

# ***FUEL FILTRATION***



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**INDUSTRIES**

## Quality Policy

Continuous improvement in our business to ensure a quality product, shipped on time, without compromise.

## Limitations of Liability

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Failure, improper selection or improper use of the products and/or systems described herein or related items can cause death, personal injury and property damage.

This catalog and other documentation from Schroeder Industries provides product information for consideration by users possessing technical expertise.

It is important that the user analyze all aspects of the specific application and review the current product information in the current catalog. Due to the variety of operating conditions and applications for these products, the user is solely responsible for making the final product selection and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, design, availability and pricing are subject to change at any time without notice.



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# Introduction

Schroeder Industries, an ISO 9001:2008 certified company, focuses on developing filtration and fluid service products for our customers in the fluid power industry and is proud of our proven track record of providing quality products over the last sixty years. The designs you see in this catalog are the result of thousands of hours of field testing and laboratory research...and decades of experience. Schroeder pioneered the development of micronic filtration, helping to set performance standards in industrial fluid power systems. As a result, Schroeder is now a leader in filtration and fluid conditioning and the proof of our expertise lies in our broad mix of unsurpassed products. Our mission statement reflects our continuing commitment to excellence.

Partnerships - We design solutions for industry and for the success of our customers by:

- Optimizing the use of technology with applications
- Using an efficient, timely customization process to fill specific customer needs
- Increasing manufacturing capacity and streamlining operations
- Preserving our reputation for reliability
- Expanding globally to support our customers and stay current with technologies
- Leveraging and sharing our knowledge to meet challenges openly
- Nurturing a creative, cooperative culture committed to the individual and to providing the best solutions for our customers

Our goal is to be your filtration partner. Our expertise in filtration technology, our superior filter and element manufacturing capabilities, and our dedication to customer service and product support are the reasons we are considered "The Filter Company." We are committed to providing the best available filter products to meet necessary cleanliness levels at a competitive price. As a cost-effective quality producer, we can work with your purchasing department to supply contamination control technology or develop long-range pricing programs that can improve your company's bottom line.

## Product Distribution

Schroeder Industries has in place a strategically located domestic and international distribution network, supported by our professional and experienced sales and marketing team. Distributor personnel are trained in the important aspects of filter application by Schroeder in training sessions held at our factory and around the globe. The effectiveness of our product and service support is multiplied by utilizing Schroeder's extensive distributor network. All Schroeder Industries distributors meet very strict criteria to enhance our ability to serve the needs of our valued customers. Schroeder's distributor network includes over 100 distributor locations throughout Europe, the United Kingdom, South Africa, Australia, Asia, North America and South America, so that customers worldwide can rely on Schroeder's exceptional support.

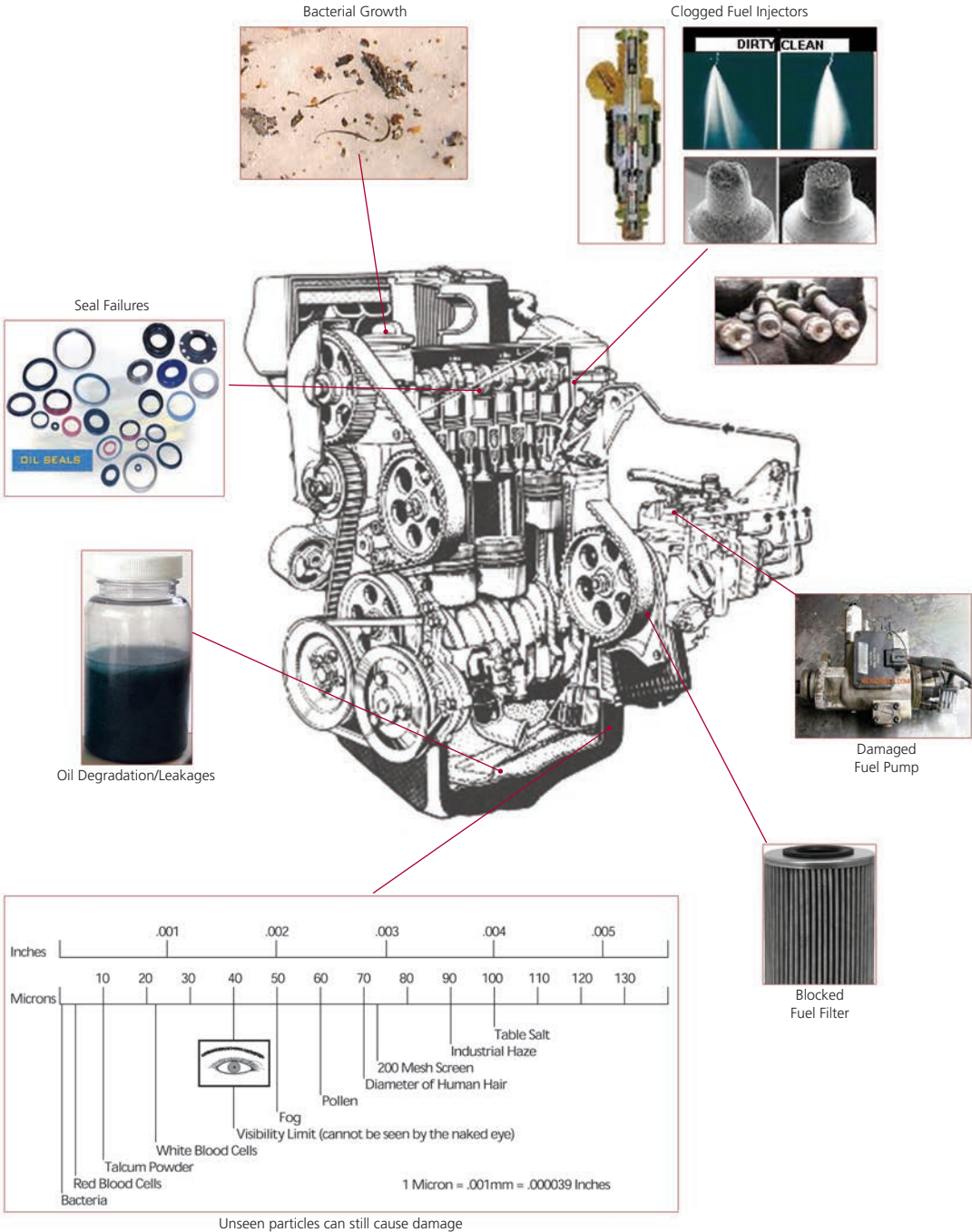
## Manufacturing and Testing

Schroeder Industries' corporate headquarters are located in Leetsdale, PA (USA) with an additional manufacturing facility in Cumberland, MD (USA). Filter housings and diagnostic and specialty products are manufactured at our Pittsburgh plant, while filter elements are manufactured in our Cumberland plant. Both facilities have the skilled workforce and the capacity to meet our customers' needs. Schroeder's research and development center as well as our contamination control laboratory are located at our corporate headquarters.

## An Open Invitation

We invite you to present us with any specific filtration challenge you may experience. Schroeder will design and make filters to meet your specific requirements. To find out more, and/or obtain a quote, call us to speak with a sales representative or technical specialist. They can help determine the optimal filtration strategy for a given system. While the quantity of any product to be manufactured to a customer's needs will determine the economic feasibility of a particular project, in many cases, we can offer modified products in relatively small quantities at competitive prices and short lead times.

# Diesel Engine Problems





# Advanced Diesel Filtration

## How Clean Is Your Fuel?

Because many people assume they're buying quality fuel that meets the required specifications, diesel fuel cleanliness is seldom questioned. But higher fuel system operating pressures, lower system tolerances, tighter filtration and the ultra-low sulfur requirements have pushed fuel cleanliness into the maintenance spotlight.

Engine manufacturers are realizing that diesel fuel cleanliness can have great impact on overall engine performance. In fact, many are now recommending that diesel fuel that does not meet an ISO Cleanliness Code of 18/16/13 should be filtered before introduction to the fuel system. Injector manufacturers are mandating an ISO cleanliness code of 13/9/6 with water content levels at less than 200 ppm.

Engine fuel systems made in the 1960's operated at around 5,800-7,250 psi (400 - 500bar), had tolerances of around 50µm (microns) and filtration systems with a micron rating of around 25µm. The fuel systems of the 1990's ran at pressures of around 18,800-21,700 psi (1300 - 1500bar), tolerances of 35µm and filtration micron ratings of 15µm. But today, operating pressures have increased to as much as 36,260 psi (2500bar) (will be at 3500 bar in the next two years), tolerances of 2µm and filtration micron ratings of only about 3µm. This means that with control valve operating clearances of only 1-3 µm, today's fuel injectors are a lot less tolerant to particulates than they once were - particulates that are now moving through the system at over four times the pressure.

Fuel system pumps and injectors are most susceptible to contamination from water, micro-organisms, wax, asphaltenes, dirt, sediment and rust. Water, usually due to condensation, not only contaminates the fuel, it also provides a breeding ground for micro-organisms that feed on the fuel's hydrocarbons. The formation of wax crystals is the result of exposure to low temperatures while asphaltenes are the result of exposure to high temperatures. Dirt, sediment and rust are typical of poor maintenance practices.

These particulates will quickly clog fuel filters, erode injectors and cause valves to stick and damage or clog injector spray nozzles causing irregular spray patterns that can lead to over-fueling, inefficient combustion and piston crown wear. Performing an ISO Particle Count along with Karl Fischer can extend fuel filter life and maximize injector performance by identifying both the size and concentration of contaminant particles and water content present.

## Tier IV Filtration

Diesel fuel cleanliness is now the standard for all engine technology, from passenger cars and pick-up trucks to off highway and highway commercial trucks. Clean diesel is a system of three key parts: cleaner diesel fuel, advanced engine technology and after treatment. Starting in 2011, this generation of clean diesel technology for off-road engines and equipment known as Tier 4 started making its way onto the construction and industrial job sites and farm fields around the world.

Tier 4 refers to a generation of federal air emissions standards established by the U.S. Environmental Protection Agency (EPA) that apply to diesel engines used in on- and off-road equipment. Essentially it requires manufacturers to reduce the levels of particulate matter and oxides of nitrogen (NOx) to a level that is 50-96 percent lower than existing generation of diesel engines. It is important to note that Tier 4 emissions requirements apply to new products only and do not apply retroactively to any existing machines or equipment. EPA and California have adopted the same standards, so there are no unique Tier 4 diesel emissions standards that apply in California.

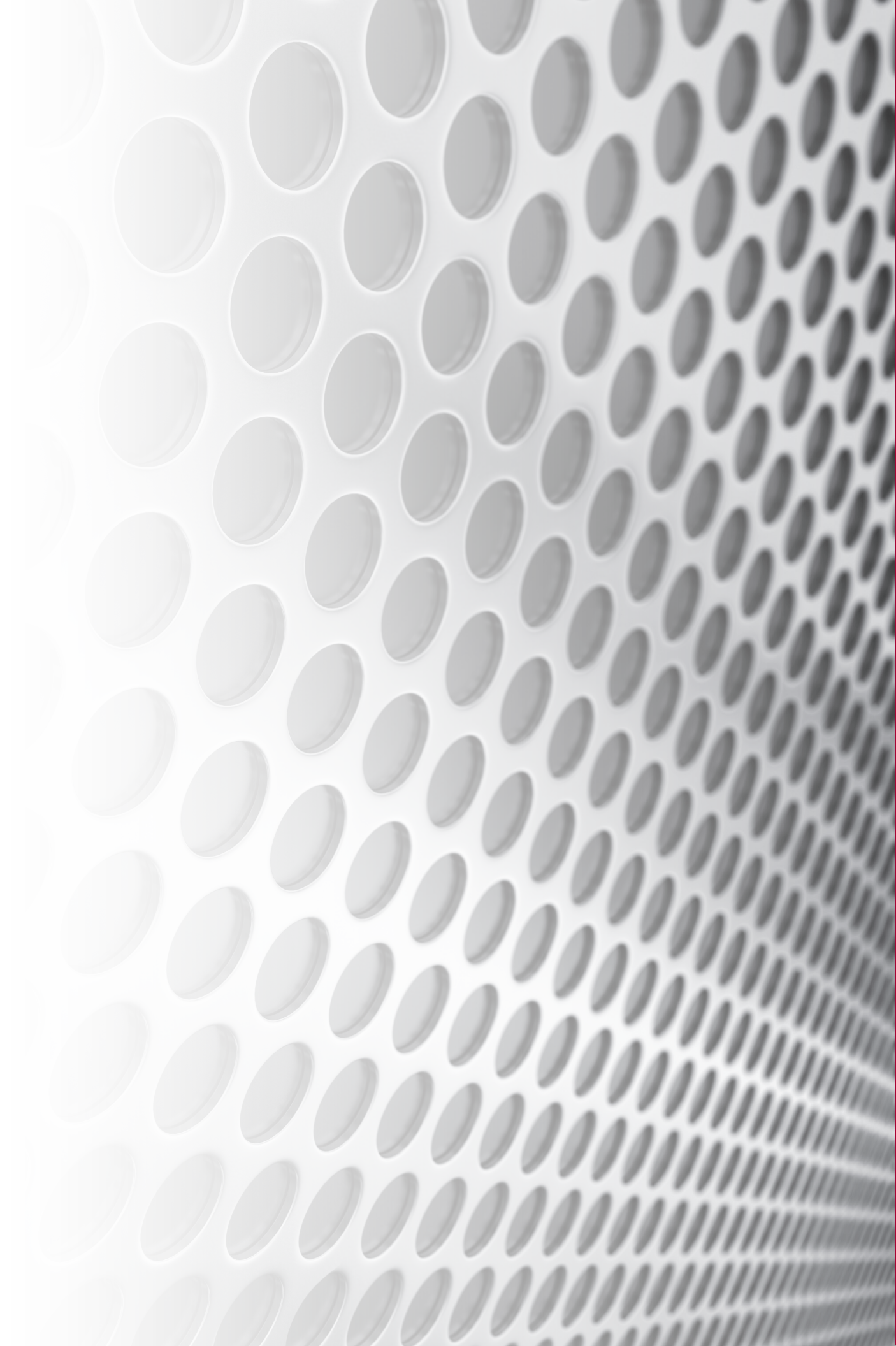
Through the Clean Air Act, EPA establishes national clean air standards that determine levels of allowable emissions (ozone, fine particles, etc.) in the air. From that, sources of these emissions (cars, trucks, tractors, power plants, other industry) are regulated by EPA and the California Air Resources Board to control the volume and types of emissions. Each state or regional area with levels of emissions that exceed the standards must develop a plan to improve air quality and meet the clean air requirements established by EPA. Introducing, cleaner diesel engines will aid in state and regional clean air compliance.

Tier 4 generation engines and equipment will require the use of ultra-low sulfur diesel fuel (ULSD) which has no more than 15 ppm sulfur. This fuel has been used since 2006 in on-highway vehicles. Older off-road machines and engines can continue to use the higher sulfur fuels which will be available in diminishing quantities nationwide until December 2011. Supplies of the old "higher sulfur" diesel fuel will be diminishing rapidly beyond 2010, but still may be available in some more remote locations and areas of the country. (For more information on clean diesel fuel requirements visit [www.clean-diesel.org](http://www.clean-diesel.org))

Globally the same standard and equipment are being used and requirements implemented. Check your countries regulations to define the time frame for requirements in your country.

Section 1:

# *BULK DIESEL FILTRATION*



# Bulk Diesel Filtration

## Prepare for, Tier IV Off-Highway Engines Requirements.

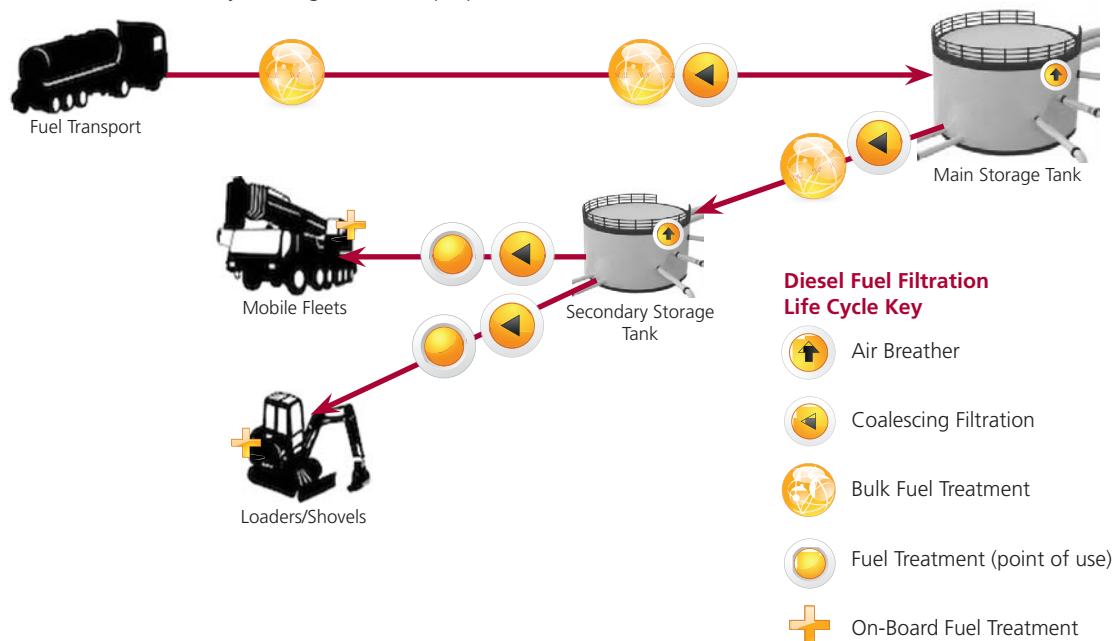
- Fuel injectors operate at high pressures to achieve emissions standards (36,000+ psi)
- Injector nozzles openings as small as 2 µm wide (40 µm is visibility limit with human eye)
- Requirements for diesel fuel based on ISO Code cleanliness levels (18/16/13 storage, 13/9/6 at the injector)
- Requirements for water removal from fuel (levels down to 200 ppm)
- Consult the Engine Manufacture for their requirements

**Schroeder's Bulk Diesel Filters and systems provide exceptional, 99.5% single-pass diesel purification to protect the latest in high pressure, common-rail, fuel injection systems that require fuel with particulate filtration down to 1 micron.**



## Why Now?

- 2004: U.S. Environmental Protection Agency announced rules to reduce emissions from on- and off-road diesel engines by more than 90% over 11 years (Tier III & IV)
- 2011: Ultra Low Sulfur Diesel (ULSD15) became standard for all diesel fuel in the US, Canada & Europe
- 2013-2014 & Beyond: Full Tier IV Engines are being shipped with fuel cleanliness requirements and enhanced water level removal needs
- Fuel that worked in Tier III Engines, doesn't meet the needs of the Tier IV Engines. Injector manufacturers advise: No warranty coverage due to improper fuel filtration



## Application Introduction: Better Bulk Fuel Filtration

Coalescing<sup>1</sup> filtration can be a highly effective method to remove water from diesel fuels. Water is typically introduced into the fuel supply by condensation. Water in a vehicle fuel system can reduce lubricity causing seizure of close tolerance parts and increased wear. Water in fuel storage tanks causes rust and promotes microbial growth. Microbial growth in fuel storage systems begins in free water at the tank bottom and can quickly migrate through the fuel. In warm weather, microbial "blooms" can quickly overwhelm and bypass fuel filters causing contamination to reach the fuel injectors. Today's high pressure 36,000+ psi (2,800bar) common-rail, Tier IV fuel injection systems have tighter tolerances and require water removal, less than 200 ppm to minimize wear related failures.

### NOTES:

1. Please refer to the Glossary for further information.



# In-Line Bulk Fuel Coalescing Filter

**ICF**



Model no. of filter in photograph is: ICFCSV516

## Features and Benefits

- Fuel and water separation media technology in a three-phase element construction for high efficiency, single-pass removal of free and emulsified water in Ultra-low Sulfur Diesel (ULSD) and blends
- Prior generation coalescing products no longer provide high-efficiency separation in ULSD and Biofuels
- Can be upstream (suction side) or downstream (pressure side) of transfer pumps
- Helps protect expensive, vital engine components against failures caused by water transferred from the bulk fuel tanks to the vehicle
- Separates emulsified and free water from diesel fuel
- Contamination control for the fuel system
- For use in single-pass fuel dispensing or multi-pass reservoir clean-up and continuous maintenance



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BULK FUEL FILTRATION

**16 gpm**  
**60 L/min**

ICF

BDF

**100 psi**  
**7 bar**

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

## Applications

EWU

BCC

## Filter Housing Specifications

Flow Rating: Up to 16 gpm (60 L/min) for ULSD15

Inlet/Outlet Connection: SAE 16

Max. Operating Pressure: 100 psi (7 bar)

Min. Yield Pressure: 400 psi (28 bar)

Rated Fatigue Pressure: 90 psi (6 bar), per NFPA T2.6.1-2005

Temp. Range: -20°F to 165°F (-29°C to 74°C) standard  
32°F to 165°F (0°C to 74°C) with included, optional sight gauge

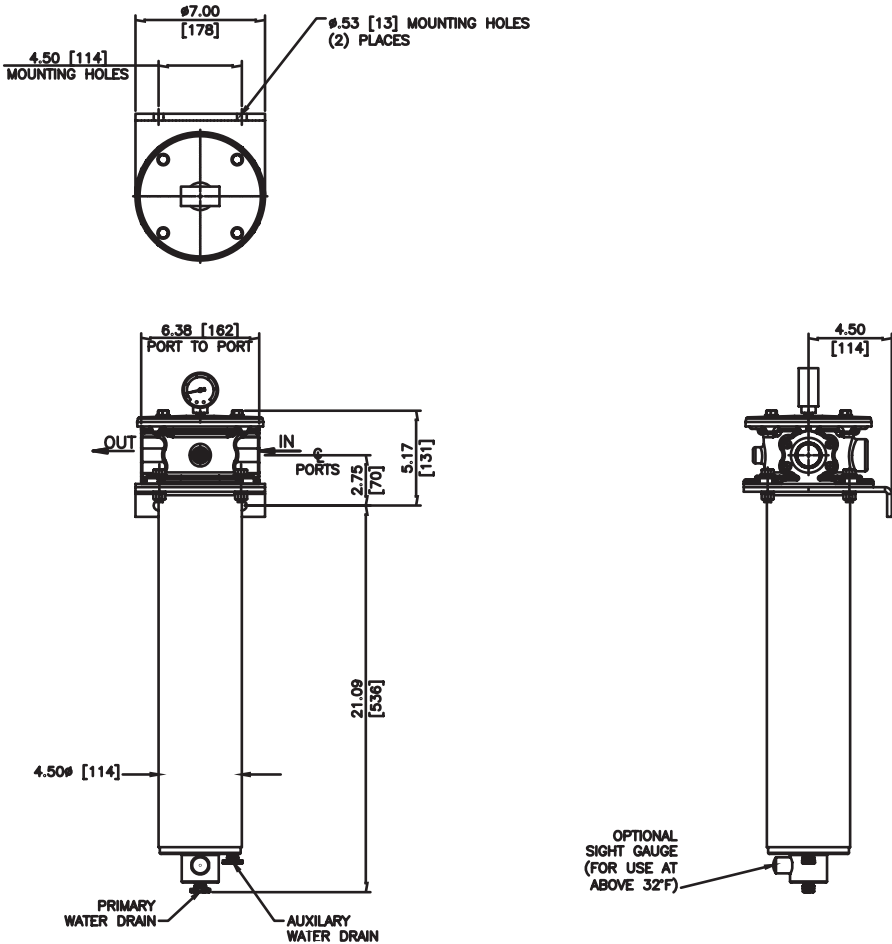
Bypass Setting: Cracking: 15 psi (1 bar)

Porting Head/Cap: Anodized Aluminum

Element Case: Nickel Coated Steel

Weight: 19 lbs (8.6 kg)

Element Change Clearance: 20" (508 mm)



Metric dimensions in ( ).

Element Water Coalescing Performance Information

	Max Flow	Single Pass Efficiency*	Max Flow	Single Pass Efficiency*
C184Z5V	16 GPM	> 99.5%*	Contact Factory	> 99.5%*

Flow Direction: Inside Out

Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

\*Note:

Based on ULSD15 with 27 Byne/cm surface tension and 0.25% (2500 PPM) water injection. Discharge water concentration of <100 PPM free and emulsified water.

