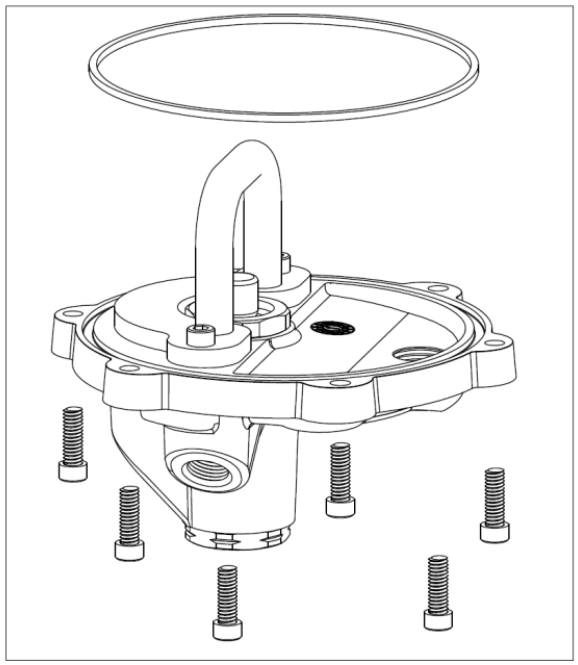


Figure 1: Kit Contents

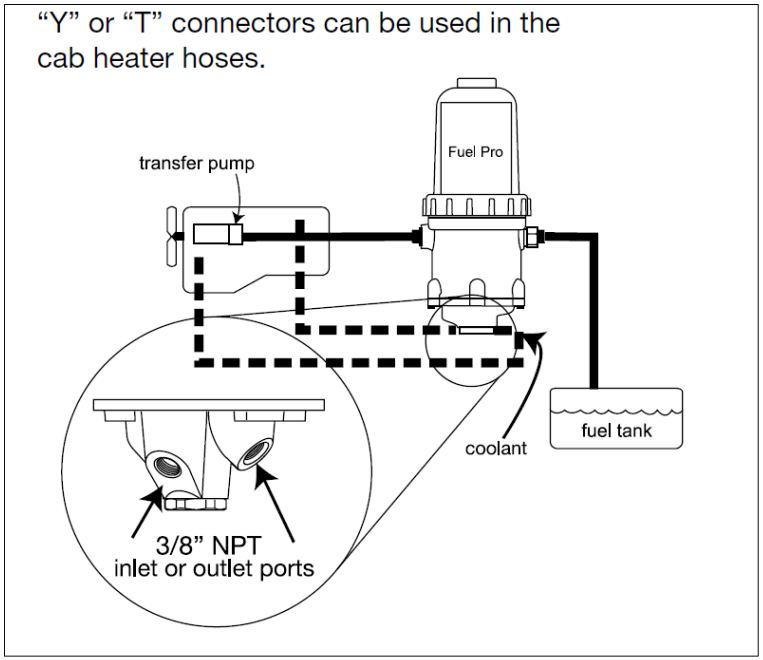


Figure 2: Coolant Heating Routing

FUEL PRO® 382

- All-In-One Unit ➔ Water Separator, Fuel Heater, Fuel Filter
- “Seeing is Believing”® Technology
- B20 Biodiesel Compatible
- EleMax® Filter Technology for Increased Filter Life
- Fluid Heat, 12vdc-250w, and/or 120vac-75w Preheater
- Serviceability ➔ No Spill Filter Changes
- Visual Troubleshooting Capabilities
- Fewer Filters to Stock, Lower Disposal Cost, Less Filters Used
- Financial Benefit

FUEL PRO® 482 FEATURES

- ***For Detroit DD13, 15 or 16 Engines***
- 7 Micron Filter
- 2.5 Times More Filter Life than Fuel Pro® 382
- Averaging 100k Miles Intervals
- Extends Maintenance Interval on DD13/DD15/DD16 Fuel Module Filters to 150K Miles
- Cast Aluminum Body
- Isoplast Cover and Collar
- Integrated Mounting Bracket
- Fuel In and Out Left Side
- Low Restriction Check Valve
- 12v – 250w Electric Pre-heater Option
- 120v Combo Overnight Heater Option
- Existing Fuel Pro® Drain

FUEL PRO® 483

- ***For Engines Other Than DD 13/15/16***
- 7 Micron Filter
- 2.5 Times More Filter Life than Fuel Pro® 382
- Significant Filter Life Increase
  - 4 to 5 Times Primary Filter Life
  - Average 100k Miles
- Cast Aluminum body
- Isoplast Cover and Collar
- Optional Fuel IN Port Locations
- Optional Coolant IN/OUT Ports
- Low Restriction Check Valve
- Optional heat:
  - Pre Heater- 12V, 24V
  - Overnight Heater- 120V
  - Coolant Heat
- Water in Fuel Sensor
- ESOC Option

SHOP PRO®

- Removes Contaminated Fuel, Sediment and Water From Diesel Fuel Tanks
- Prime Heavy-Duty Diesel Engine Fuel Systems
- Filter and Transfer Fuel in One Operation

