Telematic Communications Module with Remote Controlled Sampling System

HY-TRAX®

Patent pending

Communications Module with Remote Controlled Sampling System

Features and Benefits

- Provides Remote Visibility to the Fluid Condition of Critical Systems.
- Integrated micro VSD, (Variable Speed Drive), pump/motor provides optimal flow for accurate sensor readings in variable conditions.
- This HY-TRAX® Remote Oil Contamination Sensor Package allows remote access via the Internet and smart devices to fluid particle counts, temperature, and percent water saturation levels (optional) displayed on a customizable dashboard. The fluid sampling system collects data and the communications module transmits this data via GSM cellular at scheduled intervals. Users can receive alerts via email when a fluid's ISO contamination code or water saturation level (optional) reaches user defined critical levels. The unit can sample fluid directly from a fluid reservoir or low pressure line (<50 psi).
- The Communications Module automatically controls fluid flow to compensate for viscosity changes due to temperature or fluid type. All data is transmitted through a secure VPN and archived in a protected database in the cloud to allow real-time and historical analysis.
- The HY-TRAX® Communications Module will provide maintenance managers with the visibility and vital information necessary to pro-actively schedule preventative maintenance on local and remote equipment. Maintenance decisions can now be based on accurate and real-time data.
- The communications module components are mounted and housed in a rugged IP 40 enclosure.
- Fluid sampling system standard with Viton® seals.
- Fluid viscosities up to 350 cSt.
- 50 psi (max.) working pressure.
- Flow control valve providing optimal pressure for accurate sensor readings.
- VSD, (Variable Speed Drive), pump/motor providing optimal flow for accurate sensor readings.

What's Included

- TestMate® Contamination monitor (TCM)
- Flow Control Valve
- GSM cellular communications
- VSD pump/motor
- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment
- TestMate® Contamination Monitor (TCM) Communications/Power Cable
- Specially designed fitting for mating to pump/motor
- Plugged water sensor port (G3/8)
- IP 40 enclosure
- Water sensor (optional)
- 24 volts DC standard with optional 115 VAC Power Supply
- Optional Water Sensor (TWS-D) Communication/Power Cable
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)

Applications

- Mobile Equipment Technology
- Surface Mining
- Construction
- Monitoring of Oil Cleanliness in Storage Tanks
- Fleet Services
- Rail

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Telematic Communications Module with Remote Controlled Sampling System

Specifications

Measuring Range:	Display ISO ranges between 25/24/23 and 9/8/7 Calibration within the range ISO 13/11/10 to 23/21/18
Contamination Output Code:	**Standard:** ISO 4406:1999 or SAE AS 4059(D) **Optional:** ISO4406:1987; NAS 1638 and ISO 4406:1999
Self-Diagnosis:	Continuously with error indication via status LED
Pressure Rating:	50 psi (3.4 bar) max
Fluid Inlet/Outlet:	SAE ORB, Size 4
Seal Material:	Viton®
Pump Speed:	500-5000 rpm (adjustable)
Optimal Sampling Pump Flow Rate:	0.008-0.079 gpm (30-300 mL/min)
Fluid Temperature Range:	32°F to 185°F (0°C to +85°C)
Ambient Temperature Range:	-22°F to 176°F (-30°C to 80°)
Max Viscosity:	1622 SUS (350 cSt)
Pump Type:	Gear Pump
Power Supply:	24 volts DC
Power Consumption:	4A
Communications Module Signal Output:	GSM cellular Communication to monitoring website
Electrical Safety Class:	III (low voltage protection), IP 40 enclosure
Cellular Communications:	AT&T Quad Band GSM (850, 900, 1800, 1900 MHz)

Weight and Dimensions

Communications Module Control TestMate® Sensor	Fluid Sampling System Manifold w/ TCM & VSD Pump/Motor	HY-TRAX® Communications Module	Fluid Sampling Manifold w/ Communications Module & VSD Pump/ Motor
	10 lbs. (4.5 kg)	10 lbs. (4.5 kg)	20 lbs. (9.1 kg)
	10.4" x 6.8" x 4.3" (264 x 173 x 109 mm)	14.7" x 11.3" x 5.25" (374 x 287 x 133 mm)	

Telematic Communications Module with Remote Controlled Sampling System

HY-TRAX®

HY-TRAX® Fluid Sampling System Manifold with Contamination Sensor and VSD Pump/ Motor

Features and Benefits

- Integrated micro VFC, (Variable Speed Drive), pump/ motor provides optimal flow for accurate sensor readings in variable conditions
- Rugged design for field use
- Fluid viscosities up to 350 cSt
- 50 psi (max.) working pressure
- Flow control valve providing optimal pressure for accurate sensor readings
- Designed to be used with Schroeder Industries' communications module and optional water sensor

What's Included

- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment.
- Specially designed fitting for mating to pump/motor.
- Viton® seals.
- Plugged water sensor port (G3/8)
- Flow control valve
- Contamination Monitor
- Micro VSD pump/motor
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)

HY-TRAX® Fluid Sampling Manifold with Communications Module and VSD Pump/Motor

For Customers who have a TestMate® Contamination Monitor (TCM) (TCM must be 4-20 mA output)

What's Included

- Flow Control Valve
- GSM cellular communications
- VSD pump/motor
- Machined, 6061-T651 aluminum alloy manifold block with anodized surface treatment
- Specially designed fitting for mating to pump/motor
- IP 40 enclosure
- Plugged water sensor port (G3/8)
- Fluid Inlet/Outlet Porting (SAE Size 04 ORB)

HY-TRAX® Telematics Communications Module only operates with TCM's operating on Firmware 3.0 and 4-20 mA outputs. Older firmware versions will not communicate proper flow rate to the telematics module. Contact factory for more details.

Features and Benefits

- Provides Remote Visibility to the Fluid Condition of Critical Systems.
- Integrated micro VSD, (Variable Speed Drive), pump/ motor provides optimal flow for accurate sensor readings in variable conditions.
- Designed to be used with Schroeder Industries contamination monitor (TCM - manifold mount version only) and optional water sensor.
- This HY-TRAX® Remote Oil Contamination Sensor Package allows remote access via the Internet and smart devices to fluid particle counts, temperature, and percent water saturation levels (optional) displayed on a customizable dashboard. The fluid sampling system collects data and the communications module transmits this data via GSM cellular at scheduled intervals or on demand. Users can receive alerts via email when a fluid's ISO contamination code or water saturation level (optional) reaches user defined critical levels. The unit can sample fluid directly from a fluid reservoir or low pressure line (<50psi).
- The Communications Module automatically controls fluid flow to compensate for viscosity changes due to temperature or fluid type. All data is transmitted through a secure VPN and archived in a protected database in the cloud to allow real-time and historical analysis.
- The HY-TRAX® Communications Module will provide maintenance managers with the visibility and vital information necessary to pro-actively schedule preventative maintenance on local and remote equipment. Maintenance decisions can now be based on accurate and real-time data.
- The communications module components are mounted and housed in a rugged weatherproof IP 40 enclosure.
- Fluid sampling system standard with Viton® seals.
- Fluid viscosities up to 350 cSt.
- 50 psi (max.) working pressure.
- Flow control valve providing optimal pressure for accurate sensor readings.
- VSD, (Variable Speed Drive), pump/motor providing optimal flow for accurate sensor readings.