# In-Line Bulk Fuel Coalescing Filter

ICF

## Fuel Oils

- ULSD15, low sulfur diesel and high sulfur diesel
- Biodiesel blends
- Synthetic diesel and blends
- No. 2 fuel oil and heating oil

## Fluid Compatibility

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

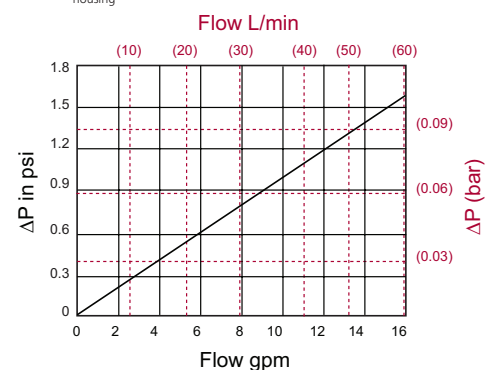
BCC

## Pressure Drop Information

Based on Flow Rate and Viscosity

$\Delta P_{\text{housing}}$

ICF  $\Delta P_{\text{housing}}$  for fluids with sp gr = 0.86



sp gr = specific gravity

$\Delta P_{\text{element}}$

$\Delta P_{\text{element}} = \text{flow} \times \text{element } \Delta P \text{ factor} \times \text{viscosity factor}$

El.  $\Delta P$  factors @ 37 SUS (3 cSt).

C184Z5V = 0.46

If working in units of bars & L/min, divide above factor by 54.9.

Viscosity factor: Divide viscosity by 37 SUS (3 cSt).

## Notes

$$\Delta P_{\text{filter}} = \Delta P_{\text{housing}} + \Delta P_{\text{element}}$$

**Exercise:** Determine  $\Delta P$  at 16 gpm (60 L/min) for ICF5VS16PG

**Solution:**

$$\Delta P_{\text{housing}} = 1.2 \text{ psi} = [0.08 \text{ bar}]$$

$$\Delta P_{\text{element}} = 16 \times 0.46 = 7.3 \text{ psi}$$

$$\Delta P_{\text{total}} = 1.2 + 7.3 = 8.5 \text{ psi}$$



# In-Line Bulk Fuel Coalescing Filter

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder ICF:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
ICF						

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	
ICF	C	5	V	S16	PG		= ICFC5VS16PG

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Element Series	Element Particulate Media Type	House Sealing Material
ICF	C = C184Z5V	5 = 5 µm Coalescing Element	V = Viton®
BOX 5	BOX 6	BOX 7	
Porting	Dirt Alarm®	Additional Options	
S16 = SAE 16	Omit = None PG = Pressure Gauge	Omit = None	

\*Note: Included, optional sight gauge (for use only >32 deg. F)

#### NOTES:

Box 4. Viton® is a registered trademark of DuPont Dow Elastomers.

Box 7. For automatic drain option, contact factory





Model no. of filter in photograph is: BDF1KKZ3VEH



Model no. of filter in photograph is: BDF2KKZ3VEH

## Features and Benefits

- Routine element change is only needed on KL3 particulate filter which saves time and money
- Particulate filtration at 1 or 3 microns utilizing Excellement® synthetic Z-Media® element for contamination control
- Fully synthetic, patent-pending coalescing (fuel/water separation) media requires minimal change outs
- Coalescing filter delivers 99.5% single pass free and emulsified water removal efficiency achieve outlet water concentrations below 100 ppm
- Optional electrical Dirt Alarm® with integrated, amber colored, particulate element change indicator light
- Optional, integrated thermostat controlled 120V, 45W water sump heater in coalescing housing

## Application Introduction:

The Reason for Better Bulk Fuel Filtration

The BDF1 and BDF2 provide exceptional single-pass diesel filtration and continuous water removal. Both filters combine Schroeder's fully synthetic Excellement® Z-Media® in a particulate pre-filter, the KL3, with our patent-pending coalescing water removal filter, the ICF, to fully protect vital diesel engines from dirt and water. The BDF1 and BDF2 are ideal for fuel dispensing operations. The filters can be installed on the inlet or outlet of a diesel fueling dispenser. The BDF1 is also perfect for generator sets in a single-pass or kidney loop installation.



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FILTRATION

## Applications

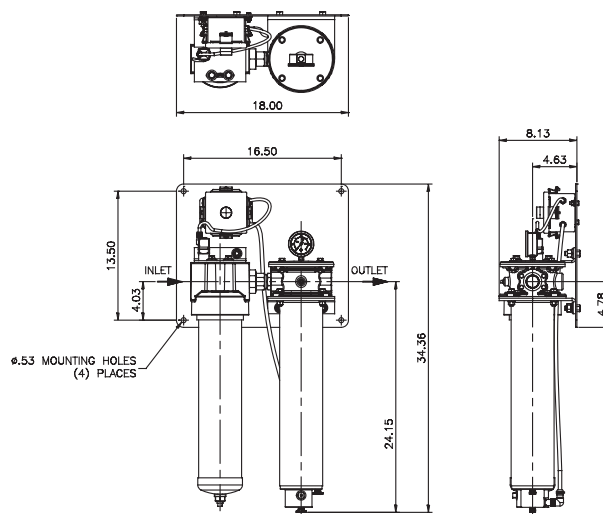
## Filter Housing Specifications

Flow Rating:	BDF1: up to 16 gpm (60 L/min) BDF2: up to 32 gpm (120 L/min)
Inlet/Outlet Connection:	1" NPT female thread
Max. Operating Pressure:	100 psi (7 bar)
Temp. Range:	32°F to 165°F (0°C to 74°C) with sight gauge, -20°F to 165°F (-29°C to 74°C) w/ optional water sump heater
Bypass Setting:	<div> <u>Particulate Filter</u> 30 psi (2 bar) </div> <div> <u>Coalescing Filter</u> 15 psi (1 bar) </div>
Materials of Construction:	<div> <u>Particulate Filter</u> Porting Head/Cap: Cast Aluminum Element Case: Steel </div> <div> <u>Coalescing Filter</u> Porting Head/Cap: Anodized Aluminum Element Case: Nickel Coated Steel </div>
Weight:	BDF1: 45 lbs. (20.4 kg)      BDF2: 90 lbs. (40.8 kg)
Element Change Clearance:	20" (508 mm)
Optional Water Sump Heater:	120VAC, 1 x 45W (BDF1) / 2 x 45W (BDF2)
Optional Electrical Indicator:	120VAC

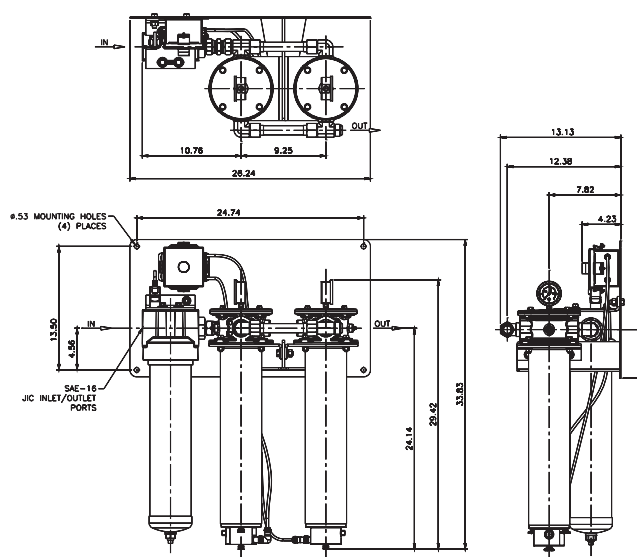
16-32 gpm ICF  
**60-120 L/min** BDF  
 100 psi  
**7 bar**

BDF  
 BDFA  
 QCF  
 BDS  
 BDCF  
 BDC  
 HDP-BC  
 HDP-HT  
 EPM  
 EPTT  
 EWU  
 BCC

## BDF1



## BDF2



Metric dimensions in ( ).

Element  
Particulate  
Performance  
Information

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x (c) \geq 200$	$\beta_x (c) \geq 1000$
KKZ1V	<1.0	<1.0	<1.0	<4.0	4.2
KKZ3V	<1.0	<1.0	<2.0	<4.0	4.8

Element Water  
Coalescing  
Performance  
Information

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency*	Max Flow	Single Pass Efficiency*
C184Z5V	16 GPM	> 99.5%*	Contact Factory	> 99.5%*

## Particulate Element

Flow Direction: Outside In

Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

## Coalescing Element

Flow Direction: Inside Out

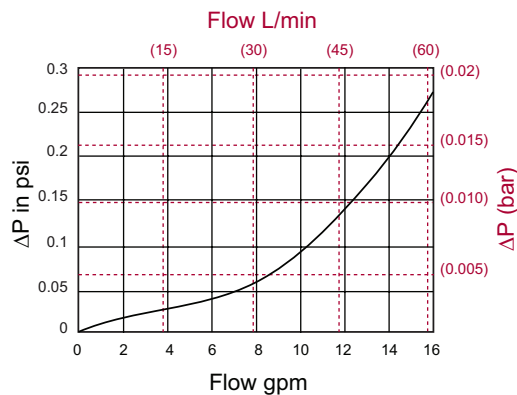
Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

## Fuel Oils

- ULSD15, low sulfur diesel and high sulfur diesel
- Biodiesel blends
- Synthetic diesel and blends
- No. 2 fuel oil and heating oil

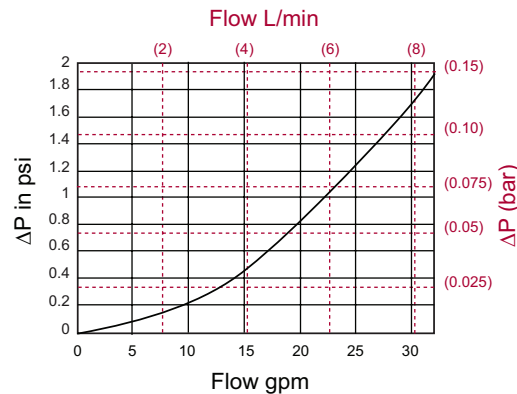
$$\Delta P_{\text{housing}} + \Delta P_{\text{QF5}}$$

BDF1  $\Delta P_{\text{housing}}$  for fluids with sp gr= 0.86



$$\Delta P_{\text{housing}} + \Delta P_{\text{QF5}}$$

BDF2  $\Delta P_{\text{housing}}$  for fluids with sp gr= 0.86



sp gr = specific gravity

## Notes

$$\Delta P_{\text{element}}$$

$\Delta P_{\text{element}} = \text{flow} \times \text{element } \Delta P \text{ factor} \times \text{viscosity factor}$

El.  $\Delta P$  factors @ 37 SUS (3 cSt).

C184Z5V = 0.46

KKZ1 = 0.02

KKZ3 = 0.01

If working in units of bars & L/min, divide above factor by 54.9.

Viscosity factor: Divide viscosity by 37 SUS (3 cSt).

$$\Delta P_{\text{filter}} = \Delta P_{\text{housing}} + \Delta P_{\text{element}}$$

**Exercise:** Determine  $\Delta P$  at 12 gpm (45 L/min) for BDF1KKZ1VVM

### Solution:

$$\Delta P_{\text{housing}} = .15 \text{ psi} = [0.01 \text{ bar}]$$

$$\Delta P_{\text{element (C184Z5V)}} = 12 \times .46 = 5.5 \text{ psi}$$

$$\Delta P_{\text{element (KKZ1)}} = 12 \times 0.02 = .24 \text{ psi}$$

$$\Delta P_{\text{total}} = .15 + 5.5 + .24 = 5.9 \text{ psi}$$

$$\Delta P_{\text{filter}} = \Delta P_{\text{housing}} + \Delta P_{\text{element}}$$

**Exercise:** Determine  $\Delta P$  at 30 gpm (114 L/min) for BDF2KKZ3VVM

### Solution:

$$\Delta P_{\text{housing}} = 1.8 \text{ psi} = [0.12 \text{ bar}]$$

$$\Delta P_{\text{element (C184Z5V)}} = 30 \times .46 = 13.8 \text{ psi}$$

$$\Delta P_{\text{element (KKZ3)}} = 30 \times 0.01 = 0.3 \text{ psi}$$

$$\Delta P_{\text{element (KKZ3)}} = 30 \times 0.01 = 0.3 \text{ psi}$$

$$\Delta P_{\text{total}} = 1.8 + 13.8 + 0.3 + 0.3 = 16.2 \text{ psi}$$

## Fluid Compatibility

ICF

BDF

BDFA

QCF

BDS

BDCF

## Pressure Drop Information

Based on Flow Rate and Viscosity

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

BCC

### \*Note:

Based on ULSD15 with 27 Byne/cm surface tension and 0.25% (2500 PPM) water injection. Discharge water concentration of <100 PPM free and emulsified water.

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder BDF:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDF					

**Example:** NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDF	1	KKZ1	V	VM	

= BDF1KKZ1VVM

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Flow rate & number of Coalescing Housings	Particulate Filter Micron Rating	Housing Seal Material
BDF	1 = 16 gpm 2 = 32 gpm	KKZ1 = 1 µm KKZ3 = 3 µm	V = Viton®

BOX 5	BOX 6
Dirt Alarm®	Options
VM = Visual pop-up w/ Manual Reset E = MS5 Electrical Indicator with Amber Light in NEMA4X box	H = Water sump heater Omit = None

*\*Note: Included, optional sight gauge (for use only >32°F)*

#### NOTES:

Box 5. If MS5 electrical indicator is selected, heater must be selected as well.



# In-Line Water Absorbing Diesel Fuel Filter

## BDFA



Model no. of filter in photograph is:  
BDFA1KKZXXVVM

### Features and Benefits

- Two stage filtration for dirt and water removal
- Particulate filtration at 1 or 3 microns utilizing Excellement® synthetic Z-Media® element
- Water removal element capable of removing free and emulsified water
- Highly efficient absorption of free water with the aid of a 'super absorber' embedded in the filter material



Model no. of filter in photograph is:  
BDFA2KKZXXVVM

### Application Introduction:

The Reason for Better Bulk Fuel Filtration

The BDFA1 and BDFA2 provide exceptional single-pass diesel filtration and continuous water removal. Both filters combine Schroeder's fully synthetic Excellement® Z-Media® in a particulate pre-filter, the KL3, with our fast-acting Water absorbing filter, IRF, to fully protect vital diesel engines from dirt and water. The BDFA1 and BDFA2 are ideal for fuel dispensing operations. The filters can be installed on the inlet or outlet of a diesel fueling dispenser. The BDFA1 is also perfect for generator sets in a single-pass or kidney loop installation.



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VEHICLES



MARINE



MINING  
TECHNOLOGY



AGRICULTURE



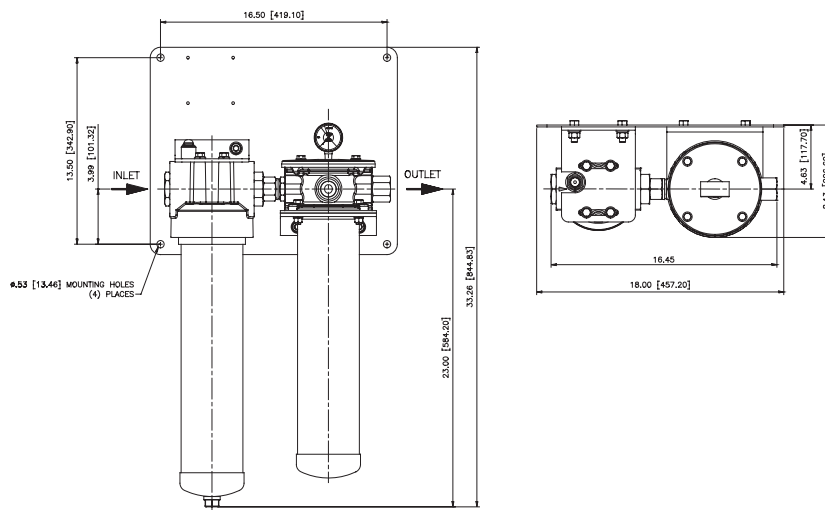
BULK FUEL  
FILTRATION

### Applications

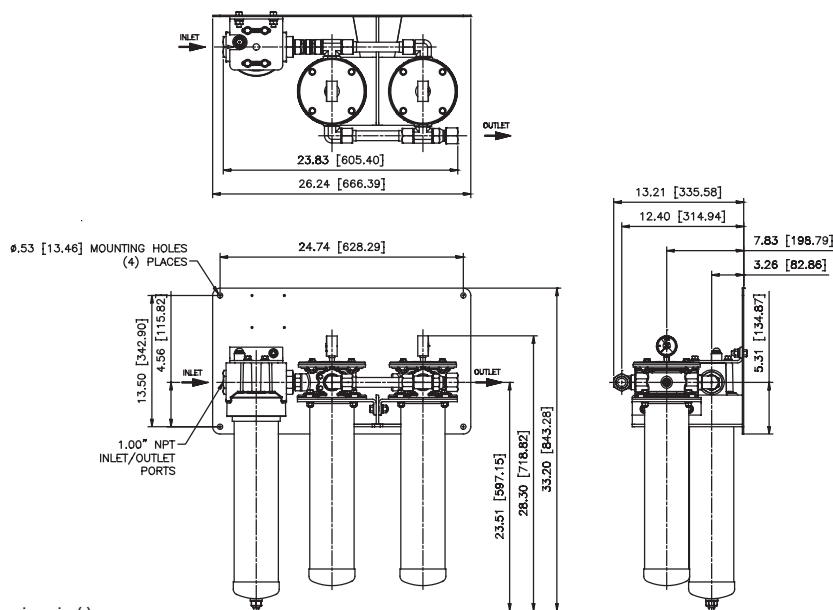
Flow Rating:	BDFA1: up to 16 gpm (60 L/min) BDFA2: up to 32 gpm (120 L/min)	
Inlet/Outlet Connection:	1" NPT female thread	
Max. Operating Pressure:	100 psi (7 bar)	
Temp. Range:	-20°F to 165°F (-29°C to 74°C)	
Bypass Setting:	<u>Particulate Filter</u> 30 psi (2 bar)	<u>Water Absorbing Filter</u> 25 psi (1.7 bar)
Materials of Construction:	<u>Particulate Filter</u> Porting Head/Cap: Cast Aluminum Element Case: Steel	<u>Water Absorbing Filter</u> Porting Head/Cap: Anodized Aluminum Element Case: Steel
Weight:	BDFA1: 45 lbs. (20.4 kg)	BDFA2: 90 lbs. (40.8 kg)
Element Change Clearance:	20" (508 mm)	

### Filter Housing Specifications

## BDFA1



## BDFA2



Metric dimensions in ( ).

### Element Particulate Performance Information

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x (c) \geq 200$	$\beta_x (c) \geq 1000$
KKZ1V	<1.0	<1.0	<1.0	<4.0	4.2
KKZ3V	<1.0	<1.0	<2.0	<4.0	4.8

### Element Water Absorbing Performance Information

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402	Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171
	Flow Rate gpm (L/min)	Water Holding Capacity ml (ounces)
KKZWV	16 (60)	400 (14)

#### Particulate Element

Flow Direction: Outside In  
Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

#### Water Absorbing Element

Flow Direction: Outside In  
Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

# In-Line Water Absorbing Diesel Fuel Filter

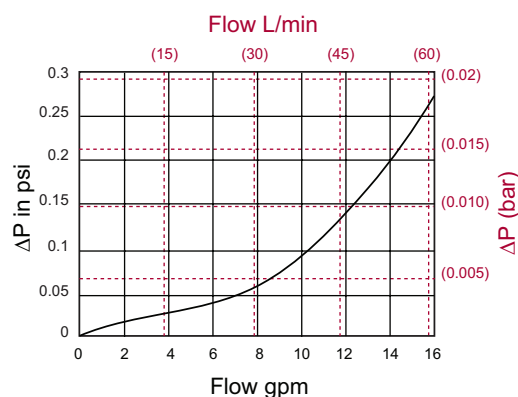
**BDFA**

## Fuel Oils

- ULSD15, low sulfur diesel and high sulfur diesel
- Biodiesel blends
- Synthetic diesel and blends
- No. 2 fuel oil and heating oil

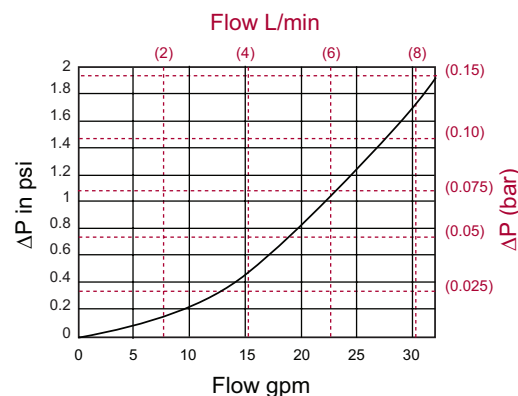
$$\Delta P_{\text{housing}} + \Delta P_{\text{QF5}}$$

BDFA1  $\Delta P_{\text{housing}}$  for fluids with sp gr= 0.86



$$\Delta P_{\text{housing}} + \Delta P_{\text{QF5}}$$

BDFA2  $\Delta P_{\text{housing}}$  for fluids with sp gr= 0.86



sp gr = specific gravity

## Notes


$$\Delta P_{\text{element}}$$

$$\Delta P_{\text{element}} = \text{flow} \times \text{element } \Delta P \text{ factor} \times \text{viscosity factor}$$

El.  $\Delta P$  factors @ 37 SUS (3 cSt).

$$\text{KKW} = 0.02$$

$$\text{KKZ1} = 0.02$$

$$\text{KKZ3} = 0.01$$

If working in units of bars & L/min, divide above factor by 54.9.

Viscosity factor: Divide viscosity by 37 SUS (3 cSt).

$$\Delta P_{\text{filter}} = \Delta P_{\text{housing}} + \Delta P_{\text{element}}$$

**Exercise:** Determine  $\Delta P$  at 12 gpm (45 L/min) for BDFA1KKZ1VVM

## Solution:

$$\Delta P_{\text{housing}} = .15 \text{ psi} = [0.01 \text{ bar}]$$

$$\Delta P_{\text{element (KKW)}} = 12 \times 0.02 = 0.24 \text{ psi}$$

$$\Delta P_{\text{element (KKZ1)}} = 12 \times 0.02 = 0.24 \text{ psi}$$

$$\Delta P_{\text{total}} = 0.15 + 0.24 + 0.24 = 0.6 \text{ psi}$$

$$\Delta P_{\text{filter}} = \Delta P_{\text{housing}} + \Delta P_{\text{element}}$$

**Exercise:** Determine  $\Delta P$  at 30 gpm (114 L/min) for BDFA2KKZ3VVM

## Solution:

$$\Delta P_{\text{housing}} = 1.8 \text{ psi} = [0.12 \text{ bar}]$$

$$\Delta P_{\text{element (KKW)}} = 30 \times 0.02 = 0.6 \text{ psi}$$

$$\Delta P_{\text{element (KKZ3)}} = 30 \times 0.01 = 0.3 \text{ psi}$$

$$\Delta P_{\text{element (KKZ3)}} = 30 \times .01 = 0.3 \text{ psi}$$

$$\Delta P_{\text{total}} = 1.8 + 0.6 + 0.3 + 0.3 = 3 \text{ psi}$$

Fluid  
Compatibility

ICF

BDF

**BDFA**

QCF

BDS

BDCF

Pressure  
Drop  
Information  
Based on  
Flow Rate  
and Viscosity

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

BCC

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder BDFA:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDFA					

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDFA	1	KKZ1	KKW	V	VM

= BDFA1KKZ1KKWVVM

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Flow rate & number of Water Absorbing Housings	Particulate Filter Micron Rating	Water Absorbing Filter
BDFA	1 = 16 gpm 2 = 32 gpm	KKZ1 = 1 µm KKZ3 = 3 µm	KKW = Standard Element KKZW5 = 5 µm Synthetic Element

BOX 5	BOX 6
Housing Seal Material	Dirt Alarm®
V = Viton®	VM = Visual pop-up w/ Manual Reset (particulate); Visual tricolor gauge (water absorbing)



# Bulk Diesel Fuel Coalescing Filter

**QCF**



Model no. of filter in photograph is: QCF5VS24VM

## Features and Benefits

- Fuel and water separation media technology in a three-phase element construction for high efficiency, single-pass removal of free-water in
- Ultra-low Sulfur Diesel (ULSD) and Biodiesel fuels
- Prior generation coalescing products no longer provide high-efficiency separation in ULSD and Biofuels
- Can be upstream (suction side) or downstream (pressure side) of transfer pumps
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Can separate emulsified or finely dispersed water from fuel
- Contamination control for the fuel system
- For use in single-pass fuel dispensing or multi-pass reservoir clean-up and continuous maintenance

## Application Introduction:

The Reason for Better Bulk Fuel Filtration

Advances in diesel engine fuel injection systems have been instrumental in complying with future emission standards. Higher pressure fuel produces a finer mist of fuel, which burns cleaner. Common rail injection systems run at higher pressures and allow more injections per combustion cycle improving fuel economy, better engine performance and lower noise. Higher pressure fuel injector systems have tighter tolerances and require complete the highest efficiency, single-pass removal to minimize wear related failures.