SHOP PRO® ST

SHOP PRO® FXP

SHOP PRO® FEATURES

- Sweep (Clean) Fuel Tanks of Contamination and Water
- Transfer Fuel
- Prime Diesel Engines
- 120VAC and 12VDC Motor with UL Approved Electrical Receptacle
- Heavy Duty Pump
- Heavy Duty Frame
- Water Proof On/Off Switch
- High Capacity EleMax®/Stratapore™ Filter
- Integrated Drip Reservoirs with Drains
- Sight Tube of Fuel Flowing into the Shop Pro Filter
- Easily Identifiably Shop Pro Suction and Pressure Hoses
- Schematic and Written Operation Instruction Labels on the Shop Pro Frame
- Five Year Warranty on Cart and Filter Assembly
- One Year Warranty on Electrical Motor and Mechanical Pump

SHOP PRO® BENEFITS

- No Additional Fuel Required to Prime Diesel Engines, Uses the Vehicle Fuel
- Quickly/Easily Prime Most Diesel Engine Fuel Systems
- Quick Disconnect Hose Connectors
- Eliminate Need for Hand Priming Pumps or Similar Devices
- Sweep Tanks Clean When Contaminated with Antifreeze or Other Fluids
- Transfer or Drain Fuel from Tanks to Aid in Fuel Tank Repair or When Selling the Vehicle or Equipment
- Fill New Spin-On Filters with Clean Fuel
- 7 micron EleMax® Filter For Full Filter Life Usage

SERVICE AND MAINTENANCE

FUEL FILTER APPLICATION CHART

DAVCO Technology, LLC

FUEL FILTER APPLICATION CHART
FUEL PRO® 380/382/482/483 AND DIESEL PRO® 243

FILTERS FOR FUEL PRO 382 WITH PLUS SIZE COVER*

Uses DAVCO Cover P/N 102420 and DAVCO Collar P/N 102425 Filter Cartridge diameter is 4.21 in.				CATERPILLAR		CUMMINS						DETROIT DIESEL	INTERNATIONAL	MACK			MERCEDES BENZ	PACCAR	VOLVO
				Acert & Non Acert		ISX 2010	ISX			ISM	M11 & N14	Series 50 & 60	MaxxForce	ASET	E7	MP 7-8-10	MBE900 & MBE4000	MX	VDE
Ref. #	Cover Size/Type	Brand/P/N	Mic	1/07 to present	Pre-2007	2010 to present	10/02 to 2009	1998 - 10/02	Pre-1998	All	All	All	All	All	All	All	All	All	All
102525	Plus Size/ EleMax	Fleetguard FS19766	2		X (one filter system only)														
102526	Plus Size/ EleMax	Fleetguard FS19763	7									X		X			X		
382139	Plus Size/ EleMax	Mack 483GM483M 21250981	7											X					
102527	Plus Size/ EleMax	Fleetguard FS19764	10	X		X			X	X	X								
102528	Plus Size/ EleMax	Fleetguard FS19765	25					X					X		X	X		X	X
382147	Plus Size/ EleMax	Mack 21737481	25												X	X			
382148	Plus Size/ EleMax	Volvo 21737499	25																X
382134	Plus Size/ EleMax	Fleetguard FS19905	50		X (two filter system only)		X												

FILTERS FOR FUEL PRO 382 WITH PRE-2008 Original Size Cover* (OR FUEL PRO 380 AS NEEDED)

Filter Cartridge diameter is 3.82 in.			CATERPILLAR		CUMMINS						DETROIT DIESEL	INTERNATIONAL	MACK			MERCEDES BENZ	PACCAR	VOLVO
			Acert & Non Acert		ISX 2010	ISX			ISM	M11 & N14	Series 50 & 60	MaxxForce	ASET Series	E7	MP 7-8-10	MBE900 & MBE4000	MX	VDE
Cover/Type	Brand/P/N	Mic	1/07 to present	Pre-2007	2010 to present	10/02 to 2009	1998 to 10/02	Pre 1998	All	All	All	All	All	All	All	All	All	All
Standard/EleMax	Fleetguard FS19761	2		X (one filter system only)														
Standard/EleMax	Fleetguard FS19624	7									X		X			X		
Standard/EleMax	Detroit 23533816	7									X					X		
Standard/EleMax	Fleetguard FS19727	10	X		X			X	X	X							X	
Standard/EleMax	Fleetguard FS19728	25					X					X		X	X			X
Standard/EleMax	Fleetguard FS19729	50		X (two filter system only)		X												

DAVCO Technology, LLC P. O. Box 487 800-328-2611 Saline, MI 48176 www.davco.com F3105-REV A2

last modified: January 23, 2015

Use Form 3105 for Filter Application Chart

Ensure the correct fuel filter is being used for the engine and meets your company's policy.

FUEL PRO® 382 SERVICE

DAVCO Technology, LLC

FILTER CHANGE PROCEDURE

Step 1: Remove the vent cap (1) and the open drain valve (5) to drain the fuel below the collar level.

Step 2: Remove the cover (2) and collar (4).
Note: Use Collar Wrench 380134 (metal) or Collar Wrench 382002 (composite)

Step 3: Remove the filter (3), grommet, cover seal, and vent cap seal. Dispose of these properly.

Step 4: Using a clean shop rag, clean the cover, the collar and threads on the Fuel Processor body.

Step 5: Be sure the grommet is in place on the bottom of the filter element. Install new filter.