HY-TRAX® Telematic Communications Module with Remote Controlled Sampling System

HY-TRAX® Communications Module Only.
Order part # HY-COMMMOD

What's Included

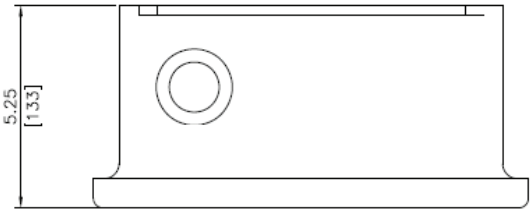
- GSM cellular communications
- IP 40 enclosure
- VSD, (Variable Speed Drive), Motor Controller
- 115 VAC Power Supply

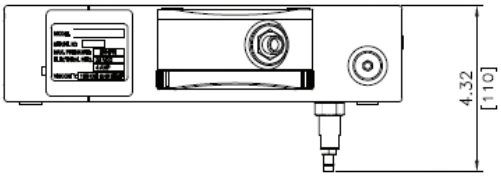
Features and Benefits

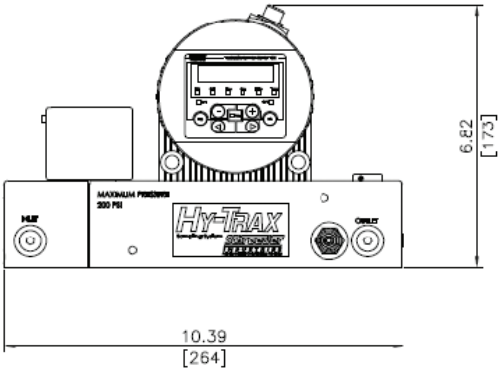
- Provides remote visibility to the fluid condition of critical systems.
- The HY-TRAX® Remote Oil Contamination Communications Module allows remote access via the Internet and smart devices to fluid particle counts, temperature and percent water saturation levels (optional) displayed on a customizable dashboard. The Communications Module collects and transmits data via GSM cellular at scheduled intervals. Users can receive alerts via email or text when the fluid's ISO contamination code or water saturation level (optional) reaches user defined critical levels.
- The Communications Module automatically controls fluid flow to compensate for viscosity changes due to temperature or fluid type. All data is transmitted through a secure VPN and archived in a protected database in the cloud to allow real-time and historical analysis.
- The HY-TRAX® Communications Module will provide maintenance managers with the visibility and vital information necessary to pro-actively schedule preventative maintenance on local and remote equipment. Maintenance decisions can now be based on accurate and real-time data.
- The communications module components are mounted and housed in a rugged IP 40 enclosure.

HY-TRAX® Communications Module

HY-TRAX® Telematics Communications Module can be utilized on existing TCM installations when the sensor receives adequate pressure (>120 psi) and flow (30-150 mL/min) from the hydraulic system. The TCM must have 4-20 mA outputs and Firmware version 3.0.

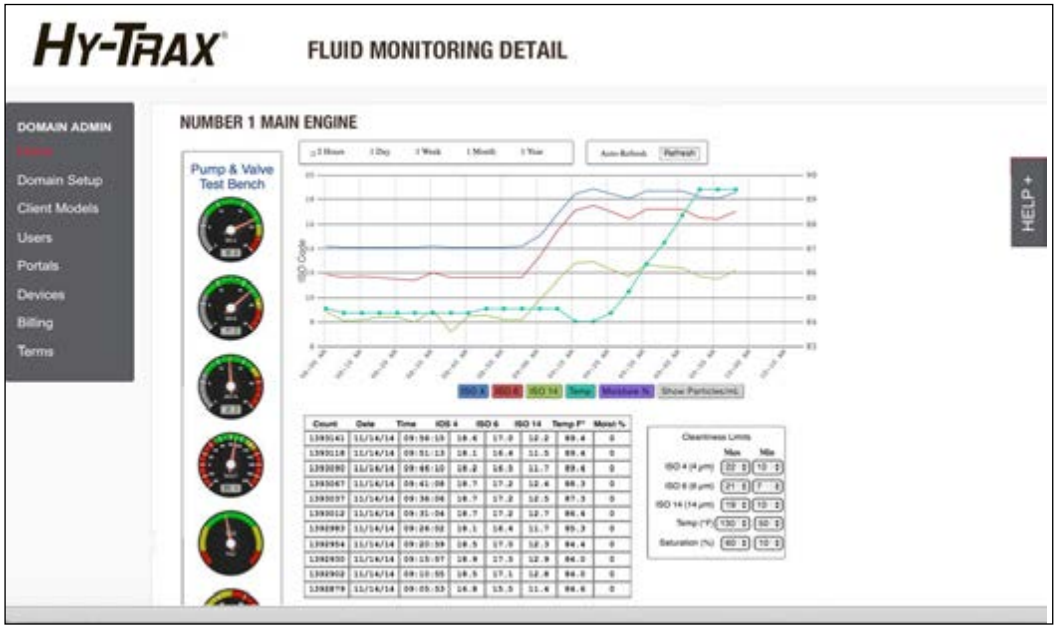




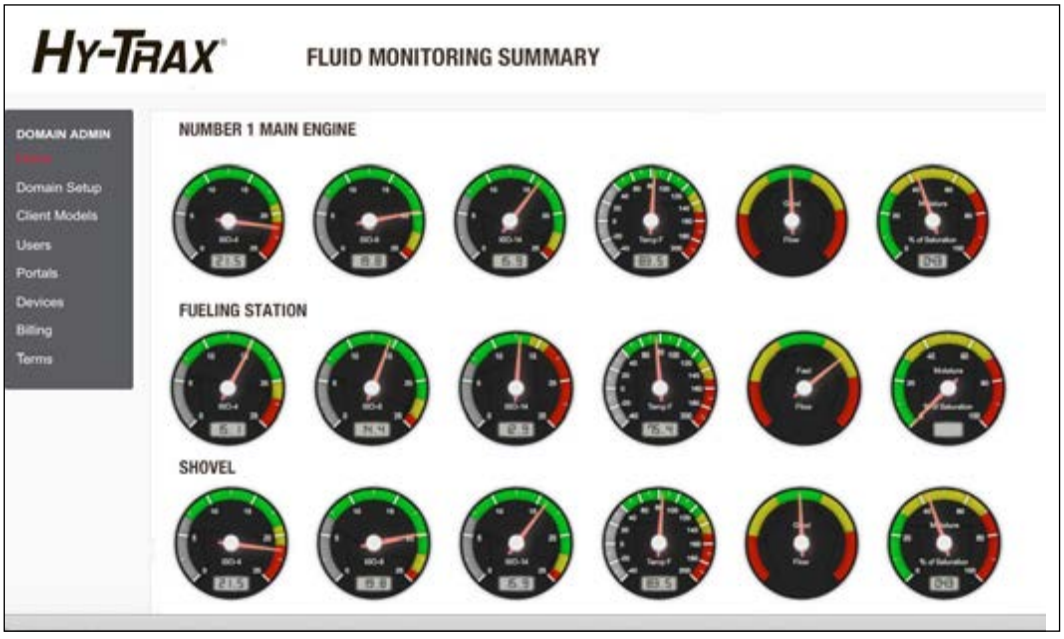


Telematic Communications Module with Remote Controlled Sampling System

Example of HY-TRAX® Communications Modules Dashboard Contamination Chart



Example of HY-TRAX® Communications Modules Dashboard Gauge Panel



HY-TRAX® Telematic Communications Module with Remote Controlled Sampling System

How to Build a Valid Model Number for a Schroeder HY-TRAX® Telematic Communications Module with Remote Controlled Fluid Sampling System:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
HY								

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	
HY		H		M		A			= HYHMA

BOX 1

Model
HY

BOX 2

TestMate® Contamination Monitor (TCM)
Omit = TCM w/ display
ND = TCM w/ no display
NT = Manifold supplied w/ no TCM, Customer will supply TCM; TCM must be 4-20 mA output only