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MINING TECHNOLOGY



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BULK FUEL FILTRATION

**70 gpm**  
**265 L/min**

ICF

BDF

**100 psi**  
**7 bar**

BDFA

Standard

**QCF**

**45 psi**  
**3 bar**

BDS

BDCF

Sight Gauge Option

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

BCC

## Applications

## Filter Housing Specifications

Flow Rating: Up to 70 gpm (265 L/min) for ULSD15

Inlet/Outlet Connection: SAE 24

Drain Connection Upper: 1/4" NPT Ball Valve

Drain Connection Lower: 1/4" NPT Ball Valve

Max. Operating Pressure: 100 psi (7 bar); 45 psi (3 bar) with water sight gauge

Min. Yield Pressure: 400 psi (27.6 bar) without sight gauge  
Contact factory for use with sight gauge

Rated Fatigue Pressure: Contact Factory

Temperature range: -20°F to 165°F (-29°C to 74°C) Standard  
32°F to 165°F (0°C to 74°C) with included, optional sight gauge

Bypass Setting: Cracking: 30 psi (2 bar)

Porting Base: Anodized Aluminum

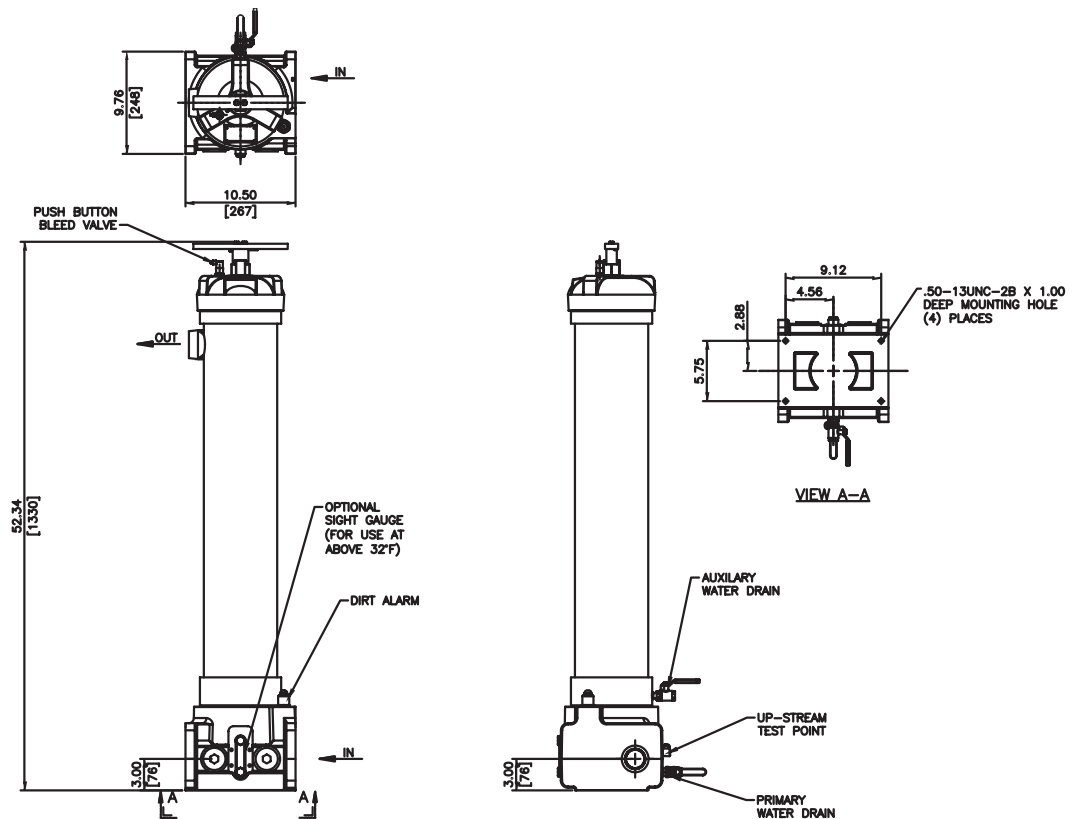
Element Case: Nickel Coated Steel

Cap: Nickel Coated Ductile Iron

Weight: 155 Lbs. (77 kg)

Element Change Clearance: 33.8" (858 mm)

# QCF Bulk Diesel Fuel Coalescing Filter



Metric dimensions in ( ).

## Element Water Coalescing Performance Information

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency*	Max Flow	Single Pass Efficiency*
C396Z5V	70 GPM	> 99.5% *	Contact Factory	> 99.5% *

Flow Direction: Inside Out

Element Nominal Dimensions: 6.4" (163 mm) O.D. x 39.4" (1001 mm) long

### Note:

Based on  
ULSD15 with  
27 Byne/CM  
surface tension  
and 0.25% (2500  
PPM) water  
injection

# Bulk Diesel Fuel Coalescing Filter



## Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel blends
- Synthetic diesel and blends

## Fluid Compatibility

ICF

BDF

BDFA

**QCF**

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

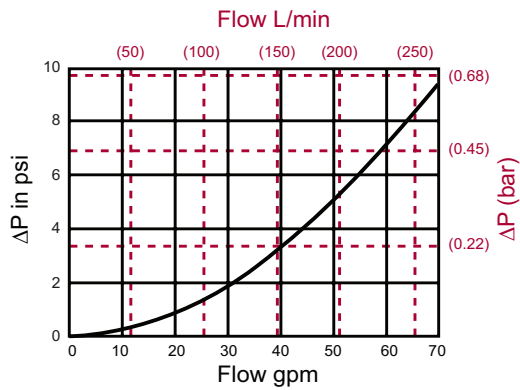
EWU

BCC

## Pressure Drop Information Based on Flow Rate and Viscosity

$\Delta P_{\text{housing}}$

QCF  $\Delta P_{\text{housing}}$  for fluids with sp gr = 0.86



sp gr = specific gravity

$\Delta P_{\text{element}}$

$\Delta P_{\text{element}} = \text{flow} \times \text{element } \Delta P \text{ factor} \times \text{viscosity factor}$

El.  $\Delta P$  factors @ 37 SUS (3 cSt).

C396Z5V = .17

If working in units of bars & L/min, divide above factor by 54.9.

Viscosity factor: Divide viscosity by 37 SUS (3 cSt).

$$\Delta P_{\text{filter}} = \Delta P_{\text{housing}} + \Delta P_{\text{element}}$$

**Exercise:** Determine  $\Delta P$  at 70 gpm (265 L/min) for QCFC5V24VM

**Solution:**

$$\Delta P_{\text{housing}} = 2.5 \text{ psi} = [0.17 \text{ bar}]$$

$$\Delta P_{\text{element}} = 70 \times 0.17 = 11.9 \text{ psi}$$

$$\Delta P_{\text{total}} = 2.5 + 11.9 = 14.4 \text{ psi}$$

## Notes

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder QCF:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
QCF						

**Example:** NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
QCF	C	5	V	S24	VM	

= QCFC5VS24VM

BOX 1	BOX 2	BOX 3	BOX 4
<b>Filter Series</b>	<b>Element Series</b>	<b>Element Particulate Media Type</b>	<b>House Sealing Material</b>
QCF	C = C396Z5V	5 = 5 µm SYN/Coalescing	V = Viton®

BOX 5	BOX 6	BOX 7
<b>Porting</b>	<b>Element Series</b>	<b>Additional Options</b>
S24 = SAE 24	VM = Visual Pop-Up w/ Manual Reset	Omit = None (standard)

*\*Note: Included, optional sight gauge (for use only >32 deg. F)*

#### NOTES:

Box 4. Viton® is a registered trademark of DuPont Dow Elastomers.

Box 7. For automatic drain option, contact factory





Model no. of filter in photograph is: BDS39QPMLZ3VVM

## Features and Benefits

- Fuel and water separation media technology in a three-phase element construction for high efficiency, single-pass removal of free-water in Ultra-low Sulfur Diesel (ULSD) and blends
- Prior generation coalescing products no longer provide high-efficiency separation in ULSD and Biofuel blends
- For use in single-pass fuel dispensing or multi-pass reservoir clean-up and continuous maintenance
- Can be upstream (suction side) or downstream (pressure side) of transfer pumps
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Manual water drains and up and downstream test points



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BULK FUEL FILTRATION

70 gpm  
**265 L/min**

100 psi  
**7 bar**

Standard

45 psi  
**3 bar**

Sight Gauge Option

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

## Applications

EWU

BCC

## Filter Housing Specifications

Flow Rating: Up to 70 gpm (265 L/min) for ULSD15

Inlet/Outlet Connection: SAE 24

Drain Connection Upper: 1/4" NPT Ball Valve

Drain Connection Lower: 1/4" NPT Ball Valve

Max. Operating Pressure: 100 psi (7 bar); 45 psi (3 bar) with water sight gauge

Min. Yield Pressure: 400 PSI (27.6 bar) without sight gauge  
Contact factory for use with sight gauge

Rated Fatigue Pressure: Contact Factory

Temperature range: -20°F to 165°F (-29°C to 74°C) Standard  
32°F to 165°F (0°C to 74°C) with included, optional sight gauge

Bypass Setting: Particulate: 20 psi (1.37 bar)  
Coalescing: 30 psi (2 bar)

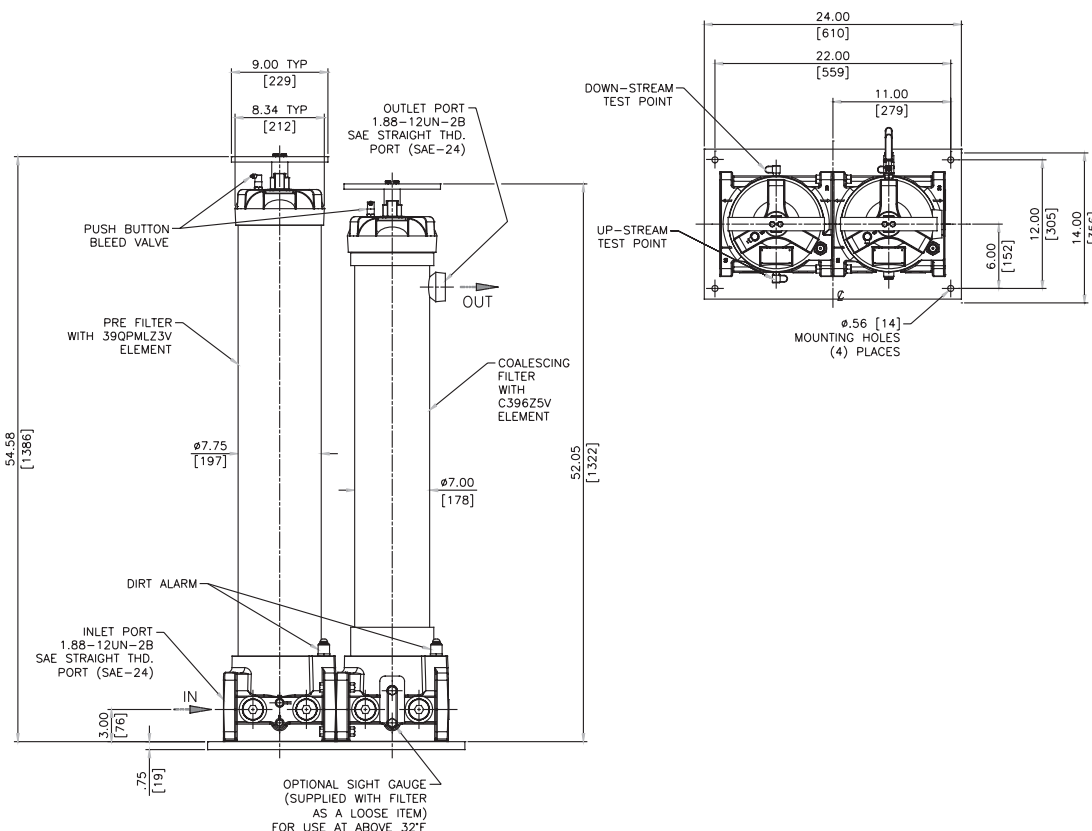
Porting Base: Anodized Aluminum

Element Case: Plated Steel

Cap: Plated Steel

Weight: 441 Lbs. (200 kg)

Element Change Clearance: 33.8" (858 mm)



Metric dimensions in ( ).

## Element Particulate Performance Information

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x (c) \geq 200$	$\beta_x (c) \geq 1000$
39QPMLZ3V	<1.0	<1.0	<2.0	<4.0	4.8

## Element Water Coalescing Performance Information

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency*	Max Flow	Single Pass Efficiency*
C396Z5V	70 GPM	> 99.5%*	Contact Factory	> 99.5%*

### Particulate Element

Flow Direction: Outside In  
Element Nominal Dimensions: 6.0" (150 mm) O.D. x 37.80" (960 mm) long

### Coalescing Element

Flow Direction: Inside Out  
Element Nominal Dimensions: 6.4" (163 mm) O.D. x 39.4" (1001 mm) long

### Note:

Based on ULSD15  
with 27 Byres/  
CM surface  
tension and 0.25%  
(2500 PPM) water  
injection

## Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel blends
- Synthetic diesel and blends

## Fluid Compatibility

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

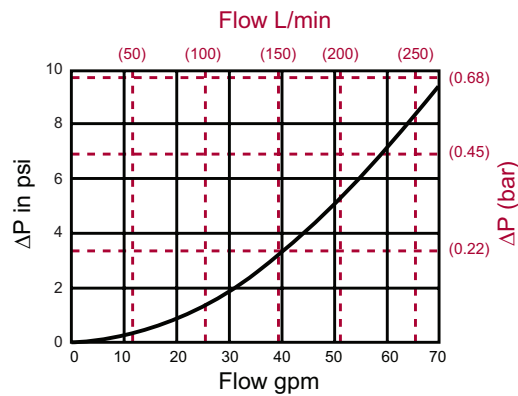
EPTT

EWU

BCC

Pressure Drop Information  
Based on Flow Rate and Viscosity

$$\Delta P_{\text{housing}} + \Delta P_{\text{QF5}}$$

BDS  $\Delta P_{\text{housing}}$  for fluids with sp gr = 0.86

sp gr = specific gravity

$$\Delta P_{\text{element}}$$

$$\Delta P_{\text{element}} = \text{flow} \times \text{element } \Delta P \text{ factor} \times \text{viscosity factor}$$

El.  $\Delta P$  factors @ 37 SUS (3 cSt).

$$\text{C396Z5V} = .17$$

$$\text{39QPMLZ1} = .01$$

$$\text{39QPMLZ3} = .01$$

If working in units of bars &amp; L/min, divide above factor by 54.9.

Viscosity factor: Divide viscosity by 37 SUS (3 cSt).

## Notes

$$\Delta P_{\text{filter}} = \Delta P_{\text{housing}} + \Delta P_{\text{element}}$$

**Exercise:** Determine  $\Delta P$  at 70 gpm (265 L/min) for BDS39QPMLZ3VVM**Solution:**

$$\Delta P_{\text{housing}} = 3.0 \text{ psi} = [0.21 \text{ bar}]$$

$$\Delta P_{\text{element (C396)}} = 70 \times 0.17 = 11.9 \text{ psi}$$

$$\Delta P_{\text{element (39QPML)}} = 70 \times 0.01 = 0.7 \text{ psi}$$

$$\Delta P_{\text{total}} = 3.0 + 11.9 + 0.7 = 15.6 \text{ psi}$$

Filter  
Model  
Number  
Selection

How to Build a Valid Model Number for a Schroeder BDS:

BOX 1	BOX 2	BOX 3	BOX 4
BDS			

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	
BDS	39QPMLZ3	V	VM	= BDS39QPMLZ3VVM

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Particulate Filter Micron Rating	Housing Seal Material	Dirt Alarm®
BDS	39QPMLZ1 = 1µm 39QPMLZ3 = 3µm	V = Viton®	VM = Visual Pop-Up w/ Manual Reset

\*Note: Included, optional sight gauge (for use only >32 deg. F)

Note:  
Box 4: Viton® is a registered trademark of DuPont Dow Elastomers

# Bulk Diesel Fuel Filter Cart

**BDFC**



Model no. of filter in photograph is: BDFCKKZXVVMX

## Features and Benefits

- Routine element change only needed on KL3 particulate filter, saving time and money
- Fully synthetic, patent-pending coalescing (fuel/water separation) media requires minimal change outs
- 10' Hoses with 3' wand ends
- At just 22" wide, cart will fit through standard doorways
- Pump motor is 115VAC with resettable overload and 7' power cord
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Great for kidney loop clean-up of contaminated reservoirs and single pass transfer
- Coalescing filter delivers 99.5% single pass, free and emulsified water removal efficiency to achieve outlet water concentrations below 100 ppm

## Application Introduction:

The Reason for Better Bulk Fuel Filtration

The BDFC provides exceptional single-pass diesel filtration and continuous water removal. Both filters combine Schroeder's fully synthetic Excellement® Z-Media® in a particulate pre-filter, the KL3, with our patent-pending coalescing water removal filter, the ICF, to fully protect vital diesel engines from dirt and water. The BDFC is ideal for kidney loop or fuel maintenance operations.

**14 gpm** ICF  
**53 L/min** BDF

B DFA

QCF

BDS

**BDFC**

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

BCC



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MARINE



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BULK FUEL  
FILTRATION



POWER  
GENERATION

## Applications

## Filter Housing Specifications

Flow Rating: Up to 14 gpm (53 L/min) for ULSD15 & biodiesel blends

Fluid Temperature Range: -20°F to 165°F (-29°C to 74°C) Standard  
32°F to 165°F (0°C to 74°C) with included, optional sight gauge

Ambient Environment Temperature Range: -20°F to 104°F (-29°C to 40°C)  
32°F to 165°F (0°C to 74°C) with included, optional sight gauge

Bypass Setting: Particulate: 30 psi (2 bar)  
Coalescing: 15 psi (1 bar)

Materials of Construction: Particulate Filter

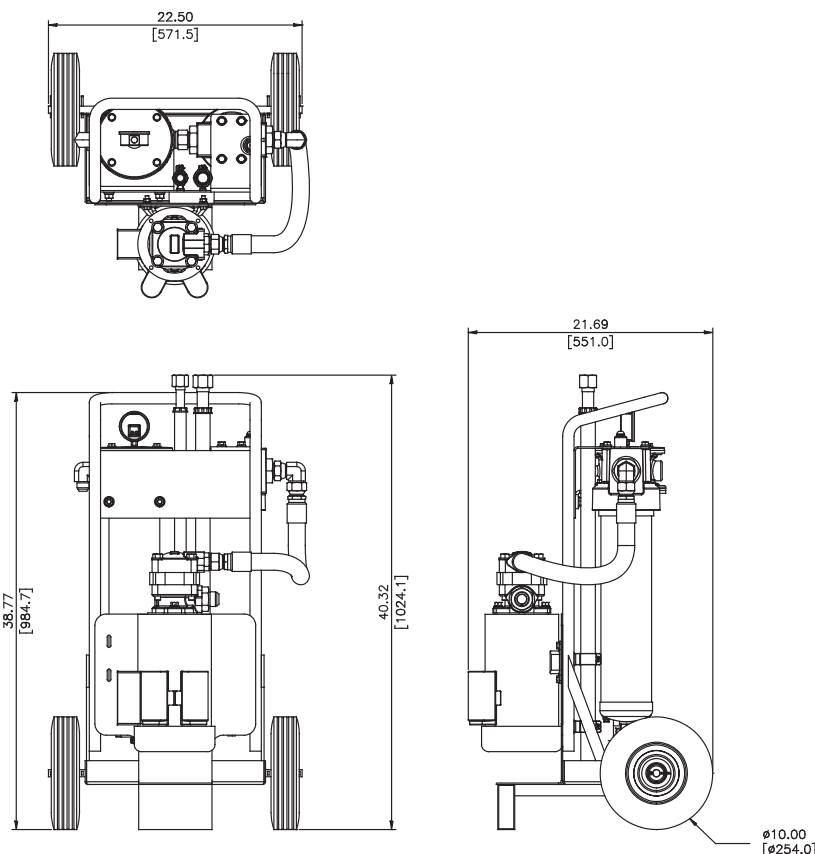
Porting Head/Cap: Cast Aluminum  
Element Case: Steel

Coalescing Filter

Porting Head/Cap: Anodized Aluminum  
Element Case: Nickel Coated Steel

Weight: 131 lbs. (59.4 kg)

Element Change Clearance: 20" (508 mm)



Metric dimensions in ( ).

## Element Particulate Performance Information

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x (c) \geq 200$	$\beta_x (c) \geq 1000$
KKZ1V	<1.0	<1.0	<1.0	<4.0	4.2
KKZ3V	<1.0	<1.0	<2.0	<4.0	<4.8

## Element Water Coalescing Performance Information

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency*	Max Flow	Single Pass Efficiency*
C184Z5V	16 GPM	> 99.5%*	Contact Factory	> 99.5%*

### Particulate Element

Flow Direction: Outside In  
Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

### Coalescing Element

Flow Direction: Inside Out  
Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

### Note:

Based on ULSD15  
with 27 Byenes/  
CM surface  
tension and 0.25%  
(2500 PPM) water  
injection

Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel blends
- Synthetic diesel and blends
- No. 2 fuel oil and heating oil

Fluid Compatibility	ICF
	BDF
	BDFA
	QCF
	BDS
	BDFC
	BDC
	HDP-BC
	HDP-HT
	EPM
	EPTT
	EWU
	BCC

Notes



## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder BDFC:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
BDFC				

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
BDFC	KKZ3	V	VM	S

= BDFCKKZ3VVMS

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Particulate Filter Micron Rating	Housing Seal Material	Dirt Alarm®
BDFC	KKZ1 = 1 µm KKZ3 = 3 µm	V = Viton®	VM = Visual pop-up w/ Manual Reset

BOX 5
Options
S = Magnetic Suction Strainer Omit = None

\*Note: Included, optional sight gauge (for use only > 32°F)

\*Note: For 50hrz applications, contact factory

#### NOTES:

Box 3. Viton® is a registered trademark of DuPont Dow Elastomers.

# Bulk Diesel Fuel Filter Cart

**BDC**



Model no. of filter in photograph is: BDC39QPMLZ1VAVM

## Features and Benefits

- Fuel and water separation media technology in a three-phase element construction for high efficiency, single-pass removal of emulsified and free-water in Ultra-low Sulfur Diesel (ULSD) and blends
- Prior generation coalescing products no longer provide high-efficiency separation in ULSD and Biofuels
- 10' Hoses with 3' wand ends
- Bag element pre-filter down to 5 micron, for gross removal of microbial bloom contamination and rust
- Pump motor is 115VAC with re-settable overload and 7' power cord
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Great for kidney loop clean-up of contaminated reservoirs and single pass transfer
- Manual water drains and up and downstream test points



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BULK FUEL FILTRATION

**25 gpm** ICF  
**95 L/min** BDF

B DFA

QCF

BDS

B DCF

**BDC**

HDP-BC

HDP-HT

EPM

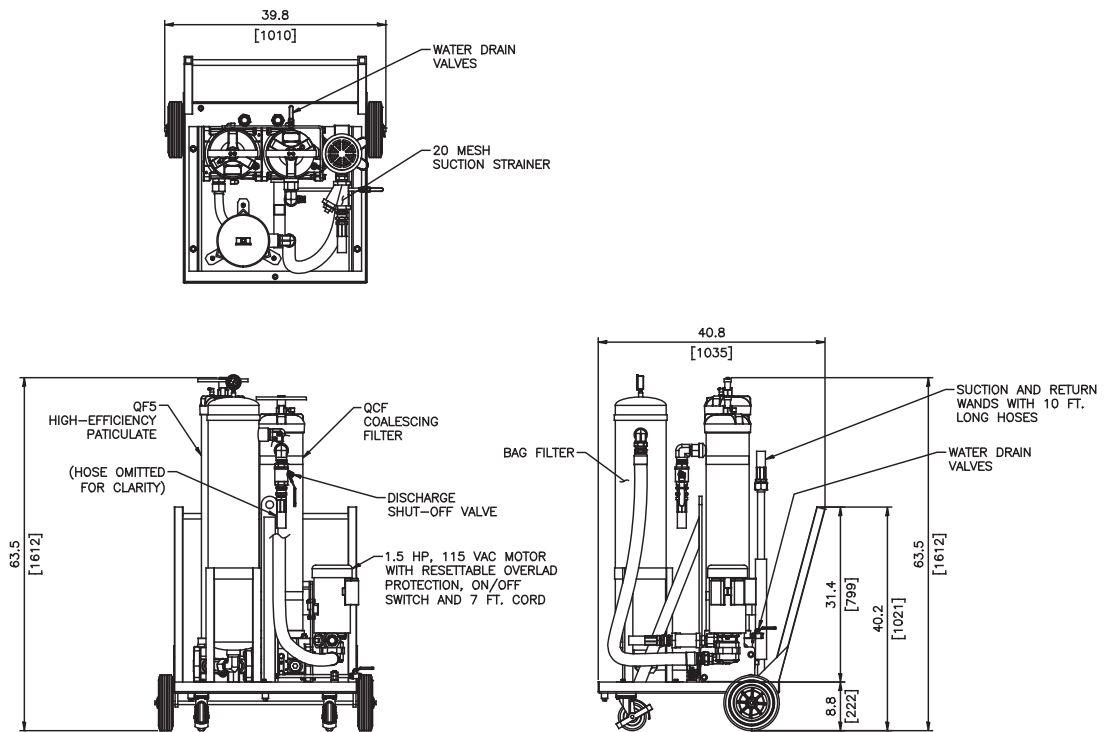
EPTT

EWU

**Applications** BCC

## Filter Housing Specifications

Flow Rating:	Up to 25 gpm (95 L/min) for ULSD15 & biodiesel blends
Fluid Temperature Range:	-20°F to 165°F (-29°C to 74°C) Standard 32°F to 165°F (0°C to 74°C) with included, optional sight gauge
Ambient Environment Temperature Range:	-20°F to 104°F (-29°C to 40°C) 32°F to 165°F (0°C to 74°C) with included, optional sight gauge
Bypass Setting:	Particulate: 20 psi (1.37 bar) Coalescing: 30 psi (2 bar)
Porting Base:	Anodized Aluminum
Element Case:	Plated Steel
Cap:	Plated Steel
Weight:	785 lbs. (356 kg)
Element Change Clearance:	33.8" (858 mm)



Metric dimensions in ( ).