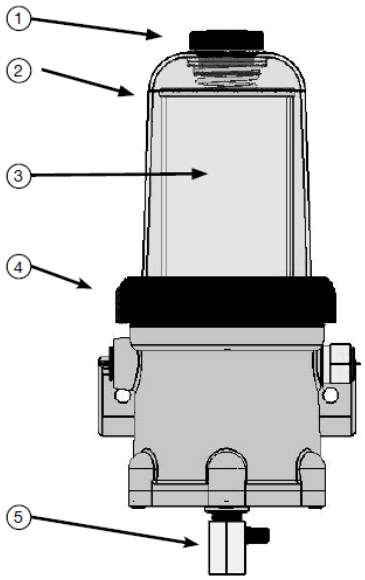
Step 6: Install the cover seal. Install cover and collar onto the Fuel Pro body. **Hand tighten the collar.**

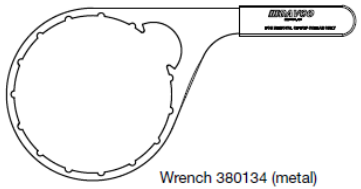
Step 7: Fill the cover with fuel.

Step 8: Place the new vent cap seal on the vent cap. Install Vent Cap onto the cover. **Hand tighten the vent cap.**

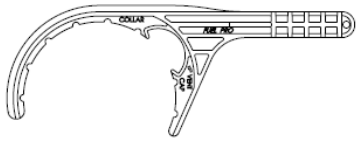
Step 9: Start the engine. When the lubrication system reaches its normal operating pressure, increase the engine RPM for one minute. **Slowly** open vent cap until the fuel level drops to one inch above the collar. **Hand tighten the vent cap.**

Note: The DAVCO Fuel Pro vent cap and collar are designed to be removed with a DAVCO wrench. As such Warranty Claims associated with broken vent caps and collars will not be accepted if tools other than a DAVCO wrench are used for removal. Please note that the vent cap and collar are to be hand tightened only. The wrench is not be used for tightening either the vent cap or collar.





Wrench 380134 (metal)



Wrench 382002 (composite)

Use Form 1333 for Service Procedure

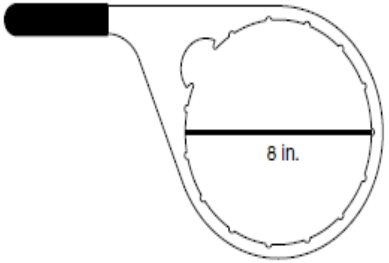
1. Remove the vent cap (1) and the open drain valve (5) to drain the fuel below the collar level.
2. Remove the cover (2) and collar (4).
   Note: Use Collar Wrench 380134 (metal) or Collar Wrench 382002 (composite)
3. Remove the filter (3), grommet, cover seal, and vent cap seal. Dispose of these properly.
4. Using a clean shop rag, clean the cover, the collar and threads on the Fuel Processor body.
5. Be sure the grommet is in place on the bottom of the filter element. Install new filter.
6. Install the cover seal. Install cover and collar onto the Fuel Pro body. **Hand tighten the collar.**
7. Fill the cover with fuel.
8. Place the new vent cap seal on the vent cap. Install Vent Cap onto the cover. **Hand tighten the vent cap.**
9. Start the engine. When the lubrication system reaches its normal operating pressure, increase the engine RPM for one minute. **Slowly** open vent cap until the fuel level drops to one inch above the collar. **Hand tighten the vent cap.**

HAND TIGHTEN THE COLLAR AND VENT CAP.
OVERTIGHTENING CAN CREATE A TWISTED SEAL RESULTING IN AN AIR LEAK.

FUEL PRO® 382 SERVICE

FILTER CHANGE PROCEDURE

1. Remove the vent cap and open the drain valve to drain the fuel below the collar level.
2. Remove the collar (using a DAVCO wrench) then remove the clear cover.
3. Remove the filter, cover and vent cap seals. Dispose of properly.
4. Using a clean shop rag, clean the cover, the collar and threads on the Fuel Pro body.
5. Install a new filter, cover seal and vent cap seal.
6. To tighten the collar with the wrench, simultaneously apply downward pressure to the top of the clear cover until it is seated on the body of the Fuel Pro and hand tighten the collar until it no longer spins freely. Torque the cover assembly by rotating the collar clockwise two additional ribs using the collar wrench (~18 ft-lbs).
7. Prime the unit by filling the clear cover with clean diesel fuel until it reaches the top of the filter.
8. Install the vent cap. Start the engine and run for one minute. **Slowly** open the vent cap and allow the fuel to drop to about one inch above the collar.
9. Close the vent cap. It is normal for the fuel level to vary after the initial start-up and during engine operation. Filter performance is not affected.



P/N 482017

Recommended Filter Guide

Brand	Part Number	Micron
DDC	A0000903651	7

Tightening the collar with the wrench:

Simultaneously apply downward pressure to the top of the clear cover until it is seated on the body of the Fuel Pro/Diesel Pro and hand tighten the collar until it no longer spins freely. Torque the cover assembly by rotating the collar clockwise two additional ribs using the collar wrench (~18 ft-lbs).

Note: The DAVCO Fuel Pro collar is designed to be removed with a DAVCO wrench. Collars damaged as a result of not using the DAVCO wrench will not be covered under warranty.

HAND TIGHTEN THE COLLAR AND VENT CAP.

OVERTIGHTENING CAN CREATE A TWISTED SEAL RESULTING IN AN AIR LEAK

DIAGNOSTICS

FREQUENTLY ASKED QUESTIONS

Q: What causes short filter life?