BOX 3

Fluid Type
H = For use w/ Hydraulic & Diesel Fuel only*

BOX 4

TestMate® Contamination Monitor (TCM) Signal Output
Omit = 4-20 mA
NOTE: For customers with existing TCMs w/ a 2 to 10 V analog output please see HY-TRAX® Manually Controlled Sampling System

BOX 5

TestMate® Contamination Monitor (TCM) Output Options
M = ISO 4406/SAE 4049
N = ISO 4406/NAS 1638

BOX 6

Water Sensor (TWS) Option
Omit = None
TWS-D = Water sensor w/ display

BOX 7

Communications Module w/ Remote Controlled Fluid Sampling System
A = Telematic Communications Module w/ Dashboard Data Display (GSM Cellular)
NOTE: For customers with existing TCMs w/ a 2 to 10 V analog output please see HY-TRAX® Manually Controlled Sampling System

BOX 8

Communications Module Power Options
Omit = 24 VDC
P = 115 VAC

BOX 9

Air Suppression Loop
Omit = None
L = Looped hose and fitting

***Note: Off-road diesel contains dye. High concentrations of dye may interfere with particle count results. Please contact factory to review application.**

Model Number Selection

Preferred order codes designate shorter lead times and faster delivery.

HY-TRAX® Telematics Communications Module only operates with TCM's operating on Firmware V03.00. Older firmware versions will not communicate proper flow rate to the telematics module. Contact factory for additional information.

NOTES:
All HY-TRAX® manifolds come with a pressure gauge and intake strainer

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Final Polishing | Off-line or Kidney Loop for Bio and Diesel Fuels

MFS / MFD Mobile Filtration Systems

- 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
- **Please note Viton® seals required for this application**

X Series Skids

- 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 Excel-ZPlus® 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)
- **Please note Viton® seals required for this application**

Notes:

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

Schroeder INDUSTRIES
Advanced Fluid Conditioning Solutions®

Products Catalog

FUEL FILTRATION

Fuel Filtration

Vision Mission Value Quality Statement:

Vision:

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

- Optimizing the use of technology with applications
- Using an efficient, timely customized process to fill specific customer needs
- Increasing capacity and streamlining operations.
- Preserving our reputation for reliability
- Expanding globally to support our customers and stay current with new 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 the customers

Leetsdale Facility

Mission Statement:

Partnerships

Innovating products, processes and services to improve performance and efficiency in our industry.

Schroeder Industries Core | Shared Values:

Honesty

Day-to-Day Behaviors:

- Tell the truth at all times, in all matters
- Have open lines of communication and share timely, accurate and thorough information with internal and external customers
- Do not steal and respect each other's and the Company's property

Teamwork

Day-to-Day Behaviors:

- Work as a team
- Cooperate within and between departments
- Coach and mentor; listen and share knowledge, experience and ideas
- Treat others with respect and consideration in all circumstances
- Invest in the development and growth of all team members
- Keep our work areas safe and clean

Leadership

Day-to-Day Behaviors:

- Recognize that we are empowered to act as leaders and participate in the decision making process
- Take responsibility for and have pride in our work
- Set goals and celebrate the efforts and accomplishments of our teammates
- Value our greater community and take leadership roles in our neighborhoods and for the environment

Ingenuity | Innovation

Day-to-Day Behaviors:

- Value innovative thinking and the generation and implementation of new ideas to solve customer (internal & external) problems
- Be flexible and adapt to new ideas and different ways of doing things
- Utilize available resources for new designs and innovations

Quality Policy:

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

Limitations of Liability

The information contained in the catalog (including, but not limited to, specifications, configurations, drawings, photographs, dimensions and packaging) is for descriptive purposes only. Any description of the products contained in this catalog is for the sole purpose of identifying the products and shall not be deemed a warranty that the products shall conform to such description. No representation or warranty is made concerning the information contained in this catalog as to the accuracy or completeness of such information. Schroeder Industries LLC reserves the right to make changes to the products included in this catalog without notice. A copy of our warranty terms and other conditions of sale are available upon request. A placed order constitutes acceptance of Schroeder's terms and conditions.

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.

Schroeder
INDUSTRIES
Advanced Fluid Conditioning Solutions®

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Introduction | The New World of Advanced Diesel Filtration

Schroeder Industries | Advanced Fluid Conditioning Solutions®: When Cleanliness is Mission Critical

Schroeder Industries, an ISO 9001:2008 certified company, is focused on developing ADVANCED FLUID CONDITIONING SYSTEMS AND PRODUCTS, and we have done so over the last sixty years. The designs in this catalog are the result of thousands of hours of laboratory research, field testing and decades of experience. Schroeder pioneered the development of micron filtration, helping to set performance standards in industrial fluid power systems. As a result, Schroeder is now a leader in almost all liquid filtration and fluid conditioning applications. Proof that our expertise lies in our broad mix of unsurpassed cleanliness products.

Our mission statement reflects our continuing commitment to excellence.
"Innovative products, solutions, process and service to improve performance and efficiency in industry."

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.

The New World of Advanced Diesel Filtration

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.

Requirements Have Changed! (The Need)

How Clean and Dry is Your Fuel?

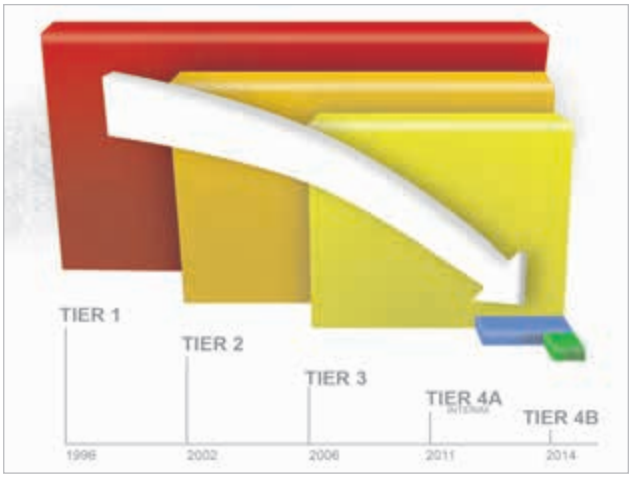
Because many people assume they're buying quality fuel that meets the required specifications, the cleanliness of diesel fuel is seldom questioned. That has changed, and with the cleanliness requirements mandated by the Tier 4 injection systems it is now time to ask "How clean does my fuel need to be?" From the 2µm tolerances in the 30,000+ psi injection systems to compliance with the warranty requirements of the injector manufactures, this question will in reality become the new benchmark. The game has changed and in the following pages we will clearly define how today's fuel, fuel systems and new emissions requirements MANDATE that both OEM's and END USERS use only the best filtration.

Ten years ago a diesel engine did not require anything close to the level of filtration provided by Schroeder. With poor quality filters the engine would still run, maybe not efficiently, but it would run. But with today's, engines both the particulate and the coalescing filters must be of only the highest quality. Be assured the results of poor filtration are no longer just black smoke and a lack of horsepower. No, with Tier 4 engines' poor filtration will likely mean lost revenue due to downtime as the operator pays to replace a failed injector. These problems are both manageable and should not add cost. With good filtration installed at the fill point and at the engine will run more efficiently and continuously, but the filters used and the higher level of filtration required can no longer be an afterthought. It must become the focal point of any feel and or any operator. Filtration quality and the profitable operation of any Tier 4 engine will become one in the same.