## Element Particulate Performance Information

Element	Filtration Ratio Per ISO 4572/NFPA T3.10.8.8 Using automated particle counter (APC) calibrated per ISO 4402			Filtration Ratio wrt ISO 16889 Using APC calibrated per ISO 11171	
	$\beta_x \geq 75$	$\beta_x \geq 100$	$\beta_x \geq 200$	$\beta_x (c) \geq 200$	$\beta_x (c) \geq 1000$
39QPMLZ3V	<1.0	<1.0	<2.0	<4.0	4.8

## Element Water Coalescing Performance Information

Element	Pressure Side Coalescing		Suction Side Coalescing	
	Max Flow	Single Pass Efficiency*	Max Flow	Single Pass Efficiency*
C396Z5V	35 GPM	> 99.5%*	Contact Factory	> 99.5%*

### Coalescing Element

Flow Direction: Inside Out  
Element Nominal Dimensions: 6.4" (163 mm) O.D. x 39.4" (1001 mm) long

### Particulate Element

Flow Direction: Outside In  
Element Nominal Dimensions: 6.0" (150 mm) O.D. x 37.8" (960 mm) long

### Note:

Based on ULSD15 with 27 Byenes/CM surface tension and 0.25% (2500 PPM) water injection

Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel blends
- Synthetic diesel and blends

Part Number	Description	Micron Rating	Elements Per Case
C396Z5V	Coalescing Element	5 µm	1
39QPMLZ1V	Particulate Element	1 µm	1
39QPMLZ3V	Particulate Element	3 µm	1
PEF5P2PW	Bag Element	5 µm	50
PEF25P2PW	Bag Element	25 µm	50
PEF50P2PW	Bag Element	50 µm	50
PEF100P2PW	Bag Element	100 µm	50

Fluid Compatibility

ICF  
BDF  
BDFA  
QCF  
BDS

Replacement Elements

BDCF  
BDC  
HDP-BC  
HDP-HT  
EPM  
EPTT  
EWU  
BCC

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder BDC:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
BDC				

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
BDC	39QPMLZ3	V	A	VM

= BDC39QPMLZ3VAVM

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Particulate Filter Micron Rating	Housing Seal Material	Bag Element Micron Rating
BDC	39QPMLZ1 = 1 µm 39QPMLZ3 = 3 µm	V = Viton®	A = 5 µm B = 25 µm C = 50 µm D = 100 µm

BOX 5
Dirt Alarm®
VM = Visual pop-up w/ Manual Reset

\*Note: Included, optional sight gauge (for use only > 32°F)

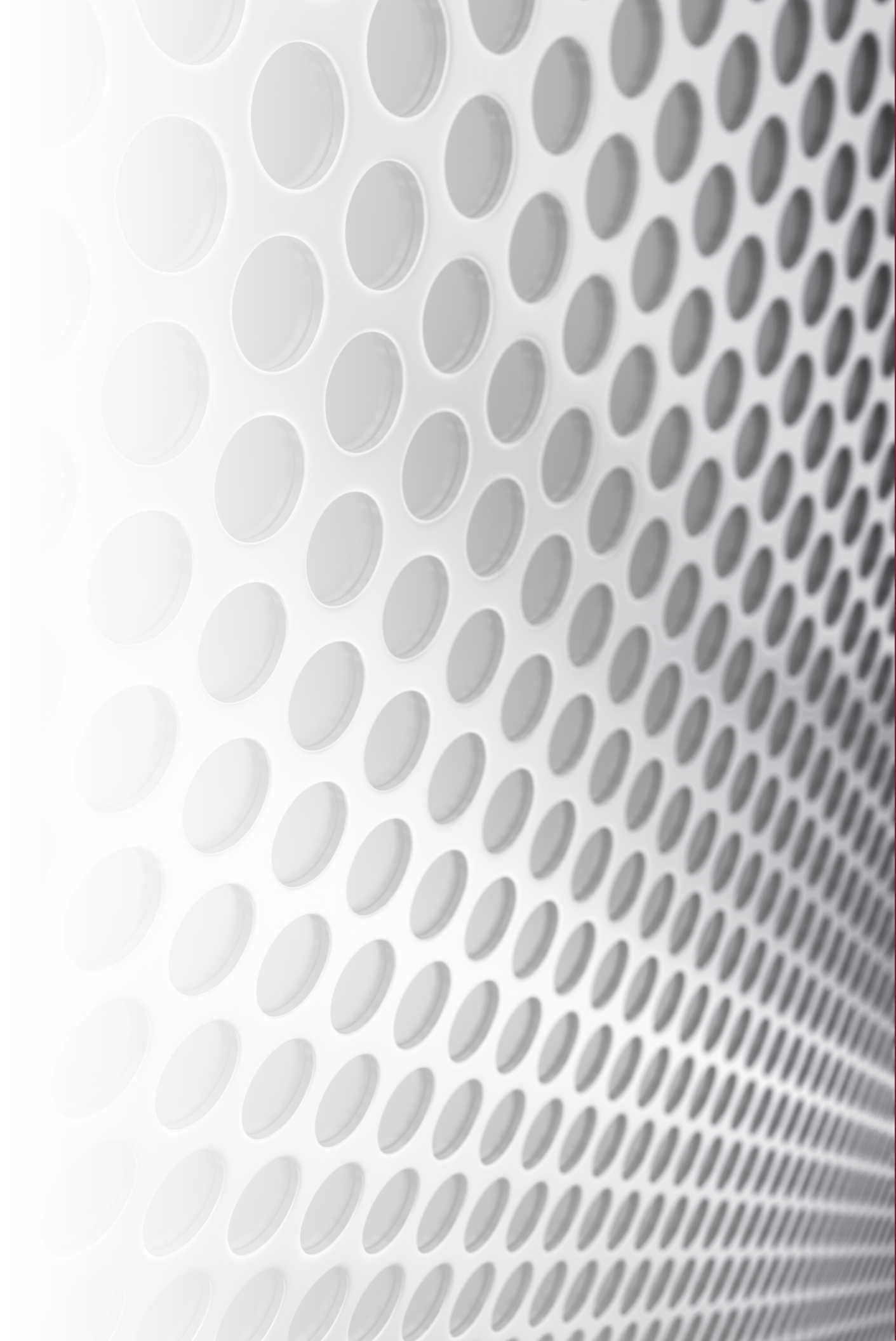
\*Note: For 50hrz applications, contact factory

#### NOTES:

Box 3. Viton® is a registered trademark of DuPont Dow Elastomers.

Section 2:

# ON-BOARD DIESEL FILTRATION



# On-Board Diesel Fuel Filtration

## Why is On-Board Diesel Filtration Required?

Mobile machines and commercial vehicles are subject to the toughest working conditions all over the world. To ensure smooth running of vehicles and to protect both the engine and the whole drive system from damage, optimum diesel fuel conditioning is particularly important. With its HDP On-Board diesel coalescing/particulate filter, Schroeder offers a modern system for diesel filtration which protects vehicle manufacturers and operators from failures, breakdowns and expensive service interventions. Our solution "Schroeder HDP On-Board Filter," is a cartridge filter system available in two versions: automatic drain (HDP-HT) and manual drain (HDP-BC).

Schroeder's HDP on-board Diesel Coalescing Filters provide the industry's best engine fuel filtration to ensure that your injectors never see poor quality fuel, and you never see the bill for expensive engine failures. All of Schroeder's fuel filters are compatible up to B100.

In addition, all Tier 4 diesel engines (on- or off-road) now require a fuel cleanliness level of 12/9/6 at injector or better. This equates to a 3-micron filtration level or smaller, with a beta rating of >1000. Today's typical Spin-on type, on-board fuel filters were not designed to filter to this level. Schroeder Fuel Filtration On-board diesel coalescing/particulate filters will protect your state-of-the-art diesel engines from costly breakdowns and rebuilds.

With all of the various additives and biodiesel now added to ULSD 15 diesel fuel to regain lubricity, compensate for seasonal differences, minimize microbial growth, and prevent gelling, additional filter clogging problems have arisen compared to fuels used in the past.

Filter clogging leads to reduced power or complete breakdown due to filters being run in bypass mode (no filtration). This can lead to common-rail fuel injector failure which will cost in the thousands of dollars to fix. The use of Schroeder's HDP filters is imperative to remove all of the clogging elements.

## The Schroeder HDP On-Board Filter's product benefits are:

- Low investment costs due to cost-optimized design.
- Small installation space required, since lower section of filter does not have to be accessible
- Great flexibility with regard to installation position since inlet and outlet can be in either direction
- Consistent dewatering over the entire life of the filter element since water is separated on the clean side
- Robust design thanks to aluminum housing.
- Economical and technically reliable operation as a result of long element service life
- High Tech design: Reliable dewatering thanks to automatic water discharge, even during suction side operation
- Simple adaptation to the on-board power supply through the use of independently controlled water discharge
- Low residues of diesel left in the filter element in the event of service
- Reliable radial seal with captive seal design
- Visual analysis of the contamination possible (Rust, metallic swarf, unusual deposits, which require further investigation)
- Water sensor and fuel preheating available as options

## The Schroeder HDP On-Board Filter results in reliable machine availability:

- From first-class contamination retention
- Due to highly effective and stable water separation on the clean-side for the entire life of the filter element
- Life-long efficiency, because at element change, the water separation stage is also replaced at the same time
- Due to the excellent water separation (achieved by using first class materials) of >95 % to ISO/CD 16332



# On-Board Diesel Fuel Coalescing Filter | Manual Drain

**HDP-BC**



Model No. of filter in photograph is: HDP-BC

## Features and Benefits

- Manual water drain
- Optional fuel pre-heater and water sensor
- Small envelope size offers greater flexibility in mounting locations
- Low investment cost due the economical design
- Long service life of the element yields low operating costs
- Seamless installation due to the plug and play
- Easy adaption to the on-board power supply
- Unsurpassed water removal for ULSD

## Application Introduction:

The Reason for Better Bulk Engine Filtration

Mobile machines and commercial vehicles are subject to the toughest working conditions. To ensure smooth running of vehicles, and to protect both the engine and the whole drive system from damage, optimum diesel fuel conditioning is particularly important. Schroeder Fuel Filtration's On-Board Diesel Coalescing filter offers a modern cartridge filter system available in two versions, which protects vehicle operators from failures, breakdowns and expensive service interventions



INDUSTRIAL



MOBILE  
VEHICLES



MARINE



AGRICULTURE



BULK FUEL  
FILTRATION

**1.5 gpm** ICF  
**5.6 L/min** BDF

**14.5 psi** BDFA  
**1 bar** QCF

Suction Side Application BDS

BDCF

BDC

**HDP-BC**

HDP-HT

EPM

EPTT

EWU

BCC

## Applications

## Filter Housing Specifications

Flow Rating: Up to 1.5 gpm (5.6 L/min)

Operating Pressure: <14.5 psi, (<1 bar) suction side application

Temperature Range: -40°F to 194°F (-40°C to 90°C)

Nominal Voltage: 24V DC (optional 12V DC) when heater or water sensor are used

Rated Power Fuel Preheating: 300W

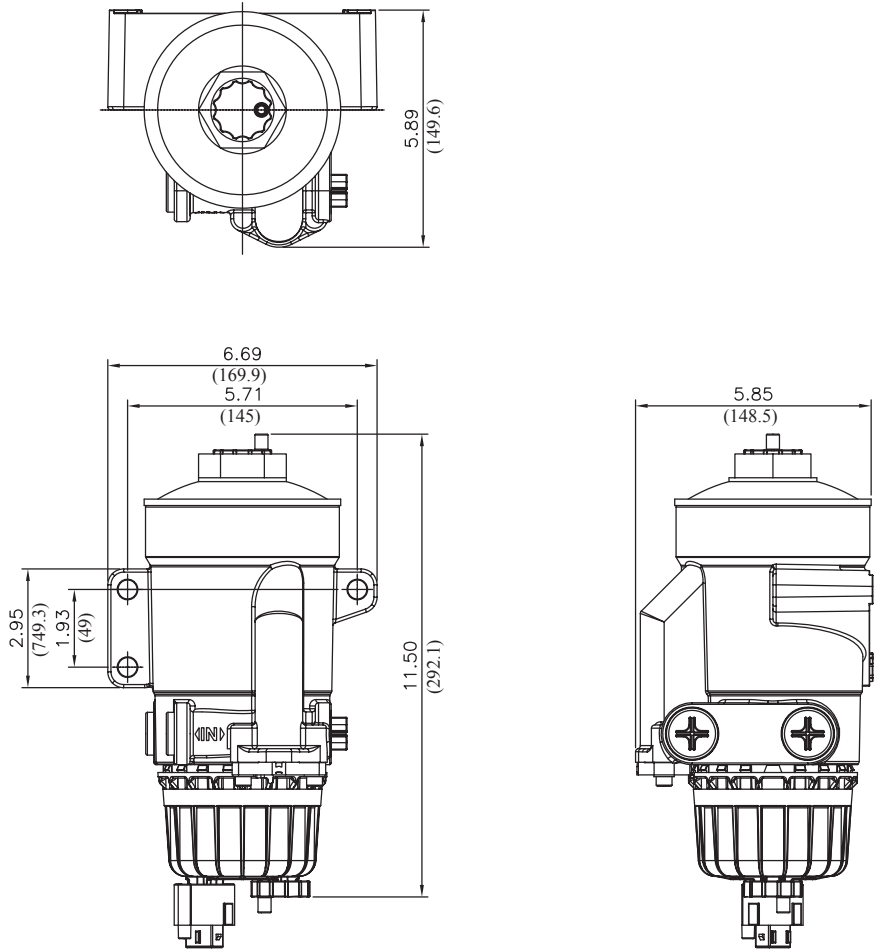
Weight of HDP-BC: 5.1 lbs (2.3 kg)

Water Separation Efficiency: >95% to ISO CD 16332

Connection Size: M22 x 1.5" Inlet/Outlet

HDP-BC

On-Board Diesel Fuel Coalescing Filter | Manual Drain



Metric dimensions in ( ). Installation instructions included on element

Element  
Particulate  
Performance  
Information

Element	Filtration Ratio Per ISO 19438	Dirt Retention Per ISO 19438
	n > 10 µm (c)	to DP
10 µm	> 99%	300 mbar m > 42g

Element Water  
Coalescing  
Performance  
Information

Element	Suction Side Coalescing Per ISO CD 16332	
	Max Flow	Single Pass Efficiency*
10 µm	158 gal/h	> 95% *

Flow Direction: Outside In  
Element Nominal Dimensions: 4.0" (100.6 mm) O.D. x 8.6" (217.6 mm) long

Note:  
Based on Diesel  
Fuel Type A, Water  
Concentration:  
1500 ppm

# On-Board Diesel Fuel Coalescing Filter | Manual Drain

**HDP-BC**

## Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel blends
- Synthetic diesel and blends

## Fluid Compatibility

ICF

BDF

BDFA

QCF

BDS

## Pressure Drop Information

Based on Flow Rate and Viscosity

BDCF

BDC

**HDP-BC**

HDP-HT

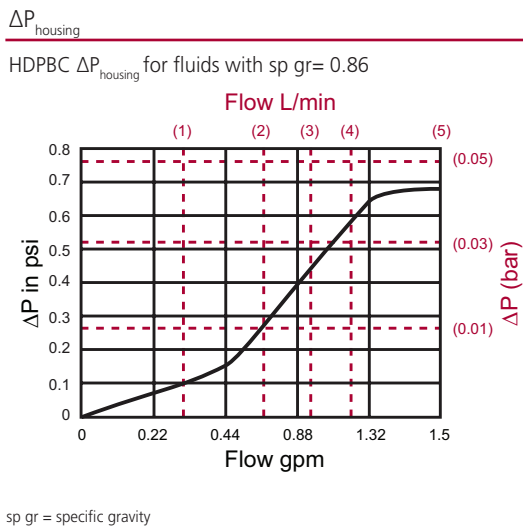
EPM

EPTT

EWU

BCC

## Replacement Elements



Notes


Size	Evolution Stage	Filtration Rating	Filter Material	SI Code
0340	BC1	7 = 7 μm	KF1	K6
		10 = 10 μm		
		30 = 30 μm		

Unit comes standard with a tyco connector, when heat and or water sensor installed. For other connector types, contact factory

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder HDP-HT:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10
HDP									

**Example:** NOTE: Only box 9 may contain more than one option

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10
HDP	KF1	340	BC1	10	W	1	X	AS1	K6

= HPDKF1340BC110W  
1XAS1K6

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
<b>Filter Series</b>	<b>Filter Material</b>	<b>Size</b>	<b>Evolution Stage</b>	<b>Filtration Rating</b>
HDP	KF1	340	BC1	7 = 7 µm *10 = 10 µm 30 = 30 µm

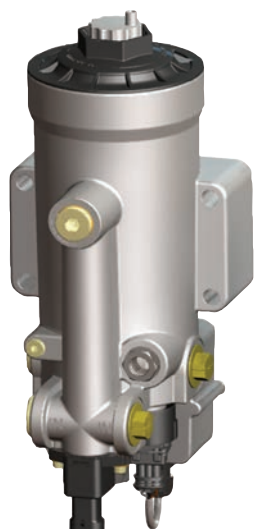
BOX 6	BOX 7	BOX 8	BOX 9	BOX 10
<b>Type of Clogging Indicator</b>	<b>Type Code</b>	<b>Modification Number</b>	<b>Options</b>	<b>SI Code</b>
W - No clogging indicator	1 = 12 VDC 2 = 24 VDC	X	AS1 - w/ integrated water sensor H1 - w/ integrated fuel pre-heating	K6

#### NOTES:

- Unit comes standard with a Tyco Connector, when heat and or water sensor is installed. For other connector types, contact factory
- TE™ is a trademark of Tyco Electronics.

# On-Board Diesel Fuel Coalescing Filter | Automatic Drain

## HDP-HT



Model No. of filter in photograph is:  
HDP-HT

### Features and Benefits

- Automatic water drain
- Optional fuel pre-heater and water sensor
- Small envelope size offers greater flexibility in mounting locations
- Low investment cost due the economical design
- Long service life of the element yields low operating costs
- Seamless installation due to the plug and play
- Easy adaption to the on-board power supply
- Unsurpassed water removal for ULSD

### Application Introduction:

The Reason for Better Engine Fuel Filtration

Mobile machines and commercial vehicles are subject to the toughest working conditions. To ensure smooth running of vehicles, and to protect both the engine and the whole drive system from damage, optimum diesel fuel conditioning is particularly important. Schroeder Fuel Filtration's On-Board Diesel Coalescing filter offers a modern cartridge filter system available in two versions, which protects vehicle operators from failures, breakdowns and expensive service interventions.



INDUSTRIAL



MOBILE  
VEHICLES



MARINE



AGRICULTURE



BULK FUEL  
FILTRATION

Flow Rating: Up to 2.6 gpm (10 L/min)

Operating Pressure: 14.5 psi, (<1 bar) suction side application

Temperature Range: -4°F to 194°F (-20°C to 90°C)

Nominal Voltage: 24V DC (optional 12V DC)

Rated Power Fuel Preheating: 300W

Weight of HDP-HT: 9.5 lbs (4.25 kg)

Water Separation Efficiency: >95% to ISO CD 16332

Connection Size: G 3/4" Inlet/Outlet

2.6 gpm  
**10 L/min**

ICF

BDF

14.5 psi  
**1 bar**

BDFA

QCF

Suction Side  
Application

BDS

BDCF

BDC

HDP-BC

**HDP-HT**

EPM

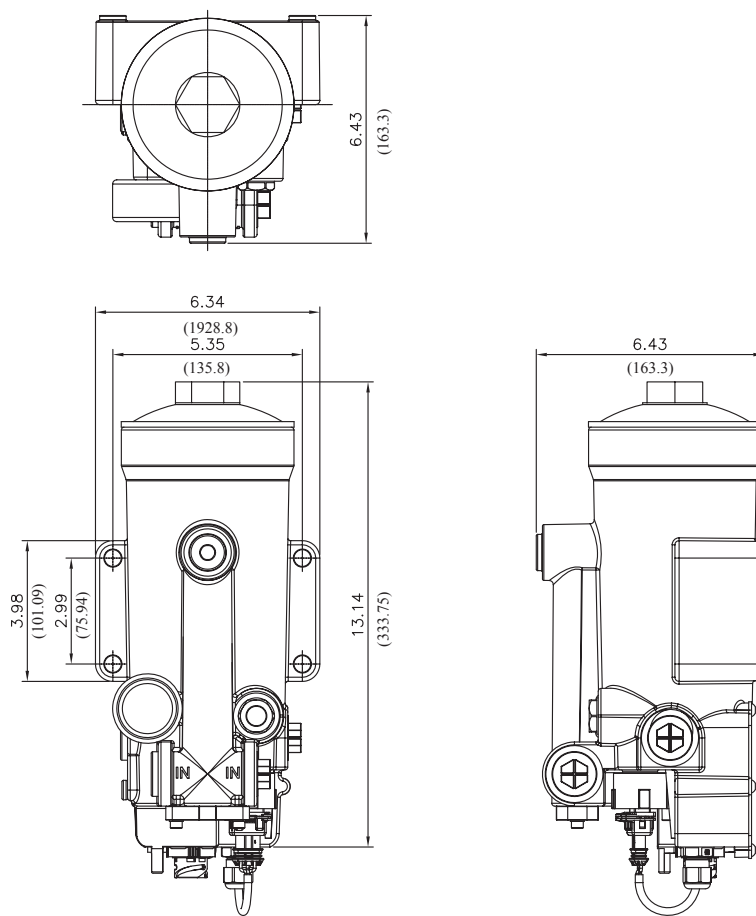
EPTT

EWU

BCC

## Applications

## Filter Housing Specifications



Metric dimensions in ( ). Installation instructions included on element

## Element Particulate Performance Information

Element	Filtration Ratio Per ISO 19438	Dirt Retention Per ISO 19438
	n > 10 μm (c)	to DP
10 μm	> 99%	300 mbar m > 42g

## Element Water Coalescing Performance Information

Element	Suction Side Coalescing Per ISO CD 16332	
	Max Flow	Single Pass Efficiency*
10 μm	158 gal/h	> 95%*

Flow Direction: Outside In  
Element Nominal Dimensions: 4.0" (100.6 mm) O.D. x 8.6" (217.6 mm) long

Note:  
Based on Diesel  
Fuel Type A, Water  
Concentration:  
1500 ppm

# On-Board Diesel Fuel Coalescing Filter | Automatic Drain

HDP-HT

### Fuel Oils

- ULSD15 and similar petroleum diesels
- Biodiesel blends
- Synthetic diesel and blends

Fluid Compatibility

ICF

BDF

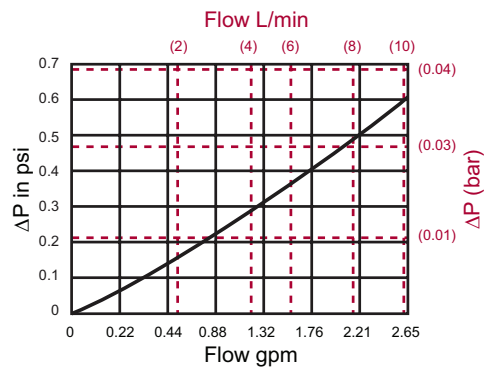
BDFA

QCF

BDS

$\Delta P_{\text{housing}}$

HDPHT  $\Delta P_{\text{housing}}$  for fluids with sp gr= 0.86



sp gr = specific gravity

Notes

Pressure Drop Information

Based on Flow Rate and Viscosity

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

BCC

Size	Evolution Stage	Filtration Rating	Filter Material	SI Code
0600	HT1	7 = 7 μm	KF1	K6
		10 = 10 μm		
		30 = 30 μm		

Replacement Elements



## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder HDP-HT:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10
HDP									

**Example:** NOTE: Only box 9 may contain more than one option

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10
HDP	KF1	600	HT1	10	A	1	X	AS1	K6

= HPDKF1600HT110A  
1XAS1K6

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
<b>Filter Series</b>	<b>Filter Material</b>	<b>Size</b>	<b>Evolution Stage</b>	<b>Filtration Rating</b>
HDP	KF1	600	HT1	7 = 7 µm *10 = 10 µm 30 = 30 µm