A: Incorrect or inferior quality fuel filter, contaminated or low quality ULSD (Ultra Low Sulfur Diesel) fuel, algae or microbiological growth or a large amount of water in the fuel.

(See Form F3507 Fuel Filter Performance)

Q: If the fuel filter media is black does the filter need to be replaced?

A: Filter media becoming Black is common with ULSD and biodiesel fuels. The black color is caused by contaminants, asphaltine formation or additives in the fuel and can shorten filter life. The advantage of seeing the fuel height in the clear cover of a DAVCO Fuel Pro eliminates unnecessary filter changes.

Only replace the filter when the fuel level is at the top of the filter regardless of the color of the media.

FREQUENTLY ASKED QUESTIONS

Q: Is there air above the fuel level in the clear cover?

A: No. The Fuel Pro is designed for the suction (vacuum) side of the fuel system. After the fuel system has been primed, and the engine run, the area above the fuel level in the clear cover is a vacuum not air.

Q: What causes the fuel system to lose prime over night (fuel level lowers in the Fuel Processor clear cover)?

A: There has to be a small air leak somewhere in the fuel system to lose prime. There is a fuel inlet check valve in the Fuel Processor to prevent losing the prime during filter changes and draining the water. If the fuel system isn't air tight the fuel can slowly drain down when the engine is not running. Ensure the inlet check valve is seated and inspect all fuel hoses and fittings for proper torque.

(See Form F3089 Test Procedures for Fuel Processors and F1318 Distinguishing Air from Vapor Bubbles)

FREQUENTLY ASKED QUESTIONS

Q: What if air bubbles are visible in the fuel inside the Fuel Processor clear cover?

A: Check all fuel hoses and fittings for proper torque. A simple procedure to determine if the air leak is between the fuel tank and the Fuel Pro is to remove the Fuel Pro inlet hose and route a new hose from the Fuel Pro Inlet into a container of fuel or the fuel tank fill cap opening. Start the engine. If bubbles are still present the air leak is in the Fuel Processor if not the air leak is between the fuel tank and the Fuel Processor inlet.

(See form F3089 Test Procedures for Fuel Processors)

Q: What if there are bubbles in a sight gauge at the lift pump inlet?

A: It's not uncommon to see vacuum bubbles at the lift pump inlet with electronic unit injectors or common rail engines. If there is no engine performance complaint, then it's most likely vapor bubbles created from the pressure differential in the fuel tank and primary filtration assembly (regardless of the fuel filter manufacturer) .

(See Form F1318 Distinguishing Air from Vapor Bubbles)

FREQUENTLY ASKED QUESTIONS

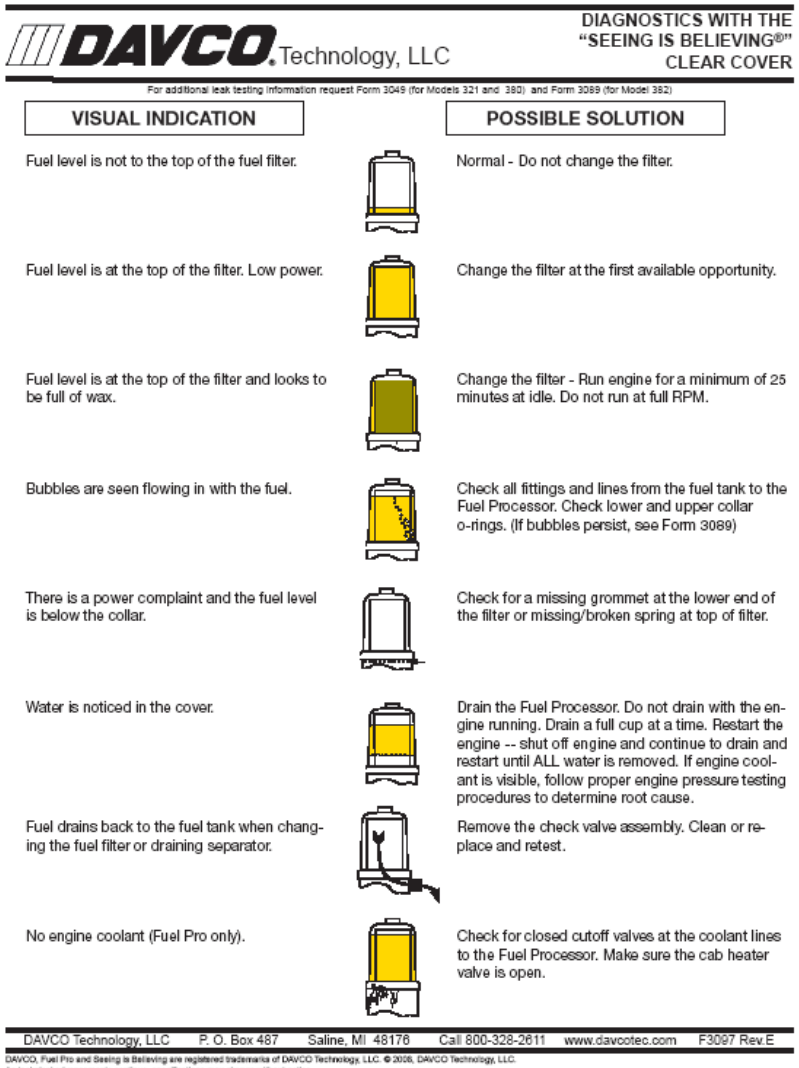
Q: Are DAVCO Fuel Processors compatible with B20 biodiesel?