The New World of Advanced Diesel Filtration

Tier 4 Requirements Demand a Sophisticated Approach and the Highest Quality Filtration

The Tier 4 engine is a technology shift and when compared to Tier 1-3 engines, Tier 4 engines require a completely superior level of filtration to run, much less to run reliably and efficiently. Tier 4 diesel engines will now react more violently if the injectors are constantly bombarded by contamination. To put this into perspective newly delivered bulk diesel fuel typically has an ISO cleanliness level of ISO 22/20/18 to ISO 21/19/17 but today's injectors need to see fluid with a cleanliness level of below ISO 11/8/6 (aerospace cleanliness).



The Tier 4 Emissions Regulations established by the U.S. Environmental Protection Agency (EPA) and Canadian Environmental Protection Agency (CEPA) are getting tougher. In 1996, the first off-highway diesel emissions standard began with the implementation of Tier 1 regulations. Since then, standards have continued to be raised and will end with Tier 4B/Final in 2014.

As we have and continue to transition into the new world of Tier 4 requirements, the answer to the question "How clean does my fuel need to be" will be – ISO 11/8/6 or better and the most cost effective way to consistently achieve this is through the use of the highest capacity, highest quality, particulate and coalescing filtration used at the point of dispense (at the bulk tank and on the engine itself). The engine filter can no longer be the only solution. There is simply not enough room in the engine and the cost to address the cleanliness only at the engine will become too high. Now going forward, bulk fuel filtration must be ground zero and it must be of the highest quality. The filtration performance specifications are now important and users must pay attention to the specifications and mandate only the best.

It's against this emissions reduction backdrop that Schroeder Industries developed its series of bulk / on-board, fuel-specific filtration products. From an environmental, economic and regulatory viewpoint we defined the critical elements our products needed to achieve customer needs, in doing so we have laid the ground work now and for the future. While our competitors approach with yesterday's technology, Schroeder Industries is focused on being a world leader in the fuels filtration field by being positioned to real issues of today.

High Pressure Common Rail System

This series of engines is built to more stringent specifications than ever before. High operating pressure in excess of 30,000 psi and 2-5 micron injector nozzle tolerances make engine injector systems and fuel pumps vulnerable to contamination levels that were not an issue in the past. While the Common Rail System does provide improved power, fuel efficiency and lower exhaust emissions it, at the same time requires a new level of fuel cleanliness and care. This cleanliness requirement for the fuel is now mission critical to system operation. OEM engine and injection makers are requiring that fuel used in the engine meet tight guidelines before warranty claims are accepted. Today's requirements call for diesel fuel cleanliness at the engines injections of ISO 11/8/6 and a water level of <200 ppm water, both of which are harder to obtain with the surfactants for lubricity found in today's ULSD.

The New World of Advanced Diesel Filtration

Ultra Low Sulfur Diesel | ULSD

Fuel requirements changed from Low Sulfur Diesel (LSD) to Ultra Low Sulfur Diesel or (ULSD). This change was mandated between 2006-2010 in North America and Europe. The purpose of moving to ULSD was to reduce the sulfur content from 500 ppm to 15 ppm, this in turn reduced exhaust emission by more than 90% from the engine. To achieve this much of the lubricity agents in Low Sulfur Diesel fuel are now striped out in the production process. Not only is much of the sulfur removed, but so is some of the original fuels built in lubricity. The result is an ultra-clean fuel where surfactants must be added to provide the needed lubricity. Diesel engines depend on the lubricity of the fuel to keep moving parts from wearing prematurely. Lubricity additives such as lubricity enhancers and anti-wear additives have also in some fuels been replaced with biodiesel blended into diesel. ULSD15 is generally hydrophobic (does not like to hold water) with 25-110 ppm water saturation point at room temp. Unlike traditional LSD the biodiesel additives are hydrophilic (they like to hold water). For this reason when biodiesel is blended, the diesel fuels' saturation points can rise to 250 ppm (B2), 500 ppm (B5), and 1,600 ppm (B20). That is OK, but the user must understand that there is more water in the fuel and that this water can become free water when the temps decrease. More free water in storage tanks! More free water at the injector, more free water molecules in the combustion chamber none of which are good for the engine or its performance. Water must be eliminated and this is now even more difficult when the Inter Facial Surface Tension (IFT) of Diesel with surfactants and or biodiesel blends is lower making it harder to separate the water in ULSD fluids that it was in the past. A coalescing filter that in the past was >90% efficient in traditional diesel is typically now only, 66% efficient at removing water in the new ULSD fuels.

Biodiesel Addition to ULSD15 as a Blend

The EPA requirement under Renewable Fuel Standard 2 required that renewable fuel, such as biodiesel, for diesel be blended into the fuels. The goal is to reduce dependence on carbon-heavy fuels and contribute to the goal of reducing carbon pollution 17 percent below 2005 levels by 2020. In 2008, this involved 9 billion gallons and is expected to increase to 36 billion gallons by 2022.

Additional challenge, the bulk tank and water from condensation and the delivered fuel itself. Existing bulk tanks, water, microbes and bacteria, hundreds of thousands of bulk tanks exist in North America and around the world today. Most bulk tanks are not designed to help meet the cleanliness requirements of Tier 4. Many traditional bulk storage reservoirs are open to their surrounding atmospheres. Almost all have some volume of free water caused by temperature changes, ingression and delivered fuel quality. More importantly poor tank design makes the complete removal of all free water nearly impossible. Free water in diesel fuel accelerates corrosion and fuel degradation. It can also create an ideal growth environment for microbial contamination. Bacteria can grow in the water at the fuel interface, and can cause the liquid fuels to breakdown and involves all grades. The results can be the accelerated corrosion of metals, especially iron and steel along with plugged fuel systems and clogged filters and clogged lines. Bacteria grows better in warm climates and with favorable conditions mean they can double their population every 20 minutes; 8 Billion bacteria per gallon have no effect on fuel clarity! Fungus tends to grow on solid surfaces, like filters, and in piping. Once established, the biomass will grow faster than a bacterial biomass. It can grow over a wide range of temperatures but grows quicker in summer with the higher temperature, increased airborne contaminants and higher fluid temperature.

Previously acceptable "industry standard" filtration solutions won't make the grade in Tier 4 engines

Against this backdrop, Schroeder Industries developed its series of bulk diesel fuel specific filter products. The critical needs are defined and our desiccant breathing systems, our series of bulk housings and skids and fuel. Our specially engineered patent-pending coalescing elements we provide the world with the right portfolio of products to meet almost any of today's bulk fuel requirements. We are focused on being a world leader in the diesel fuel filtration by being positioned to addresses the needs of customers with the following experience and forward thinking technologies.

The New World of Advanced Diesel Filtration

Past Practice

Separation of emulsified water from diesel fuel is a long standing requirement for diesel engine operation. Water removal has been traditionally performed by a fuel-water separation filter mounted in the engine fuel system or, in tough operating environments where downtime has been managed by implementing best practice fluid maintenance, as part of the bulk tanks staged filtration at the dispensing system. The most typical filtration media found in such separators is a single resin impregnated hydrophobic barrier, such as silicone treated cellulose. This media separates water on its water repellent surface. Water in the fuel is rejected and beads up on the upstream side of the barrier media. As more water is rejected, beads coalesce into large drops, and drain into a collection cup while the fuel passes through a port located above the sump.

There are often unintended outcomes when a process or specification change is made. The changes to diesel engines and diesel fuels provide no exception to this rule. The transition to ultra-low sulfur diesel (ULSD) provides a specific example.

In order to meet mandated sulfur levels, ULSD is subjected to refining processes that removes not only the sulfur but also the inherent lubricity of the original higher sulfur diesel. The result is the ultra-clean fuel. Unfortunately, it is an ultra-clean fuel that has been stripped of its native lubricity. Fuel lubricity is critical as it is the fuel's lubricity that is one area protecting the injection systems from catastrophic wear and precise control of combustion. A fuel system must hold pressure in order to inject fuel into the cylinder. Wear induced leaks can lead to engine failure due to fuel starvation.