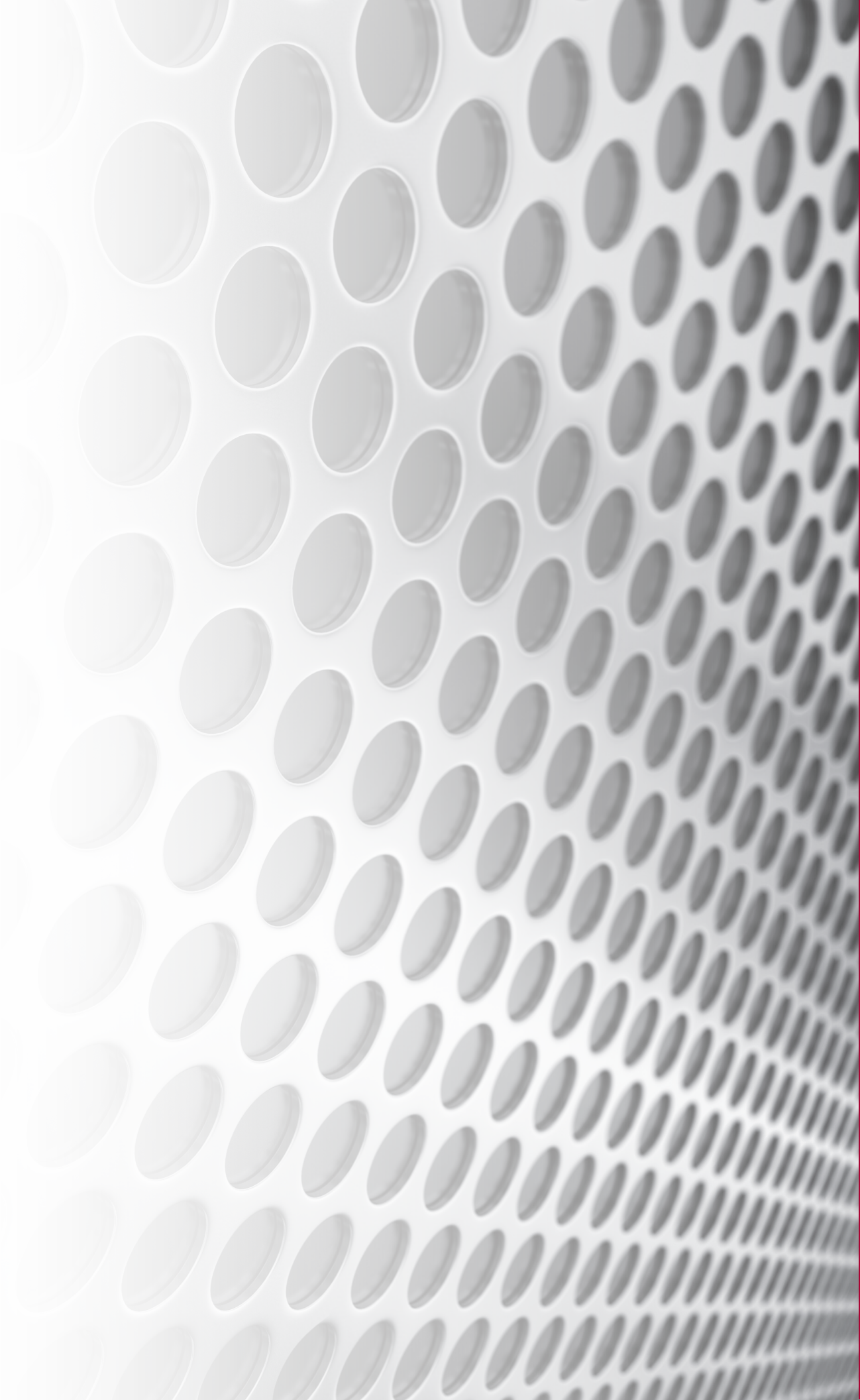
  

BOX 6	BOX 7	BOX 8	BOX 9	BOX 10
<b>Type of Clogging Indicator</b>	<b>Type Code</b>	<b>Modification Number</b>	<b>Options</b>	<b>SI Code</b>
A - Steel Blanking Plug UED - Vacuum Gauge	1 = 12 VDC 2 = 24 VDC	X	*AS1 - w/ integrated water sensor H1 - w/ integrated fuel pre-heating	K6

\*Note: Standard Option

Section 3:

# *BIODIESEL PURIFICATION*



# Biodiesel Fuel Purification

## Schroeder Fuel Filtration

Over the years, Schroeder design engineers have encountered many types of fluid systems. We are proud of our continuing success in providing “value-added products” for our customers, that is, making or modifying our products to meet their specific needs. When customers order products from Schroeder, they are assured of a reliable source of supply, consistent and prompt service, and direct support. Pre- and post-technical service is provided to ensure customer satisfaction. So if you’re faced with a filtration dilemma, call us. Schroeder Industries: Advanced Fluid Conditioning Solutions™.

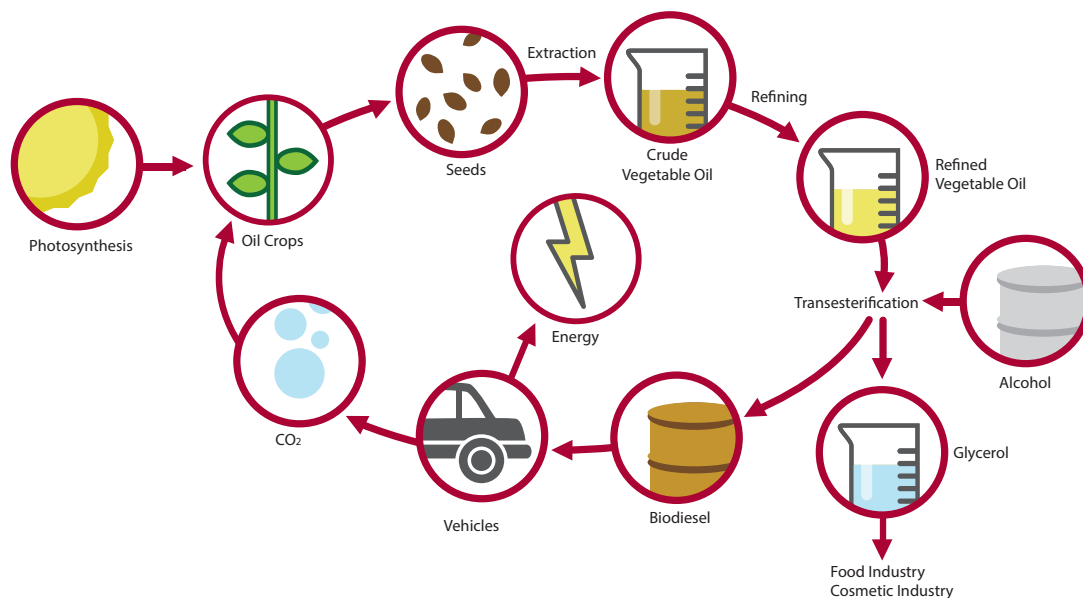
## Importance of Biofuel Treatment

Most biodiesel is made from waste vegetable oil (WVO) collected from catering and food production facilities or from virgin feedstocks. The WVO often contains high levels of Free Fatty Acids, moisture, as well as solids, other impurities and contaminants. The solids can be filtered out using correct filtration procedures. The water must be removed to meet Tier IV engine requirements less than 200 ppm. Pre-treatment of WVO prior to the transesterification process is important. Free Fatty Acids (FFA), oil contaminants and moisture need to be effectively removed in order to ensure a clean, irreversible reaction. WVO typically contains from 2-5% free fatty acids. If the Free Fatty Acids are above this amount, it is very difficult to produce biodiesel without an acid esterification process. The Free Fatty Acids number is determined by a filtration process. A full description of this process is available on request.

A common problem with biodiesel producers is instead of a clear separation between the biodiesel and the glycerine after the reaction and settling process, they end up with a semi-solid, gelatinous mixture that cannot be purified and used as fuel. This is an indication that the oil contained excessive Free Fatty Acids and/or water.

Raw vegetable oils that are produced by pressing oilseeds, such as canola, mustard, soybeans or other virgin oils like sugar cane or algae, can also be converted to biodiesel. The Free Fatty Acids level of these raw oils are usually 0.5% or less, which is low enough not to pose a problem. However, the oil may contain gum compounds that can create sludge deposits in the processing equipment, and can make it difficult to separate the glycerine at the end of the reaction.

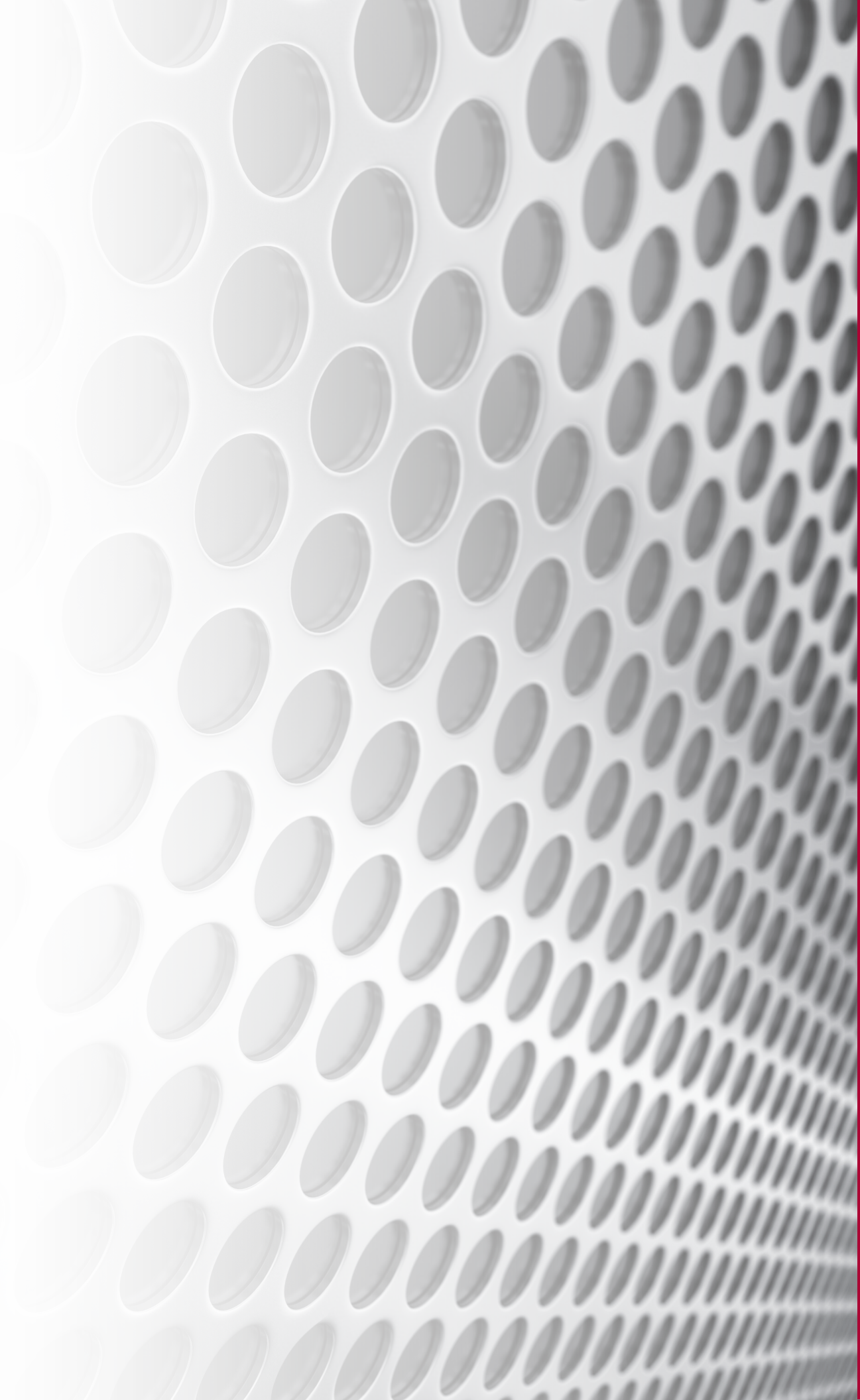
Choose from our range of filter elements (reusable or disposable) and a range of filter housings to suit all budgets and production levels. Schroeder Fuel Filtration can supply individual components, as well as complete filtration systems. Irrespective of your budget and production levels, Schroeder Fuel Filtration has a solution to suit your operation.





Section 4:

# *DRY WASH PURIFICATION*



# Dry Wash Purification

Dry wash purification is a more recent addition to biodiesel purification. Current methods for dry washing the crude fuel include ion-exchange resins (like Amberlite or Purolite) and silicates (like Magnesol or TriSyl). Though both methods are dry, they are applied differently.

An ion exchange resin is an insoluble matrix (or support structure) normally in the form of small (1-2 mm diameter) beads, usually white or yellowish, fabricated from an organic polymer substrate. The material has highly developed structure of pores on the surface of which easily trap and release ions.

The trapping of ions takes place only with simultaneous releasing of other ions, thus the process is called ion exchange.

There are different types of ion exchange resin, which are fabricated to selectively prefer one or several different types of ions. Ion exchange resins are widely used in different separation, purification and decontamination processes. The most common examples in the past have been water softening and water purification. Specialty ion exchange resins can be utilized to bind and remove trace impurities from a biodiesel process stream. After the bulk separation of the glycerin, the biodiesel stream is simply passed through a column of the dried ion exchange resin to bind and remove ionic salts (such as  $\text{Na}^+$  and  $\text{Ca}^{++0}$ ), trace catalysts, soaps and glycerin. The dried resin also acts as a desiccant retaining and removing trace water from the biodiesel feed. The efficiency and life of a resin to reduce and remove impurities from the biodiesel will depend upon how well bulk separation of the biodiesel and glycerin are made. A resin operation step should be viewed as a polishing process to remove trace materials in the 275-750 ppm range, not as a replacement for optimizing the bulk separation. Generally, a lead-lag two column continuous feed system is recommended for most operations. In many cases, a third column may be considered in order to ensure continuous operations and reduce down time.

On balance, the down side to an ion exchange media is that it does as the name implies; exchanges ions, for whatever is removed from the matrix, something else is added. So, of solving one problem, another is created. Resins remove soap by replacing the metal ion in the soap with a hydrogen ion forming FFA that is passed through the resin and left in the biodiesel. If there is too much soap present, there will be too much FFA in the finished biodiesel to meet TAN (Total Acid Number ASTM D664). Eco2Pure™ should be considered as a replacement for resins, as it is an inert, absorptive material with an affinity for polar compounds. Schroeder's Eco2Pure™ removes soaps and other polar compounds, nothing is released downstream. Challenges of this process include the possibility of blinding over the resin, and thereby disabling its capacity by passing a bad batch of fuel through it. Other concerns are that fine particles can pass downstream into your final fuel, so final polishing and filtration is still required. Polishing can be accomplished via our K9, MFD or any of our Schroeder filters outfitted with our Z-Media® (high efficiency) or Schroeder meltblown elements with Viton™ seals. The adoption of a TCM, a LED particle monitor, can provide assurance that all final particles have been removed.

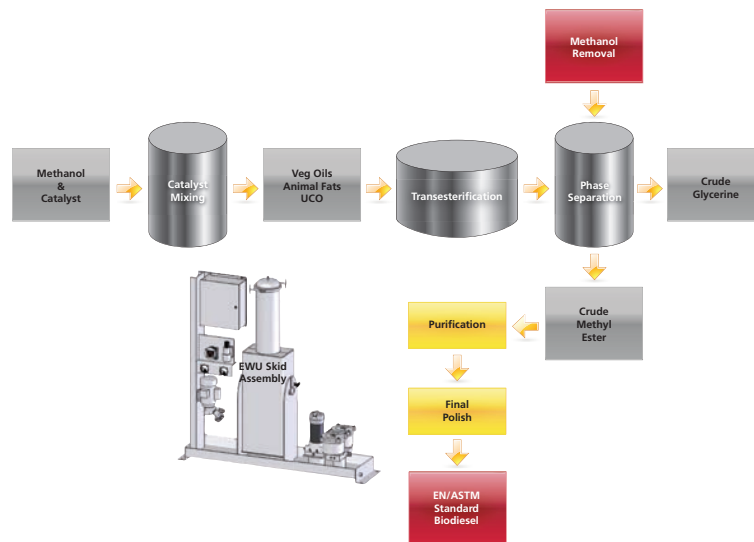


Diagram of a Biodiesel Production Process

## The Standard of Drywash Technology

Eco<sub>2</sub>Pure™ is a unique cellulose based, natural and sustainable composition of absorbent technologies, specifically formulated for biodiesel purification from any feedstock. Eco<sub>2</sub>Pure's™ composition is designed to optimize purification efficiency and contamination removal, combined with increased flow enhancement characteristics.

Eco<sub>2</sub>Pure™ is designed to be a filter-free wash process with no consumables in the wash stage and the lowest cost drywash biodiesel purification method in existence today. Each pound of Eco<sub>2</sub>Pure™ is capable of purifying between 41-82 gals of biodiesel (Each kilogram or pounds of Eco<sub>2</sub>Pure™ is capable of purifying between 93-185 gallons of biodiesel\*).

Eco<sub>2</sub>Pure™ removes soaps, catalyst traces, residual methanol, moisture and other production residues from biodiesel, thereby assisting in the attainment of EN14214 & ASTM-D6751 quality standards.

Eco<sub>2</sub>Pure™ outperforms existing ion exchange resin technologies in terms of fuel quality, purification speed, as well as price, boasting the lowest purification costs on the market today\*. At \$0.03 cents per gallon\*\*, Eco<sub>2</sub>Pure™ can be used to replace or compliment your existing purification system, while allowing for a reduction in overall purification costs.

The frequency of re-bedding (replacing the spent media) will depend on the level of impurities in your biodiesel, the amount of biodiesel treated and the size of the treatment tower. So a single 120 lb (70 kg) Treatment Tower could only require re-bedding on average every 9,840 gallons. Loading is fast and simple, and once Eco<sub>2</sub>Pure™ is loaded, no other intervention is required. Once the Eco<sub>2</sub>Pure™ is bedded in the Treatment Tower, it automatically purifies the biodiesel in a single passage of flow.

Eco<sub>2</sub>Pure™ is available in 15 kg sacks for easy storage and transportation for the smaller producer, and available in bulk quantity for larger producers. For details of a stocking distributor near you, please contact us for more details.

A representative will work with you to determine the optimum utilization for your plant and to select the precise amount of Eco<sub>2</sub>Pure™ required, according to your process conditions.



Eco<sub>2</sub>Pure™ Media



15 kg Sack

## Overview

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

**EPM**

EPTT

EWU

BCC

## NOTES:

1. Based on speed and price comparison of average resin prices on UK/USA mainland
2. Eco<sub>2</sub>Pure™ life performance is determined by the initial starting quality of the crude biodiesel, base feed stocks, etc.

## Features and Benefits

- Continuous single pass purification
- Unmatched in soap removal
- Faster per kg or lbs flow than ion exchange
- Low capital expenses compared to batch adsorbents
- Sustainable media and no water required
- Spent Eco2Pure™ has a fuel value

Eco2Pure™ is packaged in convenient sized sacks for easy storage and transportation.

A representative will work with you to determine the optimum utilization for your plant, and to select the precise amount of Eco2Pure™ required, according to your process conditions.

For details of a stocking distributor near you, please visit [www.schroederbiofuels.com](http://www.schroederbiofuels.com).

## Filter Model Number Selection

### Single Bags

#### How to Build a Valid Model Number for Bag of EPM:

BOX 1	BOX 2	BOX 3
EPM		

**Example:** NOTE: One option per box

BOX 1	BOX 2	BOX 3	
EPM	15K	S	= EPM15KS

BOX 1	BOX 2	BOX 3
Filter Series	Size	Packaging
EPM	15K	S = Sack

## Filter Model Number Selection

### Direct Shipped Container Quantities

The Direct Shipped Container option offers competitive pricing to the end user. Please see cost per gallon analysis below.

#### How to Build a Valid Model Number for Direct Shipped Container Quantities of EPM

BOX 1	BOX 2	BOX 3
EPM		

**Example:** NOTE: One option per box

BOX 1	BOX 2	BOX 3	
EPM	20C	S	= EPM20CS

BOX 1	BOX 2	BOX 3
Filter Series	Size	Packaging
EPM	20C = 20 ft Shipping Container 40C = 40 ft. Shipping Container	S = Sack

## Cost Per Gallon Analysis

Part Code	Min \$/gal*	Max \$/gal*
EPM-15K-S (Bag)	\$0.05	\$0.07
EPM-15K-S (Pallet)	\$0.04	\$0.05
EPM-20C-S	\$0.03	\$0.04
EPM-40C-S	\$0.02	\$0.03

\* Based on laboratory and customer results



### Features and Benefits

- Rugged stainless steel construction
- Easily retro-fitted to your existing production line
- Designed for easy change outs
- Filter-free wash process
- Single-pass process
- Dry/waterless process
- Replacing Eco<sub>2</sub>Pure™ media is fast and simple
- Eco<sub>2</sub>Pure™ Treatment Towers are built specifically to maximize the performance of the Eco<sub>2</sub>Pure™ purification process.

### Application Introduction:

Eco<sub>2</sub>Pure™ Treatment Towers can be configured to suit all production volumes. Available with 70 kg Eco<sub>2</sub>Pure™ holding capacity, our systems are scalable to allow for increased volume production, allowing for continuous production and reduced purification times.

As the unwashed biodiesel enters the Eco<sub>2</sub>Pure™ Treatment Tower, it passes through a fixed bed of Eco<sub>2</sub>Pure™ purification media, ensuring the fuel is purified in a single pass, removing production residues, fuel contaminants and soaps. Flow rates need to be governed accordingly in order to ensure maximum removal of production residues and soap.

With each kilogram/pounds of Eco<sub>2</sub>Pure™ capable of purifying between 93-185 gallons of biodiesel, and each pound of Eco<sub>2</sub>Pure™ capable of purifying between 41-82 gals of biodiesel, the frequency of media replacement is kept to a minimum. All our products have been pressure tested to meet international standards.

Purification times can be shortened and production levels increased by adding extra towers to your purification line.

#### One tower capacity

Capacity	Flow			
	gpm	gph	12hr day (gallons)	24 hr day (gallons)
120 lbs (70 kg)	2.0	120	1,440	2,880

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

BCC



Filter  
Model  
Number  
Selection

How to Build a Valid Model Number for Schroeder EPTT

BOX 1	BOX 2	BOX 3
EPTT		

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3
EPTT	70K	W

= EPTT70KW

BOX 1	BOX 2	BOX 3
Filter Series	Eco <sub>2</sub> Pure™ Media Capacity	Mounting
EPTT	70K = 120 lbs. (70 kg)	W = Wheel Mounted B = Base Mounted

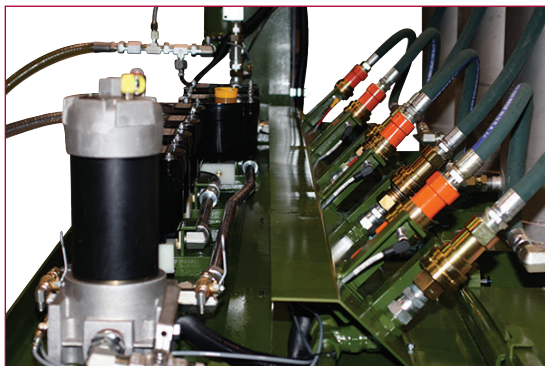
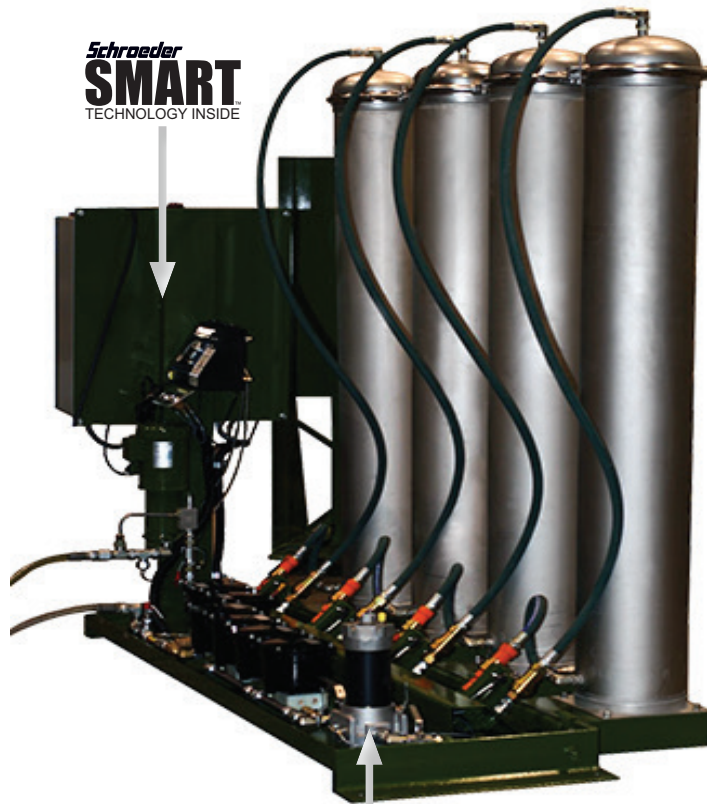
## Continuous Flow

Schroeder Fuel Filtrations' unique design configurations enable continuous flow during the purification process, thereby eliminating any downtime. Any number of Eco<sub>2</sub>Pure™ Treatment Towers can be built into system designs, complete with pump, control panel and safety features. Flow rates will be governed accordingly to suit the number of towers in operation.