A: Yes. In 2008 all DAVCO Fuel Processors were upgraded with state of the art seals to ensure compatibility with all B20 applications. In addition the Fuel Pro 384 model is available for biodiesel fuel greater than B20.

Q: When should the Fuel Processor assembly be replaced?

A: The only time a Fuel Processor assembly requires replacement is when the aluminum body is damaged.

CLEAR COVER DIAGNOSTICS



DAVCO Technology, LLC

DIAGNOSTICS WITH THE "SEEING IS BELIEVING®" CLEAR COVER

For additional leak testing information request Form 3049 (for Models 321 and 380) and Form 3089 (for Model 382)

VISUAL INDICATION	POSSIBLE SOLUTION
Fuel level is not to the top of the fuel filter.	Normal - Do not change the filter.
Fuel level is at the top of the filter. Low power.	Change the filter at the first available opportunity.
Fuel level is at the top of the filter and looks to be full of wax.	Change the filter - Run engine for a minimum of 25 minutes at idle. Do not run at full RPM.
Bubbles are seen flowing in with the fuel.	Check all fittings and lines from the fuel tank to the Fuel Processor. Check lower and upper collar o-rings. (If bubbles persist, see Form 3089)
There is a power complaint and the fuel level is below the collar.	Check for a missing grommet at the lower end of the filter or missing/broken spring at top of filter.
Water is noticed in the cover.	Drain the Fuel Processor. Do not drain with the engine running. Drain a full cup at a time. Restart the engine -- shut off engine and continue to drain and restart until ALL water is removed. If engine coolant is visible, follow proper engine pressure testing procedures to determine root cause.
Fuel drains back to the fuel tank when changing the fuel filter or draining separator.	Remove the check valve assembly. Clean or replace and retest.
No engine coolant (Fuel Pro only).	Check for closed cutoff valves at the coolant lines to the Fuel Processor. Make sure the cab heater valve is open.

DAVCO Technology, LLC P. O. Box 487 Saline, MI 48176 Call 800-328-2611 www.davcotec.com F3097 Rev.E

Use Form F3097 for Clear Cover Diagnostics

- Fuel level not to the top – Normal
- Fuel level at top, low power – Change Filter
- Bubbles – See Form 3089
- Fuel waxed to top of filter – change filter and idle
- Water visible in cover – drain water, if antifreeze pressure test engine
- Fuel drain back when changing filter or draining the water – inspect inlet check valve
- Low power and fuel below Fuel Pro collar – inspect filter grommet and spring
- No engine coolant flow to Fuel Pro fluid heater – open coolant flow valves

CHECK VALVE DIAGNOSTICS

CHECK VALVE DIAGNOSTICS

To test for proper check valve operation, remove the fuel inlet hose and open the vent cap. Fuel should not flow out of the Fuel Pro, although a slight seepage of fuel is normal. If fuel drains back to the fuel tank, remove the check valve assembly at the fuel inlet fitting.

Step 1: Use a back-up wrench to hold the check valve body and remove the fuel hose from the inlet of the Fuel Pro.

Step 2: Remove and disassemble the check valve assembly.

Step 3: Clean and inspect the check valve body. Replace the check valve body if any cuts, grooves or nicks are evident or if the ball seat is not smooth.

Step 4: Inspect the check valve spring and spring retainer. If the spring or spring retainer is broken or if the check ball has groves, nicks or is out of round, replace with a check valve service kit. Otherwise, clean and reassemble the check valve assembly.

Note: The spring retainer snaps into a groove in the check-valve body.

Step 5: Replace the check valve assembly into the body and torque to 44-60 ft-lb.

Step 6: . Connect the fuel inlet hose, using liquid or paste type thread sealant.

Step 7: Prime the fuel system, start the engine and check for any fuel leaks.

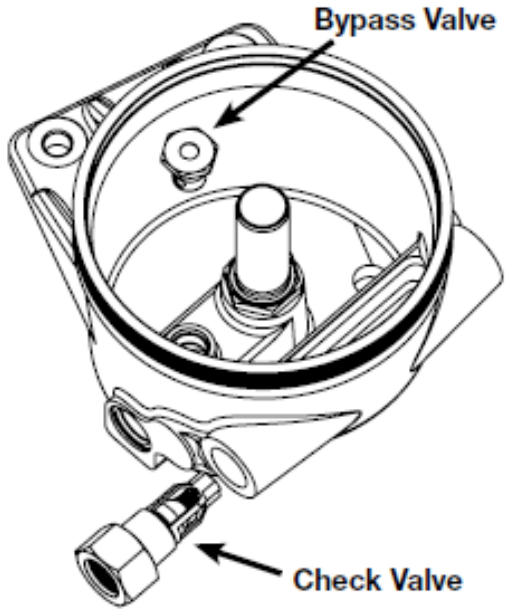
Check Valve Service Kits	
Check valve service kit: P/N 101132	
Check valve assembly: P/N 103071	