As lubricity deficiencies were surfacing with early ULSD adoption, biodiesel production and the push to use biodiesel began to take hold in the North American diesel market. Biodiesel improved ULSD lubricity, and as a result, generated some independent motivation for its use as a blended lubricity component of diesel fuel. The additional perceived need for a domestic or "green" fuel supply, and pressure to minimize fossil carbon emissions have prompted governments mandate a percent of biodiesel in diesel blends.

Just as the processing of ULSD produced unforeseen side effects in diesel fuel lubricity, the failure of existing fuel-water separators to react to the changing needs became apparent. With the lubricity additives the ULSD blends containing biodiesel, created conditions where the industry standard commercial fuel-water separators failed to remove 40-100% of fuel-entrained water. The side effect is now typically 40% more water downstream of the filters that in the past worked at a 90% efficiency. Meanwhile there is no way for an operator to know it is happening unless the effects are drastic and observed and questions asked. Unlike particle filters, which generate pressure differentials prior to by-pass alerting the operator to the end of the element life, there is nothing that communicates to the operator that the fuel-water separator is not removing water. Fuel-water separators rely on an operator or auto-valve to empty a water to a collection chamber when the housing is partially full. If the collection chamber does not fill up, it is not an indicator of fuel-water separator failure; rather it is an indicator of dry fuel. The result is the fuel-water separator can be passing the water continuously into the injection system without the operator's knowledge.

The New World of Advanced Diesel Filtration

Fuel Surfactant and ULSD15

The root cause of fuel-water separator failure in ULSD-biodiesel blends is increased fuel surfactant. Although given separate titles to address the lubricity issue, lubricity enhancers, anti-wear additives, and biodiesel can all be grouped into a single molecular family: surfactants. Fuel and water are classes that normally do not dissolve into one another; if forced to coexist, they are most stable as separate layers, with the fuel layer on top of the water layer. The degree to which these layers repel is measurable as the interfacial surface tension (IFT). If mixed, an emulsion is formed, where water briefly exists as suspended drops in the fuel. Surfactants are molecules unique in that they form strong associations with both fuel and water. When surfactants are in a fuel, they associate with water, and increase fuel-water compatibility. The increased compatibility is reflected in lower IFT between the two fluids. This unique surfactant behavior allows more water to dissolve into the fuel.

Surfactants create sufficiently small water drops (because they do not want to coalesce into larger drops) that will often pass through the media without encountering it. Surfactants also stabilize the emulsion from separation so that drops that do impact the media are less likely to fall out of the fuel at the barrier media. Also, drops that impact other drops resist coalescing into the larger drops necessary for successful separation. Collectively, the result of blending additives and biodiesel into ULSD is a significant reduction of the fuel-water separation process efficiency and finally the escape of water into the injector circuit.

You may be asking "How this can take place and nobody knew?" Testing in obsolete fuels is the reply! Fuel-water separating devices must prove efficacy in standardized industry tests like SAE J1488 (pressure side = smaller water droplets). Water separation tests involve mixing a precise amount of water into fuel and passing the resulting emulsion through the separating device. Water content in the fuel upstream and downstream of the device is measured at regular intervals and time-weighted average water removal efficiency for the device is calculated. Water removal testing is very much all or nothing, with most end users requiring at least 95% average water removal efficiency for any commercial device.

At the same time another unforeseen consequence of the mandated fuel change surfaced: A lack of correlation of the tests with actual field performance. The result, the end user is largely unaware of the alarming failure consistency of fuel dewatering systems in ULSD-biodiesel blends. This is the case because the time required for a legislative body to mandate 2% biodiesel inclusion in diesel is fleeting relative to the time needed to adapt proven standardized industry tests for the new fuel. Regardless of the procedure selected, there are currently key differences between fuels surfactants / emulsifications found in the field versus the tests that are still specified to measure and rate water separator performance. Until resolved, the result is a disconcerting overestimation of a separators fuel water separation performance and capability as measured using standardized tests.

Tier 4 Fuel Quality Requirements

Organization	Particulate ISO 4406	Water
Bosch	11/8/6 at Injector	<200 ppm
CAT	18/16/13 at storage	<500 ppm
CUMMINS	18/16/13 at storage 11/8/3 at injector	<200 ppm
Worldwide Fuel Charter	18/16/13	No free or emulsified, dissolved <200 ppm

Most diesel storage tank owners, maintenance staff and company buyers are not knowledgeable of these guidelines.

The New World of Advanced Diesel Filtration

Schroeder Industries and Advanced Tier 4 Ready Diesel Fuel Filtration Solutions:

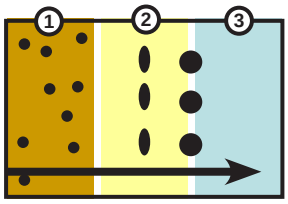
Particulate and Fuel Water separation Filtration Solutions for Today Fuels used in Today's Engines- Job matched filtration; At the Bulk Tank, at the Point of Fuel Dispense, and at the Engine.

K9 Filter Housing (H&L catalog)

Schroeder Industries is committed to delivering the solutions to allow OEM's and users meet today's diesel filtration requirements. We offer a series of diesel fuel filtration products working in-line and or in a fuel conditioning circuit with flow rates from 1.5 gpm to 1000 gpm. We offer condensation management solutions for the tank and the diagnostic tools such as particle counters and water sensors measure the results.

Design Principles of Schroeder Particulate Removal Filters & Elements

The highest quality particulate removal filtration with the best combination of Dirt Holding Capacity, Low Element Delta P, the highest beta stability throughout the service life of the element at all of the available micron sizes applied to achieve and maintain the target cleanliness level for each application. Contamination removal efficiencies from 1um>Beta1000 to as open as 150um metal mesh. Most importantly when filtering diesel fuel we use these filters and elements upstream to protect and extend the life of the downstream dedicated coalescing elements. We do this because testing shows that with our patent-pending materials of construction, our coalescing elements can will outperform the competition averaging <96% efficiency in today's fuels and because they will, by their materials and design, last for years if protected from premature contamination related failures using the right upstream particulate filter. In short. Schroeder offers an entirely new level of coalescing performance, one that has an associated cost, but one, when used correctly, mandates total cost to use our solution to be the lowest over time. The technical details and the design principals of our particulate elements are shown below.



Design principles of the water removal (Water Coalescing) filters and Elements - Inside-Out flow to optimize coalescing effect 5 micron synthetic pre-filter pleat pack to protect the downstream components, depth tube coalesces water which either drains to the bottom or creates large droplets, Downstream 25 micron treated hydrophobic barrier sleeve traps droplets <25µ, This 3 elements in one pre-filter, coalescing, and separation (most competitors have separate elements for each function) = smaller size! Tested per SAE J1488 (pressure side = smaller water droplets), Tested with fuel down to 12 dynes/cm IFT to replicate performance with poor fuel quality.

Contaminated fuel enters the element as the Fuel passes through a 3 or 5 micron synthetic media pleat pack. Wet fuel then passes through the coalescing layer. Water collects and drains from the element forming large droplets, the fuel then passes through the downstream hydrophobic barrier. Water droplets are repelled by barrier and fall to bottom of the chamber, which is collected into the filter housing sump. Through the union of high surface area the coalescing media or tube provides the perfect balance to collect and trap both water and contaminants in a single element, the composite barrier separation media element have been developed with greater than 99% water removal capability in all but the highest surfactant ULSD or ULSD-biodiesel blends. Our Fuels product lines cover a range of particle removal efficiencies and dirt holding capacities, giving the end user flexibility in pairing flow requirements to their need. This coalescing media provides a minimum of 95% water removal efficiency from biodiesel blends (B5). Water exits the media in the form of drops that settle out of the flow.