## Single Flow

As the unwashed biodiesel enters the Eco<sub>2</sub>Pure™ Treatment Tower, the fuel is purified in a single pass. In the same passage of flow, the washed fuel passes through a long-life final polishing bank to allow for the removal of residual production residues and soaps.

Eco<sub>2</sub>Pure™ is scalable to any size.



\*Close-up of Hose Connections

Excellence® Beta1000 Media

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

**EWU**

BCC

## Features and Benefits

- Easily retrofitted to your existing production process
- Low capital investment costs
- Filterless wash process-no consumables
- Can be configured for continuous flow applications
- Can replace or compliment your existing purification system
- Single-pass process
- Saves time... 2x faster than ion exchange resins
- Saves energy - no drying required
- Completely dry, waterless process
- Traceability with TestMate® Contamination Monitor (TCM) fitted

## Flow Comparison Chart

Eco2Pure vs. Ion Exchange Resins

### Purification Speed based on a SINGLE vessel \*

Eco2Pure™ Speed			gallons	gallons
Capacity* (kg)	gpm	gph	12hr day	24 hr day
120 lbs (70 kg)	2.0	120	1,440	2,880
Ion Exchange Resins Speed			gallons	gallons
Capacity* (kg)	gpm	gph	12hr day	24 hr day
110 lbs (50 kg)	0.7	40	480	960

## Cost Per Gallon Analysis

\*Eco<sub>2</sub>Pure™ is one of lowest cost purification methods available in today's biodiesel market, and is priced as low as \$0.025 per gallon.

# Single Tower Eco<sub>2</sub>Pure™ Purification Systems

**EWU**



## Features and Benefits

- Rugged stainless steel construction
- Easily retro-fitted to your existing production line
- Designed for easy change outs
- Single-pass process
- Dry/waterless process
- Replacing Eco<sub>2</sub>Pure™ media is fast and simple

## Application Introduction:

The single tower Eco<sub>2</sub>Pure™ purification system combines the performance of the second generation dry wash media, Eco<sub>2</sub>Pure™, the filtration performance of Schroeder Industries' Excellement® media and 65 years of US manufactured quality. Systems include controls, safety considerations, Online quality control options and operator feedback for ease of use.

Single 70 kg Tower w/ Performance Filter

Flow Rating:	2 - 2.6 gpm (7.5 - 10 L/min)
Daily Production Volumes (24 hrs):	2,853 - 3,804 gals (10,800 - 14,400 L)
Final Filtration Method:	Excellement® Beta1000 Media
Changeover Frequency:	± 7,925 gals (± 30,000 L)
Estimated Annual Production:	1,300,000 gal (4,921,035 L)

## How to Build a Valid Model Number for a Schroeder EWU:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
EWU						

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
EWU	1	70K	2W	1	WQ	0

= EWU170K2W1WQ0

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	No. of Towers	Treatment Tower Capacity	Filtration Stages
EWU	1	70K = 120 lbs. (70 kg)	2W

BOX 5	BOX 6	BOX 7
Power Options	Connector	Quality Control
1 = 110V 60Hz 2 = 220V 60Hz 1 phase 3 = 460V/120V 3 phase 4 = 575V 5 = Air Diaphragm 6 = 110V 50Hz	WQ = Hoses w/ Quick Disconnect 16M = 1" NPT 16V = 1" Cam Lock 16Q = 1" Quick Disconnects	0 = Blank Port 1 = TCM Particle Monitor 2 = TWS Water Sensor 3 = TCM & TWS

## Specifications

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

**EWU**

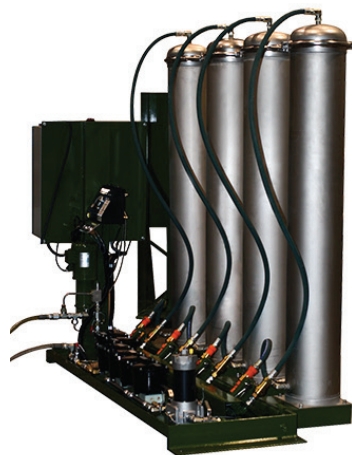
BCC

## Filter Model Number Selection

Notes:

1. Other sizes are available upon request
2. We can design, build and commission a purification system to suit your operation. For more information please contact us to discuss your requirements.

BOX 5: For 50 HZ applications consult the factory.



### Features and Benefits

- Rugged stainless steel construction
- Easily retrofitted to your existing production line
- Designed for easy change outs
- Single-pass process
- Dry/waterless process
- Replacing Eco<sub>2</sub>Pure™ media is fast and simple

### Application Introduction:

The multi tower Eco<sub>2</sub>Pure™ purification system combines the performance of the second generation dry wash media, Eco<sub>2</sub>Pure™, the filtration performance of Schroeder Industries' Excellement® media and 65 years of US manufactured quality. Systems include controls, safety considerations, Online quality control options and operator feedback for ease of use.

## Specifications

	Two 70 kg Tower w/ Performance Filter	Four 70 kg Tower w/ Performance Filter	Eight 70 kg Tower w/ Performance Filter
Flow Rating:	4 - 5.25 gpm (15 - 20 L/min)	7.5 - 10 gpm (30 - 40 L/min)	15 - 20 gpm (60 - 80 L/min)
Daily Production Volumes (24 hrs):	5,706 - 7,608 gals (21,600 - 28,800 L)	11,412 - 15,216 gals (43,200 - 57,600 L)	22,824 - 30,469 gals (86,400 - 115,340 L)
Final Filtration Method:	Excellement® Beta <sub>1000</sub> Media	Excellement® Beta <sub>1000</sub> Media	Excellement® Beta <sub>1000</sub> Media
Changeover Frequency:	± 15,850 gals (± 60,000 L)	± 31,700 gals (± 120,000 L)	± 63,400 gals (± 240,000 L)
Estimated Annual Production:	2,700,000 gal (10,220,612 L)	5,330,000 gal (20,176,245 L)	10,700,000 gal (40,503,906 L)

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder EWU:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
EWU						

**Example:** NOTE: One option per box

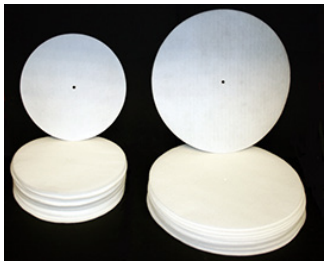
BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7
EWU	4	70K	2W	1	WQ	0

= EWU470K2W1WQ0

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	No. of Towers	Treatment Tower Capacity	Filtration Stages
EWU	2 3 4 8	70K = 120 lbs. (70 kg)	2W 3W
BOX 5	BOX 6	BOX 7	
Power Options	Connector	Quality Control	
1 = 110V 60Hz 2 = 220V 60Hz 1 phase 3 = 460V/120V 3 phase 4 = 575V 5 = Air Diaphragm 6 = 110V 50Hz	WQ = Hoses w/ Quick Disconnect 16M = 1" NPT 16V = 1" Cam Lock 16Q = 1" Quick Disconnects	0 = Blank Port 1 = TCM Particle Monitor 2 = TWS Water Sensor 3 = TCM & TWS	

### Notes:

1. Other sizes are available upon request
2. We can design, build and commission a purification system to suit your operation.



Filter Pads for EPTT Towers

Each part number listed below includes a single filter pad.

Part Number	Description
BD-192	25 micron filter pad for EPTT-70K

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

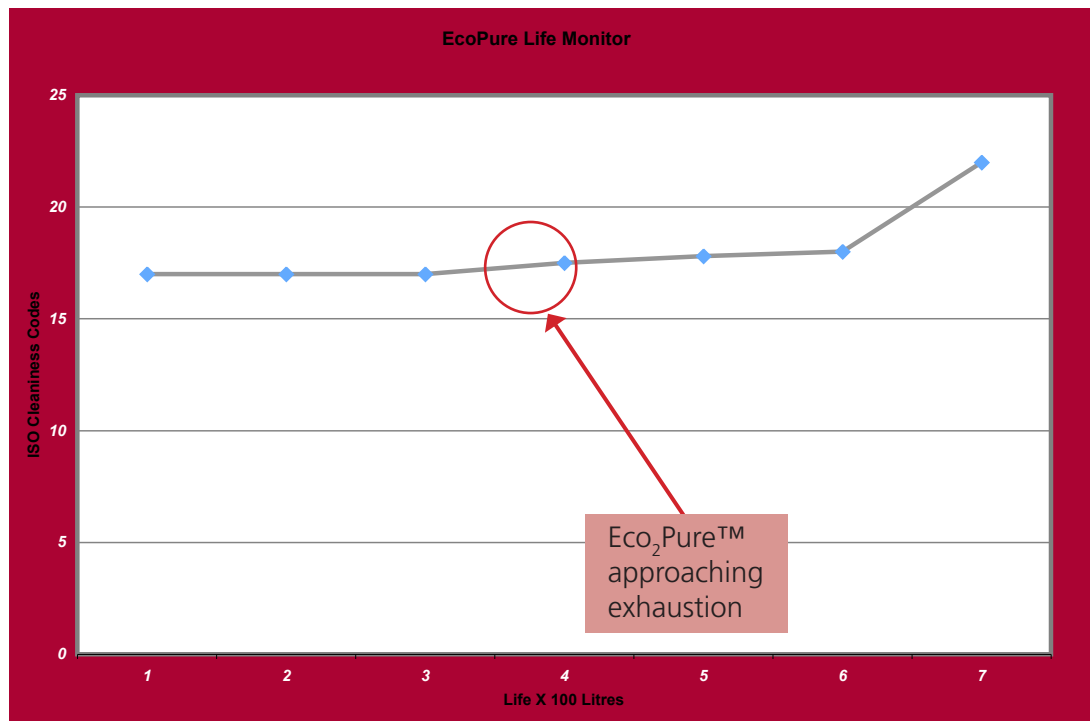
EPM

EPTT

EWU

BCC

# Life Monitoring & Quality Control



## Eco<sub>2</sub>Pure™ Monitoring Using TCM Particle Monitor

Using the TCM Online particle monitor, biodiesel producers can effectively monitor the residual life of Eco<sub>2</sub>Pure™. The particle counts increase as the media approaches exhaustion, allowing for adequate notification for Eco<sub>2</sub>Pure™ rebedding. This is an excellent way of ensuring that ONLY quality fuel is produced, and eliminates the possibility of downstream migration of production residues, moisture and soaps. This also allows for trend indication for batch/continuous process control. Live cleanliness data can be viewed on your PC screen and archived in real-time.



**"Putting You in Control of Your Biodiesel Quality"**

# Eco<sub>2</sub>Pure™ Performance Data

Parameter	Test method	Units	Europe	USA	Rape Seed M.E		WVO	Methyl Ester
			EN14214	ASTM D6751	Before	After	Before	After
Soap	None	None	None	None	650	0	1890	0
Free Glycerol	EN14105	% mass	0.2 max	0.2 max	0.052	0.005	0.0065	0.002
Total Glycerol %	EN14105	% mass	0.25 max	0.24 max	0.23	0.169	0.215	0.139
Flash Point °C	ISO2719	°C	120 min	130 min	90	140	105	158
Group Metals I (Na+K)		mg/kg	5 max	5 max	51	0	66	0
Group Metals II (Ca+Mg)		mg/kg	5 max	5 max	5	0	7	0
Oxidation Stability @ 110°C	EN14112	Hours	6 mins	3 mins	0.63	2.27	0.5	4.3
Water	EN ISO 12937	mg/kg	500 max	500 max	400	363	1400	420
Sulfated Ash	EN ISO 3987	mass %	0.02 max	0.02 max	0.056	0	0.09	0.002
Methanol Content %	EN14110	mass %	0.2 max		0.19	0.009	0.36	0.0019
Acid Value mg/KOH/g	EN1404	mg KOH/g	0.5 max	0.8 max	0.5	0.09	0.6	0.3
Total Contamination	EN12662	mg/kg	24 max	*	29	4	35	6
Appearance	None	None	None	None	Cloudy	Clear Bright	Cloudy	Clear Bright

\* Combined water and contamination test under ASTM D6759



# Frequently Asked Questions

## **What makes Eco<sub>2</sub>Pure™ so unique?**

Eco<sub>2</sub>Pure™ is a natural and sustainable biodiesel purification media, and is a chemically inert absorptive media, designed for ease of use and landfill disposal. Eco<sub>2</sub>Pure™ boasts one of the lowest purification costs per liter/gallon on the market today. Eco<sub>2</sub>Pure™ is proven to assist in the attainment of EN/ASTM quality standards.

## **Is Eco<sub>2</sub>Pure™ similar to ion exchange resin?**

No, unlike ion exchange systems, Eco<sub>2</sub>Pure™ is absorptive technology, which allow for removal of soaps, production residues, residual methanol and moisture from biodiesel.

## **Are Eco<sub>2</sub>Pure™ Treatment Towers available loose?**

Eco<sub>2</sub>Pure™ Treatment Towers are available loose for producers to configure as they like or as part of a system.

## **What is an Eco<sub>2</sub>Pure™ System?**

We do all the work for you. Pumps, control panels, safety features are all configured to achieve maximum media life, production throughput and fuel quality.

## **How do you know when the Eco<sub>2</sub>Pure™ is exhausted?**

There are several ways to monitor remaining life:

- a) Pressure indication
- b) Flow measurement
- c) Particle counts

## **How much biodiesel will each pound of and Eco<sub>2</sub>Pure™ purify?**

Each pound of Eco<sub>2</sub>Pure™ will purify between 93-185 gallons of biodiesel.

## **Can I increase my purification rate if I need to upscale?**

By adding extra Treatment Towers, you can increase your throughput. Treatment Towers are available in various sizes to suit all production volumes.

## **Do I require final polishing?**

Irrespective of the wash method you employ, final polishing is advisable to remove all traces of production residues, soaps and moisture prior to use.

## **Can you still offer traceability with the Eco<sub>2</sub>Pure™ system?**

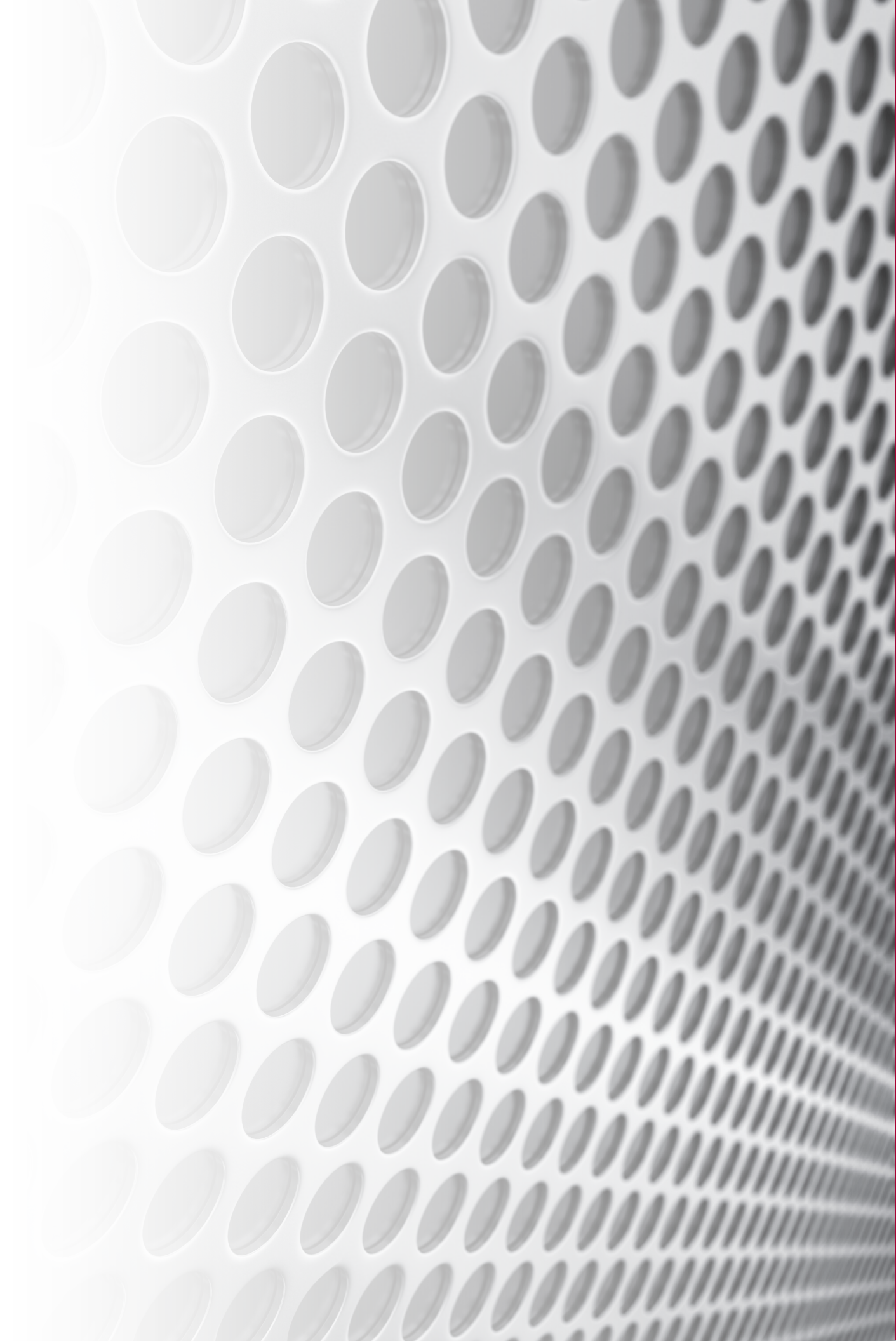
Yes, a particle counter can be fitted to our systems to monitor fuel quality in real time.

## **How does the price of Eco<sub>2</sub>Pure™ compare to other wash methods?**

Eco<sub>2</sub>Pure™ is one of the most competitively priced systems on the market today. Not only in terms of start-up costs, but also in terms of the cents per gallon cost.

Section 5:

# *COLD SOAK FILTRATION*





**Cold Clear™** The ASTM D6751 Cold Soak Filtration Test is leaving many biodiesel producers and consumers “out in the cold.” In response, Schroeder Fuel Filtration is proud to present ColdClear™, a proprietary multi-stage separation technology designed specifically to ensure that biodiesel products conform to this ASTM standard for cold flow properties. The ColdClear™ System consists of a three-stage bank of filters using a combination of filtration and adsorption principles to capture compounds that could cause plugging or crystallization in biodiesel fluids. Notably, ColdClear™ is the first multi-stage treatment system for solving the cold soak filtration dilemma in B-100 biodiesel and biodiesel blends in a single pass.

### The Cold Flow Dilemma

Fuel filter plugging, both in the ASTM procedure and in the field, has been researched significantly with a range of answers to the single question. Most producers and consumers assumed poor cold flow performance was due to feedstock issues, or even poor biodiesel quality. When data started coming in from biodiesel producers across the USA, the answer became even more confusing. A wide range of cold soak results were found for biodiesel samples from a wide range of feedstocks and an even wider range of producers. Obviously, the cold flow problem was not just quality or feedstock dependent.

### Why Cold Soak Matters

Cold flow problems can cripple entire fleets during winter months, as evidenced by widespread reports regarding plugged fuel filters, plugged tank filters, and in some instances, even gelling in storage situations. The ASTM Test is performance-based, and designed to aid fleet managers in understanding the gelling potential of fuel during winter operation. Many researchers believed the key culprits were sterol glucosides and monoglycerides produced during the transesterification reaction. While these compounds were found to be in some samples, other biodiesel samples with low concentrations of these compounds were found to fail the cold soak test. In addition, many samples of biodiesel blends gathered due to plugging instances were found to have water and petroleum-based diesel contaminants on the filter.

### Why ColdClear™ is the Solution

Schroeder Fuel Filtration took this data into consideration in developing ColdClear™, a multi-stage filtration/adsorption system that ensures any potential factors that would initiate crystallization or plugging on the filter are dramatically reduced. By sequentially removing certain impurities that create a higher than normal likelihood of surface crystallization on the filter, our ColdClear™ technology ensures that your biodiesel can meet the ASTM specification for cold soak filtration. It also ensures that fleet customers are receiving the very highest quality biodiesel and will minimize system plugging quality issues. ColdClear™ is effective for B100 and a range of diesel blends, meaning that producers, distributors or even fleet consumers of biodiesel blends can use it.

The cartridges are disposable and easy to remove from the housings. The cartridges can be changed in minutes, which means very little downtime between production runs. Each bank of cartridges is rated to treat a fixed volume of B100 biodiesel, while biodiesel blends are scaled by the blend percentage.

All housings have the option for test points installed in the base. The first housing can be equipped with a visual or electrical differential pressure indicator. Because differential pressure is not a relevant indicator of life for the cartridges in the latter two housings, an indicator is not offered for stage 2 & 3 housings.

- ColdClear™ is a three-stage system with all filters mounted in series on a single skid
- The first stage serves as a pre-filter and captures solid particulates down to three microns in size
- Stages 2 and 3 utilize custom design elements that combine adsorption technologies with the proven effectiveness of Schroeder's high efficiency Excellement® synthetic filtering media
- Multiple units can be employed in parallel to meet higher flow requirements
- The ColdClear™ System can be easily integrated into existing plant piping environments
- If multiple units are required, Schroeder Fuels offers a range of monitoring options to ensure proper operation of the filter banks
- The essence of the ColdClear™ technology is the removal of crystallization precursors from the biodiesel or biodiesel blend. Therefore, knowing the exact flow rate of your system is essential for the ColdClear™ System to be properly sized and configured for a specific application.
- In-plant treatment of biodiesel (B100) to conform to ASTM standards prior to blending or shipment
- In-plant treatment of biodiesel blends (ex. B5, B10, etc) to ensure blended biodiesel meets or exceeds cold flow specifications
- For use in diesel fuel storage and distribution systems where B100 or biodiesel blends are stored and distributed to ensure shipped blends conform to ASTM specifications
- Large fleet terminals that have on-site diesel (and biodiesel blend) storage to ensure tight adherence to cold flow standards
- Unit must be wet for at least 10 hours before use.

	BCC100	BCC300	BCC900	BCC1200	BCC1500
Flow gpm (L/min):	5 (19)	15 (57)	45 (170)	60 (225)	75 (280)
Throughput (gal):	15,000	40,000	120,000	160,000	200,000
Max Oper Press psi (bar):	150 (10.3)	150 (10.3)	150 (10.3)	150 (10.3)	150 (10.3)
Oper Temp °F :	70 Optimal; Allowable 40-100	70 Optimal; Allowable 40-100	70 Optimal; Allowable 40-100	70 Optimal; Allowable 40-100	70 Optimal; Allowable 40-100
Element Case Material:	Steel	Aluminum	Aluminum (Pod arrangement)	Aluminum (Pod arrangement)	Aluminum (Pod arrangement)
Porting Base & Cap Mat'l:	Cast Aluminum	Aluminum	Housing Construction: Steel	Housing Construction: Steel	Housing Construction: Steel
Element Change Clearance in (mm):	8.5 (215)	33.8 (859)	33.8 (859)	33.8 (859)	33.8 (859)
Pre-filter Cartridge P/N:	BCCPREFILTER	BCC39QPRE	BCC39QPRE	BCC39QPRE	BCC39QPRE
Polish Cartridge P/N:	BCCPOLISH	BCC39QPOL	BCC39QPOL	BCC39QPOL	BCC39QPOL
No. of Housings per Stage:	1	1	1	1	1
No. of Cartridges per Stage:	3	1	3	4	5
Cartridge Case Lot Qty:	12	1	1	1	1

**Description** ICF

BDF

BDFA

QCF

BDS

BDCF

**Applications** BDC

HDP-BC

HDP-HT

EPM

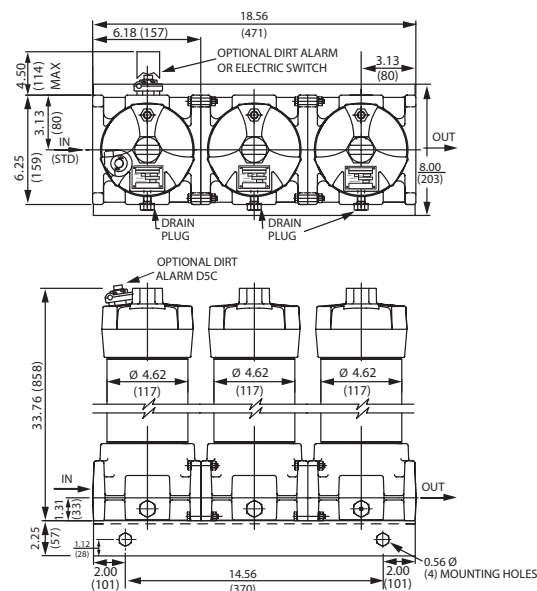
EPTT

**Specifications** EWU

BCC

Notes:

The above results are based on using the best feedstock available



Metric dimensions in ( ).