FUEL PRO® 482 BYPASS VALVE SERVICE PROCEDURES

SERVICE PROCEDURES

Bypass valve assembly

1. Remove the vent cap and open the drain valve, drain the Fuel Pro 482 completely.
2. Remove the collar (using a DAVCO wrench) then remove the clear cover.
3. Remove the filter, cover and vent cap seals. Dispose of properly.
4. Using a clean shop rag, clean the cover, the collar and the threads on the Fuel Pro 482 body.
5. Flush the inside of the Fuel Pro 482 body with clean diesel fuel to clear it of any debris.
6. Remove the bypass valve assembly and discard.
7. Remove the protective cap from the replacement bypass valve assembly.
8. Install the replacement bypass valve assembly into the Fuel Pro 482 body (torque to 20 ft-lbs).
9. Install a new filter, cover seal and vent cap seal.
10. Simultaneously apply downward pressure to the top of the clear cover until it is seated on the body of the Fuel Pro/Diesel Pro and hand tighten the collar until it no longer spins freely. Torque the cover assembly by rotating the collar clockwise two additional ribs using the collar wrench (~18 ft-lbs).
11. Prime the unit by filling the clear cover with clean diesel fuel until it reaches the top of the filter.
12. Install the vent cap.
13. Start the engine and run for one minute. Slowly open the vent cap and allow the fuel level to drop to about one inch above the collar.
14. Close the vent cap. **Hand tighten only.**



12VDC AND 120VAC PREHEATERS

DAVCO® Technology, LLC

ELECTRIC PRE-HEATER AND FLUID HEATER TEST PROCEDURES

There are various configurations of electric pre-heaters and thermoswitches available for the Fuel Pro/Diesel Pro. These include 12VDC pre-heaters, 24VDC pre-heaters, 120VAC pre-heaters/thermoswitches, and combination pre-heater thermoswitches. The voltage and wattage ratings are stamped either on the sheath or the hex of each component for identification.

Equipment Needed

- A precision low resistance ohm meter capable of measuring 1/10th ohm or less.
- Current flow meter (clamp-on type for DC current).
- Ice, dry-ice, CO_2 or some means of chilling the thermoswitch.
- A flameless source of heat. (ie: infrared heat lamp, etc.) Note: A Vortex tube is a good tool to heat and cool for testing.

⚠ DO NOT USE a test light that has a wire probe for any of these tests. If the wiring insulation is punctured, moisture and road salt can penetrate into the wires creating a corrosion issue and potential failure.

Draining the Fuel Pro

Step 1: Shut off the engine and set the parking brake.

Step 2: Attach a length of hose to the drain valve and place a receptacle under the Fuel Pro/Diesel Pro.

Step 3: Loosen the vent cap on top of the clear housing. Open the drain valve and drain the fuel into the receptacle.

Step 4: When the fuel is drained, close the drain valve.

Pre-heater Operation Test

Step 1: Disconnect the pre-heater from the harness.

Step 2: Connect the ohm meter leads to the pins of the pre-heater. For heaters with one pin, connect to the pin and the bushing.

Step 3: Use Table 1 to determine whether the pre-heater resistance value is in the acceptable range.

Electric Pre-heater	Watts	Resistance Range (ohms)
12VDC (two pin)	250 W	0.6 to 0.8
12VDC (single pin)	250 W	0.6 to 0.8
12VDC (single pin)	150 W	0.8 to 1.1
12VDC (two pin)	150 W	0.8 to 1.1
24VDC (two pin)	250 W	2 to 2.5
24VDC (single pin)	250 W	1.8 to 2.3
24VDC (single pin)	150 W	3.6 to 4.1
24VDC (two pin)	150 W	3.6 to 4.1
120VAC	75 W	173 to 203
120VAC	37 W	369 to 411

Table 1

12VDC Thermoswitch Performance Test

Step 1: Disconnect the harness from the thermoswitch.

Step 2: Connect the ohm meter leads to the pins of the thermoswitch.

Note: This test requires the thermoswitch temperature to be below 40°F. Use one of the cooling devices listed under "Equipment Needed" to obtain the required temperature. The resistance should be less than 0.01 ohm.

Step 3: Using one of the heating devices listed under "Equipment Needed" increase the temperature above 60°F. The resistance should be more than 10M ohms.

Combination Pre-heater Thermoswitch Performance Test

Step 1: Disconnect the harness from the heater/thermoswitch combination unit.

Step 2: Using one of the cooling methods listed under "Equipment Needed", reduce the temperature of the thermoswitch to below 40° F.

Step 3: Connect the ohm meter leads to the pre-heater pins. Use Table 1 to determine whether the pre-heater resistance value is in the acceptable range.

Step 4: Using one of the pre-heating devices listed under "Equipment Needed", raise the temperature of the combination pre-heater to 70°F. The ohm meter should read "open circuit" for the combination units.

Use Form 3134 Electrical and Fluid Heater Test Procedures

There are various configurations of electric preheaters. The voltage and wattage ratings are stamped either on the sheath or hex head of each preheater for identification.

Use form F3134 for the appropriate test specifications.

FUEL PRO 382® FLUID HEAT

DAVCO® Technology, LLC

ELECTRIC PRE-HEATER AND FLUID HEATER TEST PROCEDURES

Fluid Heater Thermovalve Test

Step 1: Drain the Fuel Pro completely.

Step 2: Remove the fluid hoses attached to the bottom plate. These will either be engine coolant hoses or return fuel hoses. Engine coolant hoses will have to be plugged when removing them from the Fuel Pro.

Step 3: Remove the bottom plate.