Design Principals for Diesel Fuel specific Skids and Carts for specific Fuel applications Schroeder has developed many of the core diesel products into turnkey filtration solutions with integrated pump motor dispense functions for almost every diesel application from gen sets to fleet fueling tanks to the ag tank at a farm. All are designed to address the challenges of fuel in its environment.

In the balance of this catalog, we trust you will find the products you require to meet your demanding needs.

The New World of Advanced Diesel Filtration

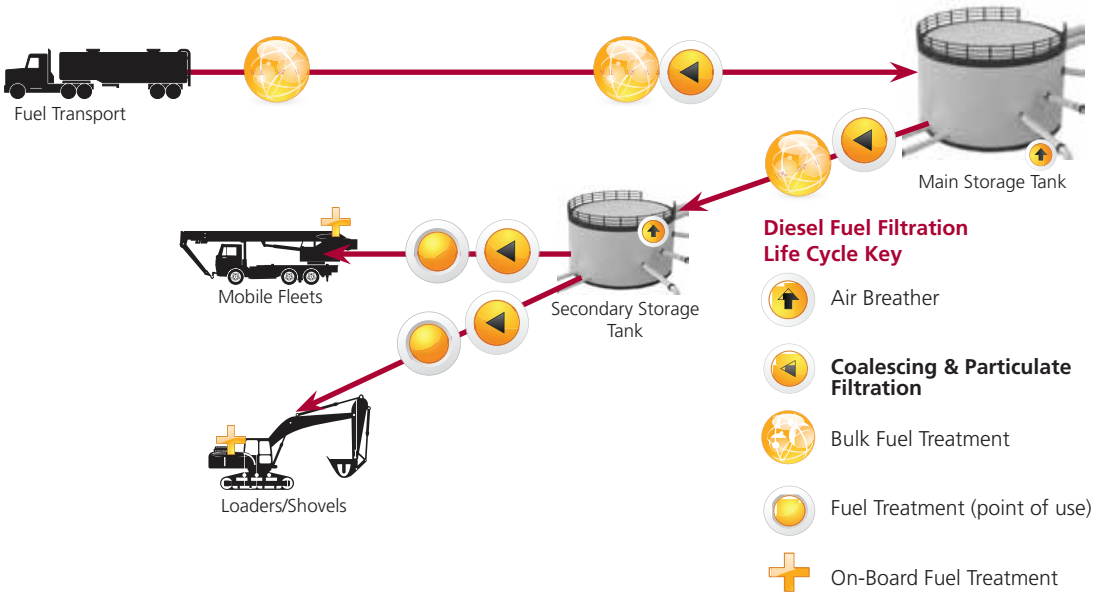
The Cost of Dirty Fuel

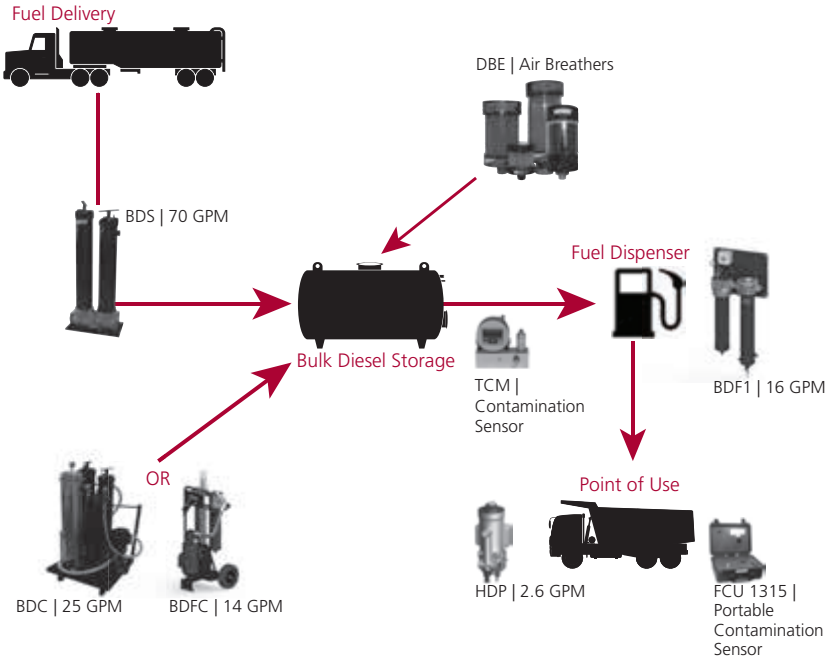
All new off-road diesel engines now must meet Tier 4 regulations. In order to achieve Tier 4 requirements, manufacturer of engines and injector systems have gone to high pressure, common rail, injection systems. The pressures can exceed 30,000 psi and might go even higher in the future. Particulates left in the fuel under the high pressure, combined with very small injector nozzle clearances as small as 2µm, can cause premature failure of nozzles or system components.

Failures of the injection system caused by particulates and water could result in repair costs of around $1,500 per injector. The associated costs for a failure due to parts damage, repair & down time, loss of production and image loss of the operation could add up to ten-thousands of dollars per incident!

Traditional On-board Engine Filtration & Fuel Water Separation is no longer enough to insure performance. Instead, a comprehensive filter strategy is required to assure proper fuel quality for trouble free engine operation:

Comprehensive Fuel Filtration Strategy by Application and by Products





Particulate Removal Element Media Selection Considerations

Performance Specifications/ Filtration Ratings

Schroeder filter elements meet a wide variety of requirements in today's workplace, from the simplest to the most sophisticated fluid power systems. Established industry standards enable users to select the optimal filter element for any application.

When evaluating the performance of hydraulic filter elements, the most important parameters to consider are:

(a) efficiency

(b) beta stability

(c) dirt holding capacity

(d) pressure drop vs. flow

(a) *Efficiency*, or filtration ratio, expressed by "Beta" (ß) relates to how well an element removes contamination from fluid. Higher efficiency translates to cleaner oil, better protection of system components, less down time for repair, and lower maintenance costs.

(b) *Beta stability* is defined as an element's ability to maintain its expected efficiency as differential pressure across the element increases. Differential pressure will increase as contamination is trapped, or with an increase in fluid viscosity (cold start). Beta stability is important because it relates to how well an element will perform in service over time. When the element is loaded with contamination, or when it is subjected to cold starts, will it perform as well as it did when new?

(c) *Dirt holding capacity (DHC)* is the amount of contamination that an element can trap before it reaches a predetermined "terminal" differential pressure. Dirt holding capacity is related to element life. Since elements with higher DHC need changed less frequently, DHC has a direct impact on the overall cost of operation. When selecting filter elements, it is beneficial to compare DHC of elements with similar particle removal efficiency.

(d) *Pressure Drop vs. Flow* is a measure of resistance to fluid flow in a system. It is important to consider the initial pressure drop (Δp) across the filter element (and housing). Ideally, a filter element should be sized so that the initial pressure drop across the clean element (plus the filter housing drop) is less than half the bypass valve setting in the filter housing.

When selecting a filter element for your system, be sure to consider all four of these performance criteria. If an element is strong in three areas, but weak in another, it may not be the right choice. At every level of filtration, Schroeder's Excel-ZPlus® Z-Media® elements offer the best combination of high efficiency, high beta stability, high dirt holding capacity, and low pressure drop.