## Filter Model Number Selection

### How to Build a Valid Model Number for a Schroeder BCC100:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC100					

**Example:** NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC100	V	P16	P16	D5C	UU

= BCC100VP16P16D5CUU

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Seals	Inlet Porting	Outlet Porting
BCC100	V = Viton®	P16 = 1" NPT F16 = 1"SAE 4-bolt flange code 61	P16 = 1" NPT F16 = 1V" SAE 4-bolt flange code 61

BOX 5	BOX 6
Dirt Alarm®	Test Points
Omit = None D5 = Visual Pop-up D5C = Visual Pop-up in cap MS10 = Electrical w/ DIN connector (male end only)	Omit = None UU = Test Points in all housings

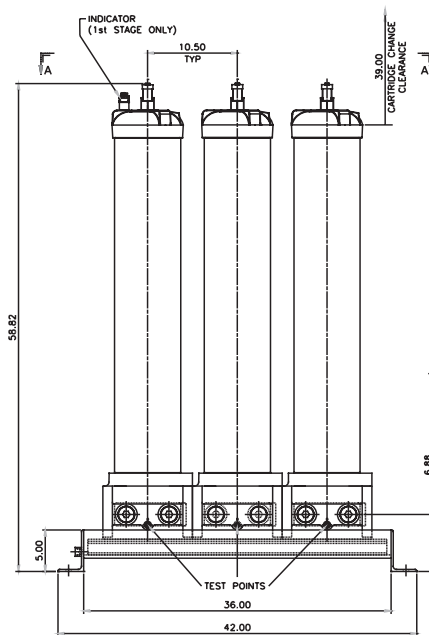
\*Note: Option UU is not available with D5 or MS10 indicator

## Replacement Cartridges

BCCPREFILTER	BCCPOLISH
Stage 1 Cartridge (3 required)	Stage 2 & 3 Cartridges (3 required for each housing)
Performs micron pre-filtering to protect ColdClear™ cartridges	Incorporates ColdClear™ technology

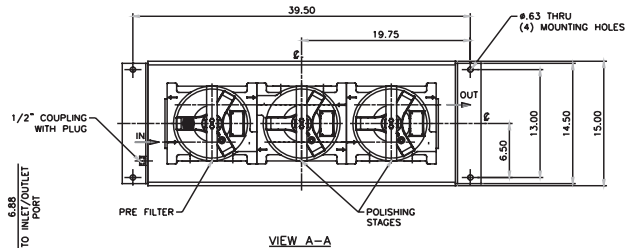
Stage 1 Cartridge:	BCC39QPRE
Stage 2 & 3 Cartridges:	BCC39QPOL





BOX 1 MODEL CODE	BOX 2 SEALS	BOX 3 INLET PORTING	BOX 4 OUTLET PORTING	BOX 5 STAGE 1 INDICATOR	BOX 6 TEST POINTS
BCC300	V=VITON	P24=1 1/2" NPT P32=2" NPT P32=2" SAE 4-BOLT FLANGE CODE 61	P24=1 1/2" NPT P32=2" NPT P32=2" SAE 4-BOLT FLANGE CODE 61	OMIT=NONE D5=VISUAL POP-UP D5C=VISUAL POP-UP IN CAP DPG=DIFFERENTIAL PRESSURE GAUGE MS10=ELECTRICAL W/DIN CONNECTOR (MALE END ONLY)	OMIT=NONE UU=TEST POINTS IN EACH STAGE

STAGE	PART NUMBER	QTY.
1	BCC390PRE	1
2	BCC390POL	1
3	BCC390POL	1



ALL DIMENSIONS SHOWN MAY CHANGE PENDING  
FINAL DESIGN. IF DIMENSIONS SHOWN MUST BE  
HOLD WITHIN A CERTAIN TOLERANCE, PLEASE  
INFORM SCHROEDER INDUSTRIES LLC FOR APPROVAL.

- NOTES:
- 1.) COATING:  
INTERNAL: NONE  
EXTERNAL: STAGE 1 - IRON GREEN  
S.I. SPEC. #144, 145, 146  
STAGE 2 - IRON BLACK  
S.I. SPEC. TBD
  - 2.) HOUSING WILL ACCOMMODATE CARTRIDGE PER  
REPLACEMENT CHART.
  - 3.) ESTIMATED EMPTY WEIGHT: TBD

### How to Build a Valid Model Number for a Schroeder BCC300:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC300					

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC300	V	P32	P32	D5C	UU
= BCC300VP32P32D5CUU					

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Seals	Inlet Porting	Outlet Porting
BCC300	V = Viton®	P24 = 1 1/2" NPT P32 = 2" NPT F32 = SAE 4-bolt flange code 61	P24 = 1 1/2" NPT P32 = 2" NPT F32 = SAE 4-bolt flange code 61

BOX 5	BOX 6
Dirt Alarm®	Test Points
Omit = None D5 = Visual Pop-up D5C = Visual Pop-up in cap DPG = Differential Pressure Gauge MS10 = Electrical w/ DIN connector (male end only)	Omit = None UU = Test Points in all housings

Stage 1 Cartridge:	BCC39QPRE
Stage 2 & 3 Cartridges:	BCC39QPOL

### Filter Model Number Selection

ICF

BDF

BDFA

QCF

BDS

BDCF

BDC

HDP-BC

HDP-HT

EPM

EPTT

EWU

BCC

### Replacement Cartridges

## Filter Model Number Selection

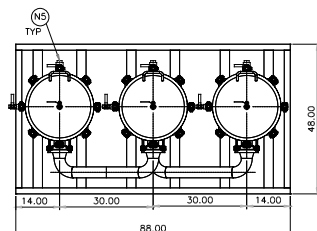
DESIGN DATA			
DESIGN PRESSURE	1149 PSIG		
MIN./MAX. DESIGN TEMP.	40°F–100°F (70° IDEAL)		

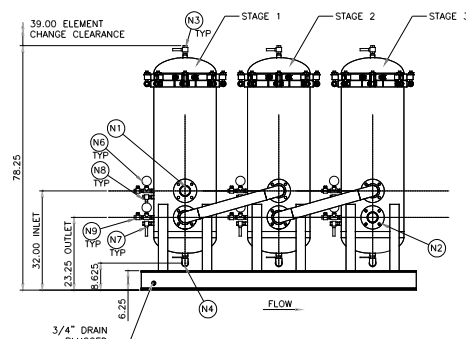
VESSEL OPENING SCHEDULE			
MK. NO.	SIZE	TYPE	REMARKS
N1	•	•	INLET
N2	•	•	OUTLET
N3	3/4"	FNPT	VENT, 1" BALL VALVE
N4	1"	FNPT	CLEAN DRAIN, 1" BALL VALVE
N5	1"	FNPT	DIRTY DRAIN, 1" BALL VALVE
N6/N7	1/2"	FNPT	DPI
N8/N9	1/2"	FNPT	TEST PT., 1/2" BALL VALVE

\* PER MODEL CODE CHART

REPLACEMENT CARTRIDGE				
STAGE	PART NUMBER	QTY. (900)	QTY. (1200)	QTY. (1500)
1	BCC39QPRE	3	4	5
2	BCC39QPOL	3	4	5
3	BCC39QPOL	3	4	5



MODEL NUMBER					
BOX 1 MODEL CODE	BOX 2 SEALS	BOX 3 INLET PORTING	BOX 4 OUTLET PORTING	BOX 5 STAGE 1 INDICATOR	BOX 6 TEST POINTS
BCC900	V=VITON	P48=3" NPT A48=3" ANSI 150# FLANGE	P48=3" NPT A48=3" ANSI 150# FLANGE	OMIT=NONE RD5=VISUAL POP-UP DPG1=DIFFERENTIAL PRESSURE GAUGE RMS10=ELECTRICAL W/DIN CONNECTOR (MALE END ONLY)	OMIT=NONE UU=TEST POINTS IN EACH STAGE
BCC1200					
BCC1500					



## How to Build a Valid Model Number for a Schroeder BCC900:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC900					

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC900	V	P48	P48	RD5	UU

= BCC900VP48P48RD5UU

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Seals	Inlet Porting	Outlet Porting
BCC900	V = Viton®	P48 = 3" NPT A48 = 3" ANSI 150# Flange	P48 = 3" NPT A48 = 3" ANSI 150# Flange

BOX 5	BOX 6
Dirt Alarm®	Test Points
Omit = None RD5 = Visual Pop-up DPG1 = Differential Pressure Gage RMS10 = Electrical w/ DIN connector (male end only)	Omit = None UU = Test Points in all housings

## Replacement Cartridges

Stage 1 Cartridge:	BCC39QPRE
Stage 2 & 3 Cartridges:	BCC39QPOL

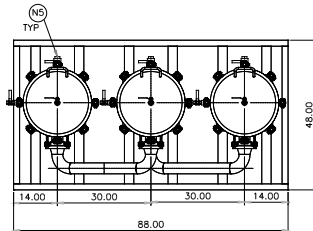
DESIGN DATA			
DESIGN PRESSURE	149 PSIG		
MIN./MAX. DESIGN TEMP.	40°F–100°F (70° IDEAL)		

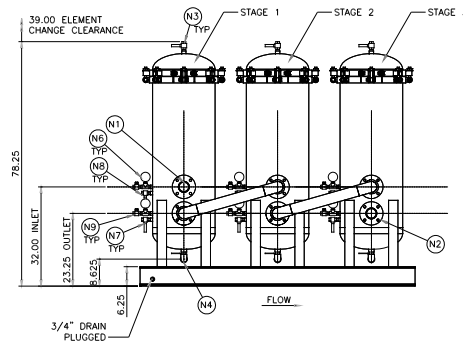
VESSEL OPENING SCHEDULE			
MK. NO.	SIZE	TYPE	REMARKS
N1	•	•	INLET
N2	•	•	OUTLET
N3	3/4"	FNPT	VENT, 1" BALL VALVE
N4	1"	FNPT	CLEAN DRAIN, 1" BALL VALVE
N5	1"	FNPT	DIRTY DRAIN, 1" BALL VALVE
N6/N7	1/2"	FNPT	DPI
N8/N9	1/2"	FNPT	TEST PT., 1/2" BALL VALVE

\* PER MODEL CODE CHART

REPLACEMENT CARTRIDGE				
STAGE	PART NUMBER	QTY. (900)	QTY. (1200)	QTY. (1500)
1	BCC39QPRE	3	4	5
2	BCC39QPOL	3	4	5
3	BCC39QPOL	3	4	5



MODEL NUMBER					
BOX 1 MODEL CODE	BOX 2 SEALS	BOX 3 INLET PORTING	BOX 4 OUTLET PORTING	BOX 5 STAGE 1 INDICATOR	BOX 6 TEST POINTS
BCC900	V=VITON	P48=3" NPT A48=3" ANSI 150# FLANGE	P48=3" NPT A48=3" ANSI 150# FLANGE	OMIT=NONE RD5=VISUAL POP-UP DPG1=DIFFERENTIAL PRESSURE GAUGE RMS10=ELECTRICAL W/DIN CONNECTOR (MALE END ONLY)	OMIT=NONE UU=TEST POINTS IN EACH STAGE
BCC1200					
BCC1500					



## How to Build a Valid Model Number for a Schroeder BCC1200:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC1200					

Example: NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
BCC1200	V	P48	P48	RD5	UU	= BCC1200VP48P48RD5UU

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Seals	Inlet Porting	Outlet Porting
BCC1200	V = Viton®	P48 = 3" NPT A48 = 3" ANSI 150# Flange	P48 = 3" NPT A48 = 3" ANSI 150# Flange
BOX 5	BOX 6		
Dirt Alarm®	Test Points		
Omit = None RD5 = Visual Pop-up DPG1 = Differential Pressure Gage RMS10 = Electrical w/ DIN connector (male end only)	Omit = None UU = Test Points in all housings		

Stage 1 Cartridge: BCC39QPRE  
Stage 2 & 3 Cartridges: BCC39QPOL

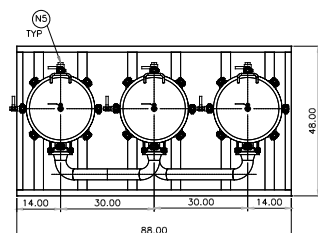
Replacement Cartridges



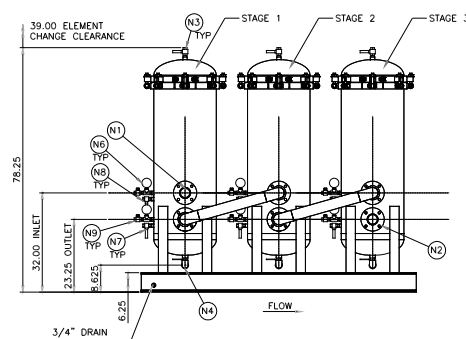
DESIGN DATA			
DESIGN PRESSURE		14.9 PSIG	
MIN./MAX. DESIGN TEMP.		40°F - 100°F (70° IDEAL)	
VESSEL OPERATING SCHEDULE			
WK. NO.	SIZE	TYPE	REMARKS
N1	*	*	INLET
N2	*	*	OUTLET
N3	3/4"	FNPT	VENT, 1" BALL VALVE
N4	1"	FNPT	CLEAN DRAIN, 1" BALL VALVE
N5	*	FNPT	DIRTY DRAIN, 1" BALL VALVE
N6/N7	1/2"	FNPT	DR
N8/N9	1/2"	FNPT	TEST PT., 1" BALL VALVE

\* RFR MODEL CODE CHART

REPLACEMENT CARTRIDGE				
STAGE	PART NUMBER	QTY. (900)	QTY. (1200)	QTY. (1500)
1	BCC39QPRE	3	4	5
2	BCC39QPOL	3	4	5
3	BCC39QPOL	3	4	5



A	MODEL NUMBER					
	BOX 1 MODEL CODE	BOX 2 SEALS	BOX 3 INLET PORTING	BOX 4 OUTLET PORTING	BOX 5 STAGE 1 INDICATOR	BOX 6 TEST POINTS
	BC900	V=VITON	P48=3" NPT A48=3" ANSI 150# FLANGE	P48=3" NPT A48=3" ANSI 150# FLANGE	OMIT=NONE R05=VISUAL POP-UP DPG1=DIFFERENTIAL PRESSURE GAUGE RMS10=ELECTRICAL W/DIN CONNECTOR (MALE END ONLY)	OMIT=NONE UU=TEST POINTS IN EACH STAGE
	BC1200					
	BC1500					



## Filter Model Number Selection

## How to Build a Valid Model Number for a Schroeder BCC900:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BCC1500					

**Example:** NOTE: One option per box

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
BCC1500	V	P48	P48	RD5	UU	= BCC1500VP48P48RD5UU

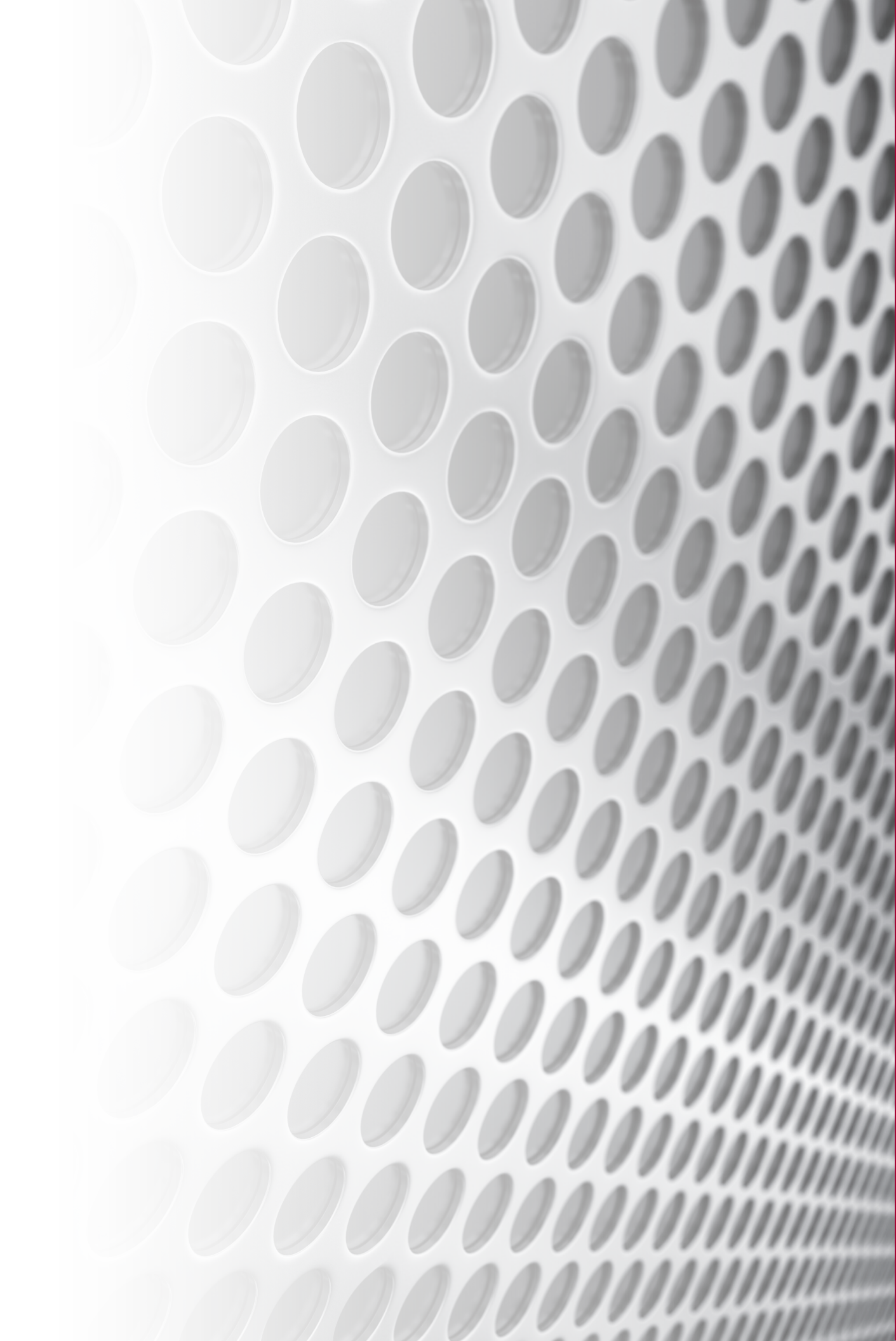
BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	Seals	Inlet Porting	Outlet Porting
BCC1500	V = Viton®	P48 = 3" NPT A48 = 3" ANSI 150# Flange	P48 = 3" NPT A48 = 3" ANSI 150# Flange
BOX 5	BOX 6		
Dirt Alarm®	Test Points		
Omit = None RD5 = Visual Pop-up DPG1 = Differential Pressure Gage RMS10 = Electrical w/ DIN connector (male end only)	Omit = None UU = Test Points in all housings		

## Replacement Cartridges

Stage 1 Cartridge:	BCC39QPRE
Stage 2 & 3 Cartridges:	BCC39QPOL

Section 6:

# *BIO & DIESEL FUEL QUALITY CONTROL*



# Final Polishing | High Efficiency Particulate Filtration for Bio & Diesel Fuel

## The Importance of Final Polishing

Irrespective of the wash process you choose for your production facility, final polishing of biodiesel is essential to ensure that fuel, once washed, is free of solid contaminants, moisture, production and wash residues. As the final step in the production process, it gives the producer total peace of mind that the fuel produced is clean and dry. Final polishing is a fundamental part of the overall production process and one that is far too frequently overlooked. It is also overlooked in dry wash purification using ion exchange resin as small particles can migrate downstream.

Final fuel quality and in-house quality control are key aspects in successful biodiesel production. Batch consistency and traceability is the main difference between successful and unsuccessful producers.

Final polishing is the last production stage in order to achieve stringent industry quality standards. Irrespective of the wash method used, final polishing is required to remove microscopic contaminants invisible to the naked eye, that could result in serious engine damage.

### K9 Medium Pressure Filter



- Base-ported in-line filter available in three different lengths
- Extremely versatile multiple inlet and outlet porting possibilities
- Stacked K-size elements require less than 9" clearance to change elements
- Available with cleanable metal mesh or high efficiency synthetic Excellement® elements
- Please note Viton® seals required for this application

### QF15 In-Line Filter



- High flow (500 gpm; 1900 L/min), high capacity (39" elements) filter
- Pressure up to 1500 psi (100 bar)
- L-ported (QLF) or Inline (QF) allows for installation flexibility
- Available with re-cleanable metal mesh or high efficiency synthetic Excellement® elements (including p/n 39Q150PSV)
- Please note Viton® seals required for this application

#### Notes:

1. Please see our Hydraulic & Lube Filtration Catalog (L-2520E) for drawings and complete sizing information.

# Final Polishing | Offline or Kidney Loop for Biofuels



- Modular base eliminates hoses between components and minimizes leakage
- Base-ported filter provides easy element service from the top cap
- Single, double and triple bowl length option allows the flexibility of additional dirt-holding capacity
- D5 Dirt Alarm® indicates when filter element needs changed
- Cleans up oil faster – 7 gpm and 14 gpm models available
- Hoses and connection tubes included
- Drip pan catches oil before it falls to the ground
- Integral suction strainer protects pump
- Off-line stationary system available
- Two 7/16 – 20 UNF sampling ports included on all models



**MFS / MFD**

- Protects and extends the life of expensive components Features
- Minimizes downtime and maintenance costs
- Designed to handle high viscosity oils up to 25,000 SUS (see Skid Selection; previous page)
- Many component combinations and variable starter options allow the flexibility to match specific user needs
- Four wheel cart option provides product portability
- Integral drip pan with drain plug protects oil from spilling on ground
- Sample valves provided at filter base for fluid sampling
- Market leading Schroeder Excellement® synthetic filtering media provides for quick, efficient clean up with maximum element life
- Availability of all plastic, environmentally friendly, coreless elements for QF15 housings (X1-X6 only)



**X Series Skids**

**Notes:**

1. Please see our Filter Systems Catalog (L-2681C) for drawings and complete sizing information.



# Fuel Quality Measurement Tools

## Online Quality Control

If you are a high volume producer, minutes count. Finding that you have produced dirty fuel an hour late can leave you with thousands of gallons of problem fuel. Online sensors can help you catch the problem before your customer does. While particle and moisture sensors will not tell you if your centane number is correct or if your flash point is acceptable; they will tell you how much particulate or moisture is in your biofuel. As the fuel passes the sensor, it can display a problem with a filter upstream and if the dry washing chemical (or any other particulate that could clog a fuel filter) is not being removed to standard.

## Offline Quality Control

Taking and examining samples during various stages of your production process can provide a priceless level of visibility to troubleshooting or even just understanding your current biodiesel production processes.

The samples below show how much the appearance of biodiesel changes as it progresses through the various stages of production. These samples were taken at key stages in the production process and clearly demonstrate the importance of effective filtration throughout.

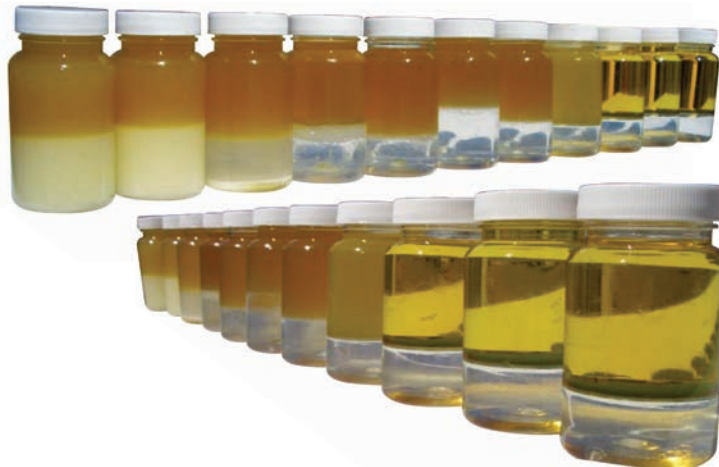
1. WVO (Waste Vegetable Oil):  
Pre-filtered
2. Biodiesel after reaction and  
initial glycerin drain
3. After 8-hour settling-final  
glycerin drain
4. Dry washing using Magnesol.  
Sample taken from wash tank.  
Significant improvement in clarity  
and excellent pH neutralization  
at this stage. Magnesium silicate  
powder still clearly visible at base  
of sample bottle



5. Sample taken after the Biodiesel Wash Tower showing great clarity and further reduction in pH value
6. After final polishing using the K9. Final effective contaminant and moisture removal and yet further reduction in pH values. Cleanliness in accordance with ISO 4406: 16/14/11

## Simple Water Test

The line of sample bottles below shows the difference between freshly produced, “dirty” biodiesel still highly contaminated with production chemicals (i.e. Methanol and NaOH left) through to the washed and polished clean samples (right). By adding a small amount of water to a sample bottle containing biodiesel, the water will collect at the base of the bottle, and the clarity of the water is a very good indicator of the level of impurities present. This in effect is a mini “wet wash.”