Step 4: While looking into the fluid port of the bottom plate (see Figure 1), run cold water over the thermovalve for 30 seconds, then run hot water over the thermovalve to determine whether the thermovalve spool is opening and closing.

Step 5: Replace the bottom plate seal and install the bottom plate onto the Fuel Pro.

Note: There are two styles of bottom plates.

- Torque the bolts of the bolt-on version bottom plate to 10 ft-lbs.
- Torque the collar of the collar version to 50 to 60 ft-lbs. Note: Applying 2-3 drops of thread sealant to secure the bottom collar is recommended.

Step 6: Reconnect the fluid hoses to the bottom of the Fuel Pro.

Step 7: Fill the Fuel Pro with fuel and restart the engine.

Step 8: Check for leaks.

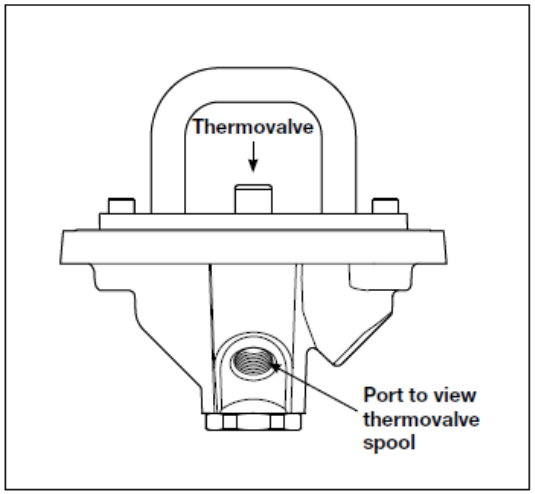


Figure 1

Use Form 3134 For Electrical and Fluid Heater Test Procedures

The Fuel Pro bottom plate has to be removed to test the fluid heat thermovalve. The thermovalve is spring loaded in the open position as a failsafe feature.

AIR IN THE FUEL SYSTEM

DAVCO® Technology, LLC

DISTINGUISHING AIR FROM VAPOR BUBBLES IN A DIESEL FUEL SYSTEM

There are two kinds of bubbles that may be visible at the fuel pump inlet of a diesel fuel system. The bubbles can be characterized as either air bubbles or vapor bubbles.

Air Bubbles

Air bubbles are caused by any air leak on the vacuum (suction) side of the fuel system from the fuel tank pick-up to, and including, the lift pump. (See Figure 1)

If there is an air leak in the fuel system, air bubbles will be present in the clear cover of the Fuel Processor. Follow test procedures outlined in Form 3089 for air leak diagnostics. If there are no bubbles present in the Fuel Processor cover and the engine continues to run rough, lopes or has a loss of power, there may be an air leak between the Fuel Processor outlet port and lift pump inlet. This type of air bubble can be seen if a sight tube is installed at the lift pump inlet. Air bubbles may also be visible in the fuel return (spill) hose out of the fuel gallery. These leaks are easily eliminated by checking and torquing the fuel fittings in the area of the leak.

NOTE 1: A quick procedure to determine if the air leak is between the fuel tank and the Fuel Pro is to remove the Fuel Pro inlet hose and route a new hose from the Fuel Pro inlet into a container of fuel or the fuel tank fill cap opening. Start the engine and check for bubbles.

If there are no air leak symptoms, but bubbles are present in a sight tube at the fuel lift pump inlet, they are most likely vapor bubbles.

Vapor Bubbles

All diesel fuel has some level of entrained air caused by the natural splashing that occurs in the fuel tank during normal vehicle or equipment operation. Vapor bubbles develop in the Fuel Processor because the pressure inside the Fuel Processor is lower than the atmospheric pressure in the fuel tank. Vapor bubbles can vary from champagne size up to ¼" in diameter. They may increase in size or volume as engine rpm increases. The lower pressure draws the entrained air/vapor out of the fuel and these bubbles will be visible as the fuel exits the Fuel Processor. (See Figure 2) As the fuel enters the lift pump, it is pressurized and the bubbles are compressed back into the fuel. There will be no bubbles on the fuel return side of the system. These vapor bubbles will not affect the performance of the engine.

NOTE 2: An easy way to determine the difference between vapor and air bubbles is by temporarily removing the filter element from the Fuel Pro. Fill the cover with clean diesel fuel, replace the vent cap and re-run the outlet fitting sight glass test. If there are no bubbles present in the sight glass then they were vapor. If bubbles are still present then they are air. If air bubbles still exist, re-run the test in **NOTE 1** to eliminate the chassis plumbing as a variable.

There is no troubleshooting or repair procedure required for vapor bubbles. Vapor bubbles do not cause performance issues and will not be present after the lift pump.

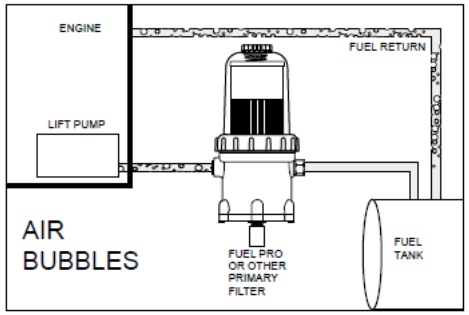


Figure 1

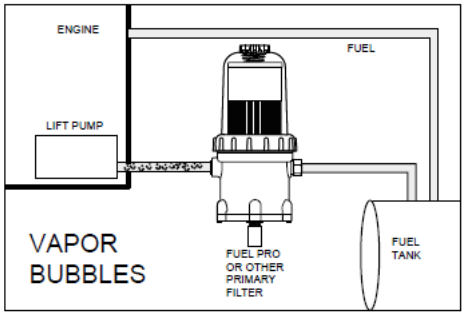


Figure 2

Use Form F1318 Distinguishing Air from Vapor Bubbles

Air bubbles visible in the clear cover are a result of an air leak in the fuel system and will affect engine performance.