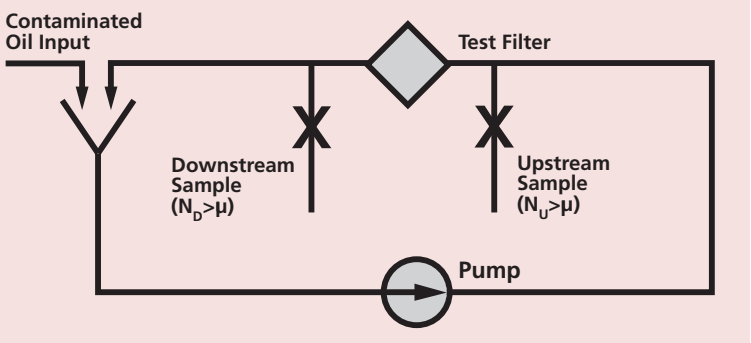
The Multi-Pass Test

Filter element efficiency ratings, beta stability, and capacities are determined by conducting a multi-pass test under controlled laboratory conditions. This is a standard industry test with procedure published by the International Standards Organization (ISO 16889). The multi-pass test yields reproducible test data for appraising the filtration performance of a filter element including its particle removal efficiency. These test results enable the user to: (1) compare the quality and specifications offered by various filter element suppliers and (2) select the proper filter element to obtain the optimal contamination control level for any particular system.

Hydraulic fluid (Mil-H-5606) is circulated through a system containing the filter element to be tested. Additional fluid contaminated with ISO MTD Test Dust is introduced upstream of the element being tested. Fluid samples are then extracted upstream and downstream of the test element.

Dirt holding capacity is defined as the total grams of ISO MTD Test Dust added to the system to bring the test filter element to terminal pressure drop.

Figure 5. Multi-Pass Test Schematic



Particulate Removal Element Media Selection Considerations

Efficiency / Filtration Ratio (Beta)

The filtration ratio (more commonly referred to as the Beta ratio) is, in fact, a measure of the particle capture efficiency of a filter element.

Per ISO 16889 $$\beta_{x(c)} = \frac{\text{number of particles upstream @ } x(c) \text{ microns}}{\text{number of particles downstream @ } x(c) \text{ microns}}$$

where *x(c)* is a specified particle size.

$$\text{Example: } \beta_{10} = \frac{400}{100} = 4$$

This particle capture efficiency can also be expressed as a percent by subtracting the number 1 from the Beta (in this case 4) and multiplying it by 100:

$$\text{Efficiency}_{10} = \frac{(4-1)}{4} \times 100 = 75\%$$

The example is read as "Beta ten is equal to four, where 400 particles, 10 microns and larger, were counted upstream of the test filter (before) and 100 particles, 10 microns and larger, were counted downstream of the test filter (after)."

The filter element tested was 75% efficient in removing particles 10 microns and larger.

Efficiency

To calculate a filter element's percent efficiency, subtract 1 from the Beta, divide that answer by the Beta, then multiply by 100.

	Example
Step 1:	$\beta_{10(c)} > +1000$
Step 2:	1000 -1 = 999
Step 3:	999 ÷ 1000 = .999%
Step 4:	.999 x 100 = 99.9%

Filtration Ratio

According to ISO 16889, each filter manufacturer can test a given filter element at a variety of flow rates and terminal pressure drop ratings that fit the application, system configuration and filter element size. Results may vary depending on the configuration of the filter element tested and the test conditions.

Currently, there is no accepted ISO, ANSI, or NFPA standard regarding absolute ratings. Some filter manufacturers use $\beta_x(c) \geq 75$ (98.7% efficiency) for their absolute rating. Others use $\beta_x(c) \geq 100$ (99.0% efficiency), $\beta_x(c) \geq 200$ (≥ 99.5% efficiency), or $\beta_x(c) \geq 1000$ (99.9% efficiency). Performance of Schroeder elements is shown in the Element Performance Chart for each filter housing in Sections 3 through 8 at a number of filtration ratios to allow the user to evaluate our performance against that of our competitors.

Beta Stability

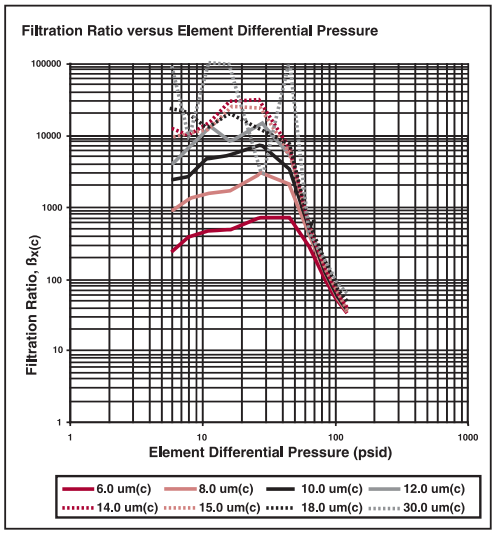
Beta stability is defined as an element's ability to maintain its expected efficiency as differential pressure across the element increases. Differential pressure will increase as contamination is trapped, or with an increase in fluid viscosity. An element's beta stability is displayed in the Filtration Ratio (Beta) vs. Differential Pressure curve from a typical multi-pass test report per ISO 16889. Good beta stability is demonstrated by consistent or improving efficiency as differential pressure builds across the element. Conversely, decreasing efficiency as pressure builds is a sign of poor stability. Poor beta stability is an indication of a filter element's structural deficiency. It is a sign of potential problems in a "real world" situation. Contamination, "cold starts," and flow surges can all create high differential pressure across an element that may cause efficiency to decrease if it is not structurally sound. In cases of "cold starts" and flow surges, the media structure in elements with poor stability can become permanently damaged in milliseconds. The result is lower efficiency and decreased system protection without warning to the operator. High beta stability results when an element is well-built with quality, durable materials. Strength of filter media and reinforcement layers, impervious seaming, proper end cap adhesion, and a rigidly supported structure all play a part in an element's beta stability. Excel-ZPlus® media structure typically maintains beta stability over 100 psi.

Particulate Removal Element Media Selection Considerations

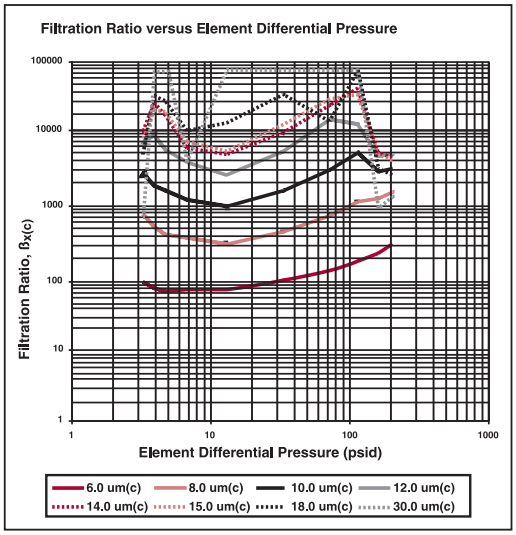
Beta Stability

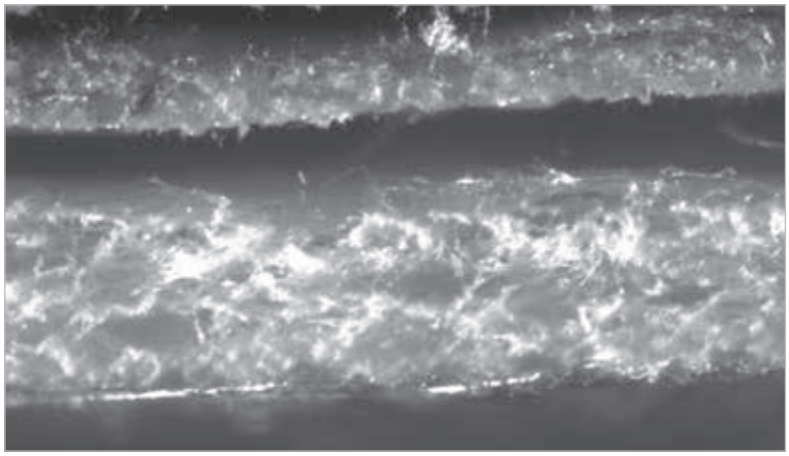
(continued)

Example of poor beta stability – efficiency declines as differential pressure increases.