# Diesel Fuel Quality Analysis Kits

Fuel analysis can identify potential causes for fuel filter plugging, smoking, loss of power, poor injector performance, malfunctioning throttle position sensors and sticking valves. Testing also confirms a diesel fuel's sulfur content, biodiesel content and compliance with manufacturer specifications and standards for cleanliness that could affect equipment warranty requirements.

Schroeder Industries offers Troubleshooting and Diesel fuel quality test packages. All packages include pre-paid testing and the required number of fuel containers for sample.

**\*Total sample volume 32 oz required for all tests listed below**

Contamination Tests	Schroeder P/N: 02098006	Includes	Sample Amount
<ul style="list-style-type: none"> <li>Identifies contamination from external sources - oil, biological growth, water, sediment</li> </ul>		ICP	2mL
		Flash Point	200mL
<ul style="list-style-type: none"> <li>Identifies contamination to be the result of a change in the fuel's physical properties - low thermal stability may require use of an asphaltene conditioner</li> </ul>		Thermal Stability	120mL
		Water and Sediment	200mL
		Bacteria, Fungi, Mold	120mL
Smoking Tests	Schroeder P/N: 02098007	Includes	Sample Amount
<ul style="list-style-type: none"> <li>Identifies low cetane index or water contamination - loss of power, white smoke</li> </ul>		Sulfur	50mL
		Cetane Index	100mL
<ul style="list-style-type: none"> <li>Identifies excessive sulfur content - black smoke</li> </ul>		API Gravity	400mL
		Distillation	200mL
		Water and Sediment	200mL
Filter Plugging Tests	Schroeder P/N: 02093395	Includes	Sample Amount
<ul style="list-style-type: none"> <li>Identifies contamination from external sources specific to filter plugging - high particle count, biological growth</li> </ul>		Thermal Stability	120mL
		Bacteria, Fungi, Mold	120mL
<ul style="list-style-type: none"> <li>Identifies contamination due to a change in the fuel's physical properties - low thermal stability or insufficient cold weather capability for operating environment</li> </ul>		Pour Point	100mL
		Cloud Point	100mL
		Cold Filter Plug Point	100mL
		Particle Count	80mL
Cleanliness Tests	Schroeder P/N: 02098008	Includes	Sample Amount
<ul style="list-style-type: none"> <li>Identifies water contamination - can lead to smoking, biological growth and corrosion</li> </ul>		Karl Fischer	10mL
		Particle Count	80mL
<ul style="list-style-type: none"> <li>Identifies particulate contamination - can result in extreme wear in high pressure fuel systems which may cause premature injector failure</li> </ul>			
Wear Prevention Tests	Schroeder P/N: 02098009	Includes	Sample Amount
<ul style="list-style-type: none"> <li>Identifies cause of wear - water contamination, excessive particles or insufficient lubricity</li> </ul>		Karl Fischer	10mL
		Particle Count	80mL
		Lubricity	20mL

## Troubleshooting Test Packages

Notes: All fuel samples must be shipped via UPS Ground.

Includes prepaid testing and one fuel can per product sample

# Diesel Fuel Quality Analysis Kits

## Fuel Quality Test Packages

**\*Total sample volume 64 oz required for all tests listed below**

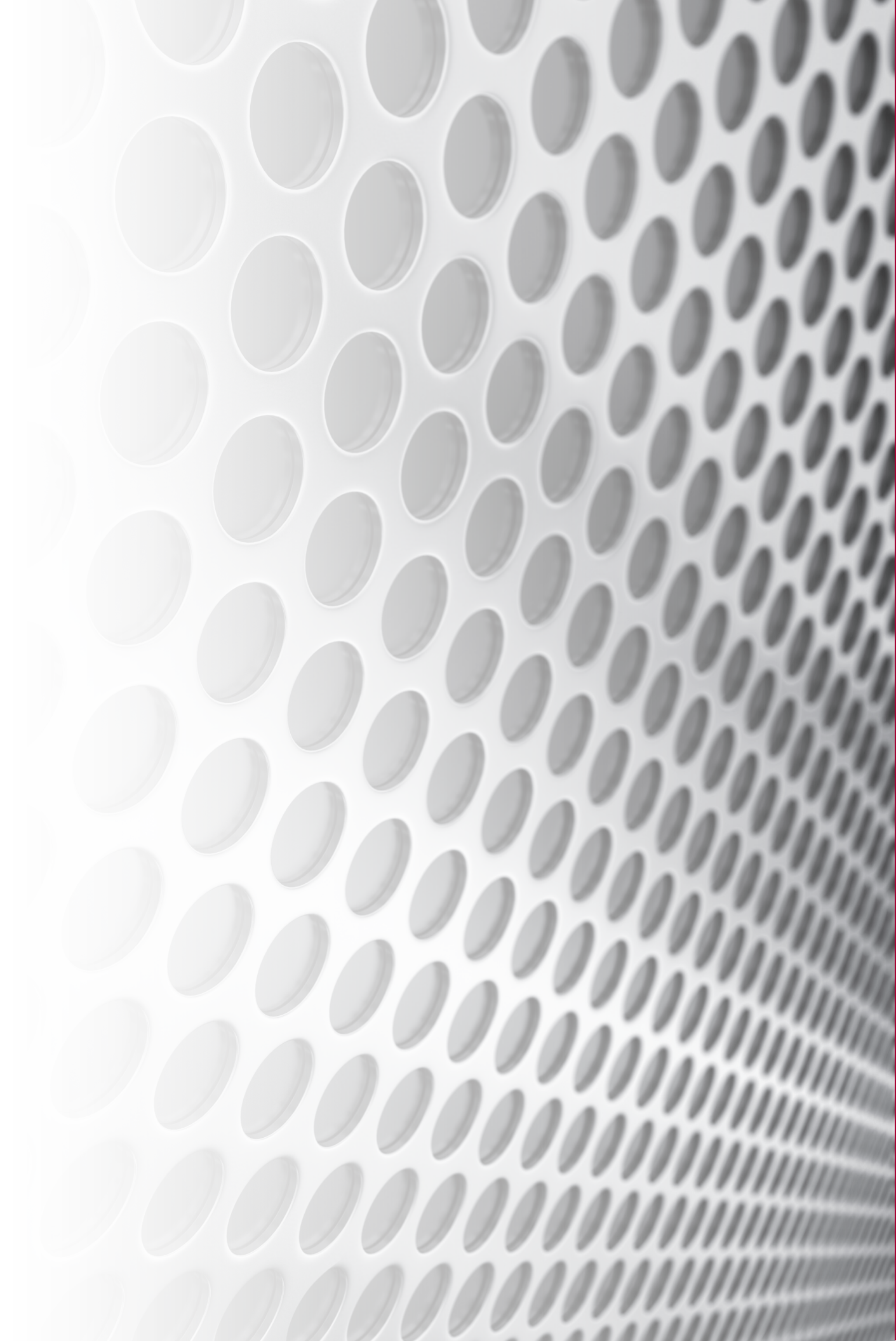
Summer Tests	Schroeder P/N: 02098010	Includes	Sample Amount
<ul style="list-style-type: none"> <li>Identifies contamination from external sources - oil, biological growth, water, sediment</li> <li>Identifies contamination to be the result of a change in the fuel's physical properties - low thermal stability may require use of an asphaltene conditioner</li> </ul>		Flash Point	200mL
		Water and Sediment	200mL
		Kinematic Viscosity	2mL
		Sulfur	50mL
		Cetane Index	100mL
		API Gravity	400mL
		Distillation	200mL
		Thermal Stability	120mL
		Bacteria, Fungi, Mold	120mL
		ICP	2mL
Winter Tests	Schroeder P/N: 02098011	Includes	Sample Amount
<ul style="list-style-type: none"> <li>Identifies low cetane index or water contamination - loss of power, white smoke</li> <li>Identifies excessive sulfur content - black smoke</li> </ul>		Flash Point	200mL
		Water and Sediment	200mL
		Kinematic Viscosity	2mL
		Sulfur	50mL
		Cetane Index	100mL
		API Gravity	400mL
		Distillation	200mL
		Thermal Stability	120mL
		Pour Point	100mL
		Cloud Point	100mL
		Bacteria, Fungi, Mold	120mL
		ICP	2mL

Notes: All fuel samples must be shipped via UPS Ground.

Includes prepaid testing and two fuel cans per product sample

Section 7:

# COALESCING ELEMENTS





# Schroeder BestFit® Replacement Coalescing Elements



Schroeder BestFit® Coalescing Filters are manufactured using multiple layers, depending on the part number, to meet or exceed OEM element performance. All coalescing elements feature a hydrophilic microglass core that condenses micro-emulsions into water droplets that fall from the downstream side of the element. The density of this microglass core changes throughout its thickness to optimize the coalescing process. Where applicable, upstream pleated cellulose pre-filter layers are an integral part of the element. The pre-filters provide excellent fuel cleanliness and also protect the coalescing core throughout its life.

The single pass efficiencies are comparable or higher than the OEM element. A wide variety of Schroeder coalescing cartridges replace most manufacturers' elements. All end caps, seal types, and medias are engineered to offer superior performance. Schroeder replacement elements are direct dimensional and performance replacements.

The Schroeder patented multi-phase coalescing element-in-one technology allows for smaller size, high efficiency and cost optimized filtration.

\* Elements available for most manufacturers' part numbers

## Element Specifications

Differential Pressure Rating: Up to 75 psid (dependent on part number)

pH Range: 5 to 9

Maximum Operating Temperature Range: 225°F (°C)

Bypass Setting: Particulate: 20 psi (1.37 bar)  
Coalescing: 30 psi (2 bar)

Cap Material: Plated Aluminum  
\*Threaded base elements have injection-molded, glass filled nylon end caps

Center Tube Material (when included): Plated Steel

Seal Material: Buna N (other materials available upon request)

Notes: See PDF Document of coalescing elements cross reference by manufacture and BestFit Cross reference for specific inquiries at [www.schroederindustries.com](http://www.schroederindustries.com)

## **FAME**

Fatty Acid Methyl Ester (FAME) is commonly known as biodiesel. It is generated from vegetable oil (e.g. soybean oils) or animal fat, which have been transesterified with methanol. The transesterification is the process of exchanging the organic group of an ester with the organic group of alcohol.

### **Density (EN ISO 3675, EN ISO 12185)**

Biodiesel generally has a higher density than mineral diesel (EN 590 820-845 kg/m<sup>3</sup> at 15°C). Density increases with a decrease in chain length and with unsaturation. This can impact on fuel consumption as fuel introduced into the combustion chamber is determined volumetrically.

### **Viscosity (EN ISO 3104, ISO 3105, D445)**

Viscosities of neat vegetable oils are many times higher which leads to serious problems in unmodified engines. The increase in viscosity results in poor atomization and incomplete combustion which leads to coking of injector tips. This results in engine power loss. Biodiesel still has higher viscosity than mineral diesel (3.50-5.00 mm<sup>2</sup>/s at 40°C vs 2.00-4.50 mm<sup>2</sup>/s). Viscosity decreases with unsaturation but increases markedly with contamination by mono, di or triglycerides.

### **Flash Point (ISO 3679, IP 523, IP 524, D93)**

Pure rapeseed methyl ester has a flash point value of up to 170°C. This method is therefore looking at residual components within the fuel that are combustible, especially methanol which is a particular hazard due to its invisible flame.

### **Sulfur Content (En ISO 20846, EN ISO 20884, D5453)**

Sulfur emissions are harmful to human health and high sulfur fuels cause greater engine wear and in particular shorten the life of the catalyst. Biodiesel derived from pure Rapeseed oil will contain virtually no Sulfur, however FAME derived from animal sources may contain significant quantities.

### **Carbon Residue (EN ISO 10370)**

The Carbon Residue is the material left after evaporation and pyrolysis of a sample fuel. This is a measure of the tendency of a fuel to produce deposits on injector tips and the combustion chamber. For FAME samples it is an indication of the amount of glycerides, free fatty acids, soaps and catalyst residues remaining within the sample.

### **Cetane Number (EN ISO 5164, D613)**

This serves as a measure of ignition quality. This is the most pronounced change from vegetable oil to the transesterified product. Fuels with low cetane numbers show an increase in emissions due to incomplete combustion. Palm Oil and Tallow derived biodiesels have the best cetane numbers.

### **Sulfated Ash (ISO 3987, D874)**

Ash describes the amount of inorganic contaminants, such as catalyst residues, remaining within the fuel. Ash is related to engine deposits on combustion.

### **Water Content (EN ISO 12937)**

As FAME is hygroscopic it can pick up water during storage and as such there can be problems meeting the specification. At around 1500 ppm the solubility limit is reached and the water bottoms out. Free water promotes biological growth and the reverse reaction turning biodiesel into free fatty acids.

# Glossary

## **Total Contamination (En 12662, ASTM 2709)**

Because production contaminants like residues and soaps can still be present in the purification stage of making biodiesel, the use of Schroeder Fuel Filtration final polishing makes achieving total contamination to EN12662/ASTM D2709 the best way to ensure the total removal of production residues, which means clean fuel and peace of mind.

## **Copper Strip Corrosion (EN ISO 2160, D130)**

This is defined as the likelihood to cause corrosion to copper, zinc and bronze parts of an engine. A polished metallic strip is heated at 50°C for 3 hours, washed and compared to standards. Corrosion is likely to be caused by free acids or sulfur compounds. However FAME gives consistently good results in this area and is unlikely to fail due to the low sulfur content.

## **Oxidation Stability**

This property relates to the overall storage stability of the fuel. The higher the degree of unsaturation (double bonds) within the FAME molecules gives a decrease in oxidative stability, which means that the longer it is stored, the greater the reduction in quality will be. Tests have shown that Eco<sub>2</sub>Pure™ can extend the product life of biodiesel via the removal of moisture, mono, di and triglycerides.

## **Acid Value (EN 14104, D664)**

Acid value is a measure of mineral acids and free fatty acids contained in a fuel sample. It is expressed in mg KOH required to neutralize 1g of FAME. High fuel acidity is linked with corrosion and engine deposits.

## **Iodine Value (EN 14111)**

Iodine number is a measure of total unsaturation (double bonds) within the FAME product. It is expressed as the grams iodine required to react with 100g of FAME sample. High iodine value is related to polymerization of fuels, leading to injector fouling. It is also linked to poor storage stability.

## **Ester Content (EN 14103)**

This is measured using gas chromatography and is restricted to esters falling within the C14-C24 range. It is ultimately a test for reaction conversion. Linolenic and polyunsaturated esters are controlled as they have been shown to display a disproportionately strong effect on oxidative stability.

## **Methanol Content (EN 14110)**

Methanol can be removed from FAME by washing or distillation. High methanol contents pose safety risks due to the very low flash point of methanol.

## **Glycerides (EN 14105, EN 14106, D6584)**

There is a limit on the mono, di, and triglycerides of no more than 0.80%, 0.20% and 0.20% respectively. Total glycerol is the sum of the bound and free glycerol and must not exceed 0.25%. Failing to meet the spec implies low conversion to ester and deposit formation on injectors and valves.

## **Group I Metals**

Sodium and Potassium are limited to a combined 5ppm. These arise from the addition of catalyst, and result in high ash levels in the engine.

## **Group II Metals**

Calcium and Magnesium are limited to a combined 5ppm. These may arise from the addition of hard water in the washing process. Calcium and Magnesium soaps have been related to injector pump sticking.

## **Phosphorous Content (EN14107, D4951)**

The phosphorous limit is approx. 10 ppm and normally arise from phospholipids within the starting material or from addition of phosphoric acid in the production process. High phosphorus fuels are suspected of poisoning catalysts and increasing emissions.

## **CFPP (EN 116)**

Cold Filter Plugging Point was considered to be a suitable indicator of low temperature operability. It defines a temperature at which a fuel is no longer filterable within a specified time limit.

## **Filter Clogging**

Filter clogging can be caused by Asphaltines which are held in suspension in all diesel fuels. Exposure to elevated temperatures causes the Asphaltines to fall out of suspension, agglomerate and clog filters. In addition, bacteria/fungi/mold-water, usually due to condensation, not only contaminated the fuel, it also provides a breeding ground for micro-organisms that feed on the fuel's hydrocarbons. The formation of wax crystals are the result of exposure to low temperatures. Dirt sediment and rust are typical of poor maintenance practices.

## **ASTM D975 Specifications**

The ASTM D975 provides the detailed specifications for Diesel Fuel Oils, this includes: Flashpoint, Distillation temp. 194°F (90°C), Viscosity, Ash %, Copper strip corrosion rating, Cetane number, Cetane index or Armoaticity %, Cloupoint or cold filter plug point (CFPP), Carbon residue, Lubricity and Conductivity.

## **Cloudpoint**

Diesel fuels have pour points and cloudpoints within their application temperature range, unlike gasoline, which has freezing points well below even the most severe winter conditions. Ships and railroad applications typically do not experience cloudpoints because heated storage can be arranged. On- and off-highway applications must take precautions to tailor low temperature fuel properties for cold weather. Seasonal blending to control cloudpoint is the refiners assurance against field problems.

## **Contamination Removal**

Contamination removal protects fuel pump injectors. The focus of contamination are water (condensation), micro-organisms (found in water feeds and hydrocarbons), Wax (crystals form in low temperatures), asphaltines ( form in presence of high temperatures) and dirt/sediment/rust (the results of poor maintenance). Schroeder's Z-Media® is a highly effective way to remove dirt/sediment/rust in the fuel.

## **Coalescing Principal**

The coalescing principal is removal of water from diesel fuels and it can be a highly effective method. Schroeder developed a fuel and water separation media technology in a multi -phase element construction for high efficiency, single-pass removal of free and emulsified water in Ultra-low Sulfur Diesel (ULSD) and blends.

In general terms, it functions as follows: A synthetic pre-filter pleat pack filters the fuel, first to remove particles and to protect the downstream coalescing media. The coalescing media is a porous or fibrous media that collects small water droplets. Those smaller droplets combine to larger droplets which eventually sink in the lighter oil, driven by gravity, and collect in the base of the filter bowl where the water can be drained.

# Glossary

## Micro-Organisms

For bacteria, fungi and mold, diesel fuel is a food source that requires oxygen (Aerobic Bacteria). Water provides oxygen as well for Micro-Organisms to grow. These Micro-Organisms exist in plugged filters, but can be removed with quality filtration.

## Storage Stability

In storage, diesel fuels are attacked by atmospheric oxygen, which can cause deposits of varnish, and for marine fuels containing residual components, asphaltic material. Copper metal deactivators reduce the catalytic effects of screens and other parts. In the presence of water, bacterial action can cause a build-up of slime in the storage system, leading to filter plugging. In cold-weather areas, there is the risk of static electric charges building up during high-rate dispensing of distillate fuels.

Sulfated Ash

## Wax Crystals

Crystals form in cold temperatures. Pourpoint is the temperature where paraffin crystals start to form. Crystals will plug injector nozzles. Treat fuel if operating within -4°F (20°C) of Pourpoint with pourpoint depressant. It is recommended to test for pourpoint from November to March. Schroeder recommends you review cold clear to treat wax crystals.

In recent times, the US Biodiesel Standard ASTM D6751, and the more stringent European standard EN14214, have been used to show the capabilities of biodiesel production equipment, which is impossible to achieve with just a biodiesel reactor alone. So as to pass the 24 sub-tests, which make up EN14214, it is important to see biodiesel as having three main phases of production:

- Pre-filtration
- Reaction
- Purification

Due to the fact the EN14214 is made up of 24 different tests, which cover several key parts of production and rely upon the acquisition of adequate quality feedstocks and good working processes, the production of biodiesel cannot be accounted for by a single piece of equipment. Due to all the variables, that only you as the producer can control, that may influence your production process, Schroeder Fuel Filtration cannot guarantee results that will pass EN14214/ASTM D6751. We can, however, highlight the processes and procedures to which producers should adhere. A simple suite of tests can be conducted at the time of manufacture to give confidence that the produced biodiesel will meet the EN14214/ASTM D6751 specification. The easily obtained results can also be used to troubleshoot the manufacturing process, helping the purification system work to its optimum level and giving you confidence in its output.

### ASTM 6751-11a

This Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels ("Diesel") covers the specifications for biodiesel in the U.S. it closely resemble the more international accepted EN14214.

Property	ASTM Method	Limits	Units
Calcium & Magnesium, combined	EN 14538	5 maximum	ppm (µg/g)
Flash Point (closed cup)	D 93	93 minimum	°C
Alcohol Control (one to be met)			
1. Methanol Content	EN 14110	0.2 maximum	mass %
2. Flash Point	D 93	130 minimum	°C
Water & Sediment	D 2709	0.05 maximum	% vol.
Kinematic Viscosity, 40°C	D 445	1.9 – 6.0	mm²/sec.
Sulfated Ash	D 874	0.02 maximum	% mass
Sulfur			
S 15 Grade	D 5453	0.0015 max.	% mass (ppm)
S 500 Grade	D 5453	(15) 0.05 max. (500)	% mass (ppm)
Copper Strip Corrosion	D 130	No. 3 maximum	
Cetane	D 613	47 minimum	
Cloud Point	D 2500	report	°C
Carbon Residue 100% sample	D 4530*	0.05 maximum	% mass
Acid Number	D 664	0.5 maximum	mg KOH/g
Free Glycerin	D 6584	0.020 maximum	% mass
Total Glycerin	D 6584	0.240 maximum	% mass
Phosphorus Content	D 4951	0.001 maximum	% mass
Distillation	D 1160	360 maximum	°C
Sodium/Potassium, combined	EN 14538	5 maximum	ppm (µg/g)
Oxidation Stability	EN 15751	3 minimum	hours
Cold Soak Filtration	D7501	360 maximum	seconds
For use in temperatures below -12°C	D7501	200 maximum	seconds

\* The carbon residue shall be run on the 100% sample.

\* Combined water and contamination test under ASTM D2709 Reference Glossary for explanation on the specifications

### EN 14214

All road fuels are subject to strict quality controls which are vital to maintain standards and provide authorities with the ability to assess safety risks and environmental pollution. For example regular mineral diesel is subject to the EN 590 standard. In 1997 the European Committee for Standardization was given the task to develop a uniform standard for Fatty Acid Methyl Ester (FAME). The result was the EN14214 specifications.

The introduction of this standard in 2004 is valid for all member states of the European Union. In particular this standard gives engine and automobile makers the ability to give warranties to those vehicles which run on Biodiesel. At present a limit of 5% FAME is allowed in the EN590 specification for mineral diesel. This 5% must conform to the EN14214 standard. Diesel Fuel Injection Equipment (FIE) manufacturers stress the importance of EN14214.

EN 14214 - Property	Units	Lower Limit	Upper Limit	Test-Method
Ester content	% (m/m)	96,5	-	EN 14103
Density at 15°C	kg/m³	860	900	EN ISO 3675/EN ISO 12185
Viscosity at 40°C	mm²/sec.	3,5	5,0	EN ISO 3104
Flash point	°C	> 101	-	ISO 3679
Sulfur content	mg/kg	-	10	-
Tar remnant (at 10% distillation remnant)	% (m/m)	-	0,3	EN ISO10370
Cetane number	-	51,0	-	EN ISO 5165
Sulfated ash content	% (m/m)	-	0,02	ISO 3987
Water content	mg/kg	-	500	EN ISO 12937
Total contamination	mg/kg	-	24	EN 12662
Copper band corrosion ( 3 hours at 50°C)	rating	Class 1	Class 1	EN ISO 2160
Cold filter plugging point (CFPP)	°C	-	*	EN 116
Oxidation stability, 110°	hours	6	-	EN 14112
Acid value	mg KOH/g	-	0,5	En 14104
Iodine value	-	-	120	EN 14111
Linolic Acid Methylester	% (m/m)	-	12	EN 14103
Polyunsaturated (> = 4 Double bonds) Methylester	% (m/m)	-	1	-
Methanol content	% (m/m)	-	0,2	EN 14110
Monoglyceride content	% (m/m)	-	0,8	EN 14105
Diglyceride content	% (m/m)	-	0,2	EN 14105
Triglyceride content	% (m/m)	-	0,2	EN 14105
Free Glycerine	% (m/m)	-	0,02	EN 14105/EN 14106
Total Glycerine	% (m/m)	-	0,25	EN 14105
Alkali Metals (Na +K)	mg/kg	-	5	EN 14108/EN 14109
Phosphorus content	mg/kg	-	10	EN 14107

\* requirments: 15.04 - 30.09. max. 0°C  
 01.10. - 15.11. max. -10 °C  
 16.11. - 28.02. max. -20 °C  
 01.03. - 14.04. max -10 °C





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