Vapor bubbles are many times misdiagnosed as air in the fuel. Vapor bubbles are a result of the pressure differential in the fuel tank and filtration assembly and will NOT affect engine performance.

COLD WEATHER TIPS

DAVCO Technology, LLC

TIPS AND REMINDERS FOR COLD WEATHER OPERATION

DAVCO Fuel Processor

- As the ambient air temperature falls, the ability for water to condense in fuel tanks increases. The condensation can be carried into the DAVCO unit. As a result, it is recommended that water be drained from the DAVCO unit weekly. During periods of extreme cold it may be necessary to drain the unit even more frequently.
- The fuel filters are the only protection the engine has against contaminants in the fuel. Ensure the correct fuel filter is installed in the DAVCO unit. A larger micron fuel filter should never be used for the purpose of extending filter life or increasing flow. Such action may void the engine warranty and can be damaging to the fuel injection system. The EleMax® filter design with StrataPore™ media provides the best protection and is highly recommended.
- Refer to www.davco.com for fuel filter recommendations (Form 3105, "Recommended Filter Guide").
- Refer to www.davco.com for procedures relating to optional DAVCO electric pre heaters (Form 3134, "Electric and Fluid Heater Test Procedures").

Tanks and Lines

- Some vehicles or equipment come with drains in the fuel tank to allow for the draining of any collected water. If the fuel tank is equipped with a drain, use the drain to remove any collected water in the bottom of the tank. If there are no drain ports in the fuel tank, it will be necessary to remove any collected water by another means. A DAVCO Shop Pro™ FXP is the recommended shop tool for such a procedure.
- If a tank heater is used, test it per the manufacturer recommendation for proper operation.
- Ensure that no loops or water traps have developed in the plumbing from the fuel tank to engine. A loop or low spot in hoses can collect water and could freeze and restrict fuel flow.
- When possible, keep the fuel in the tanks above the half full level to minimize the potential for condensation formation.

Starting Recommendations

- A battery load test is recommended to ensure there is sufficient power for cold ambient starts.
- It is recommended to plug in block heaters while the engine is still warm as opposed to attempting to heat a cold engine with a block heater.
- If your DAVCO Fuel Processor has the optional 12VDC pre-heater, turn the ignition key to the "on" position. The DAVCO patented clear cover provides an easy visual to determine if the fuel is clouded. The fuel will be in a liquid form when it is heated above the cloud point with the optional pre-heater feature. (Note: Lab tests indicate 8-12 minutes of pre-heating can raise static fuel temperatures from –20°F up to 30°F.)

Use Form F3506 Tips for Cold Weather Operation

The initial onset of cold ambient conditions always generate calls to the DAVCO Customer Support Group. This document contains tips and reminders relative to cold weather operation. The basics, as you already know, are to keep water drained from the fuel tanks and the Fuel Processor, use the preheaters before starting the engine if the fuel is clouded, and ensure all valves are open for the engine coolant heat to the Fuel Processor.

TEST YOUR KNOWLEDGE

- Are DAVCO products designed to work with all diesel engine applications? Yes or No
- Are Fuel Processors designed for the pressure or vacuum side of the fuel system?
- How do you know when to change the filter element in the DAVCO Fuel Pro®?
- What is “Seeing is Believing”® technology?
- Does “Seeing is Believing” technology allow you to see:
  a. How much clean filter media is available
  b. Air Bubbles
  c. Clouded fuel
  d. All of the above

TEST YOUR KNOWLEDGE

- What is an Elemax® Filter?
- Efficient diagnostics always begin with the easiest item to check. After checking the proper torque of all fittings what would be the next simplest procedure if air bubbles are visible in the DAVCO clear cover?
- If a diesel engine is experiencing low power, how can the technician determine if fuel filter restriction is the root cause?
- Over tightening the clear cover collar can create an air leak? Yes or No
- How tight should the clear cover collar be when tightening it?

TEST YOUR KNOWLEDGE

- Is a damaged aluminum body the only reason to the replace the Fuel Processor Assembly? Yes or No

- Are vapor bubbles at the lift pump inlet common? Yes or No

- Are DAVCO Fuel Processors B20 compatible? Yes or No

- How much more filter media does the Fuel Pro 482 and 483 EleMax Filters have than the Fuel Pro 382 EleMax filter?

  2 - 2.5 - 3 - 3.5 times larger?

- What are the Shop Pro Functions?

  A - Sweep Fuel Tanks B – Transfer Diesel Fuel

  C - Prime Diesel Engines D – Filter the Fuel to 7 Microns

THANK YOU!

Please contact DAVCO Customer Support or a Regional Sales and Service Manager with any questions, suggestions, comments or request for assistance.

We appreciate the time you have invested to increase your knowledge of the DAVCO products.

Customer Service: 800-328-2611

Email: customerservice@davco.com