Example of Excel-ZPlus® beta stability – efficiency does not decline as differential pressure increases.

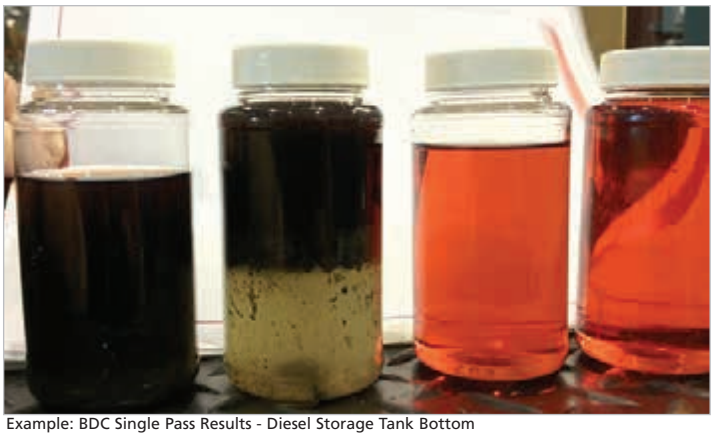




Microscopic Photo - 50X magnification

Top: competitor's media Bottom: Schroeder Excel-ZPlus® Z-Media®

Thin, weak media cannot withstand differential pressure as well as Z-Media®.



Example: BDC Single Pass Results - Diesel Storage Tank Bottom

Particulate Removal Element Media Selection Considerations

Dirt Holding Capacity

Dirt holding capacity (DHC) is the amount of contaminant (expressed in grams) the element will retain before it goes into bypass. All other factors being equal, an element's DHC generally indicates how long the element will operate until it needs to be replaced. The element's life span is directly related to the cost of operating the filter.

Dirt holding capacity, sometimes referred to as "retained capacity," is a very important and often overlooked factor in selecting the right element for the application. The dirt holding capacity of an element is measured in grams of ISO medium test dust contaminant as determined from the multi-pass test (ISO 16889). When selecting filter elements, it is beneficial to compare the dirt holding capacities of elements with similar particle removal efficiencies.

BDC: 25 gpm Fuel Filter/Coalescing Cart
25,000 ppm became 250 ppm - water only

Table 5. Typical Dirt Holding Capacities for Z-Media® Elements

Element Size	Medium				
	Z1	Z3	Z5	Z10	Z25
3TA	9	7	10	8	8
3TB	27	11	12	11	11
5TB	40	18	21	17	18
KB	110	99	138	110	112
KI	85	88	130	104	106
KKI	181	185	263	174	214
27KI	336	345	357	324	279
16Q	258	283	254	280	234
39Q	593	1001	691	940	537
39QCLQF	1259	1293	869	1214	1102
39QPML	1485	1525	1235	1432	1299
BBI	306		341	272	
KG	112	115	119	108	93
KKG	224	230	238	216	186
27KG	336	345	357	247	279
4Y	6	5	6	5	5
8Y	12	10	12	11	9
8R	33	26	51	29	30
K	112	115	119	108	93
KK	224	230	238	216	186
27K	336	345	357	324	279
FZX	6	5	7	5	5
SVZX	27	21	30	24	24
5CT	27	22	31	24	25
8CT	44	35	49	39	40
14CT	94	75	105	84	85
5CTZ	19	16	18	21	17
8CTZ	31	27	34	28	24
14CTZ	66	57	64	72	60S
6G	38	30	42	34	34
9G	64	51	71	57	58
5H	26	28	39	47	48
9H	51	42	59	42	48
13HZ	N/A	100	113	119	123
16QCLQF	307	315	364	306	278
16QPML	307	315	364	330	299
25DN	N/A	57	62	52	48
40DN	N/A	105S	115	104	94

Pressure Drop

When sizing a filter, it is important to consider the initial differential pressure (ΔP) across the element and the housing. Elements offering a lower pressure drop at a high Beta efficiency are better than elements with a high ΔP at the same efficiency. At every level of filtration, Schroeder's Excel-ZPlus® Z-Media® elements offer the best combination of high efficiency, high stability, high dirt holding capacity, and low pressure drop. The pressure drop of an element is determined by testing according to ISO 3968.

Collapse Rating

The collapse (crush) rating of a filter (determined by ISO 2941/ANSI B93.25) represents the differential pressure across the element that causes it to collapse. The collapse rating of a filter element installed in a filter housing, with a bypass valve, should be at least two times greater than the full flow bypass valve pressure drop. The collapse rating for filter elements used in filter housings with no bypass valve should be at least the same as the setting of the system relief valve upstream of the high-crush element. When a high collapse element becomes clogged with contamination all functions downstream of the filter will become inoperative.

Particulate Removal Element Media Selection Considerations

Filtration Application Guidelines

Selecting the proper Schroeder media for your application is easy if you follow these simple guidelines:

Step 1. Remember that the key to cost effective contamination control is to maintain the system's cleanliness at the tolerance level of the system's most sensitive component. So, the first step is to identify the most sensitive component.

Step 2. Determine the desired cleanliness level (ISO Code) for that component by referring to Table 3 on page 13 or by contacting the component manufacturer directly.

Step 3. Identify the Schroeder filter medium referencing Table 6 that will meet or exceed the desired cleanliness level.

Step 4. Remember to regularly check the effectiveness of the selected media through the use of contamination monitoring equipment.

Table 6. Schroeder Element Media Recommendations

Desired Cleanliness Levels (ISO Code)	Schroeder Media
20/18/15-19/17/14	Z25
19/17/14-18/16/13	Z10
18/16/13-15/13/10	Z5
15/13/10-14/12/9	Z3
14/12/9-13/11/8	Z1

Effect of Ingression

Filter element life varies with the dirt holding capacity of the element and the amount of dirt introduced into the circuit. The rate of this ingression in combination with the desired cleanliness level should be considered when selecting the media to be used for a particular application. Table 7 provides recommendations accordingly.

The amount of dirt introduced can vary from day to day and hour to hour, generally making it difficult to predict when an element will become fully loaded. This is why we recommend specifying a Dirt Alarm®.

Schroeder's-designed Dirt Alarm® provides a vital measure of protection for your system by indicating when the filter element needs to be changed or cleaned. Schroeder filters are available with visual, electrical and electrical-visual combination Dirt Alarm®. These indicators may also be purchased as separate items. For more information on Schroeder Dirt Alarm®, see Appendix A.

Table 7. Recommended Schroeder Media to Achieve Desired Cleanliness Levels Based on Ingression Level

Desired Cleanliness Levels (ISO Code)	Ingression Rate	Schroeder Element Medium
20/18/15	High	Z25
19/17/14	Low	Z25
19/17/14	High	Z10
18/16/13	Low	Z10
18/16/13	High	Z5
15/13/10	Low	Z5
15/13/10	High	Z3
14/12/9	Low	Z3
14/12/9	High	Z1
13/11/8	Low	Z1

Bulk Diesel Coalescing Filtration Fundamentals

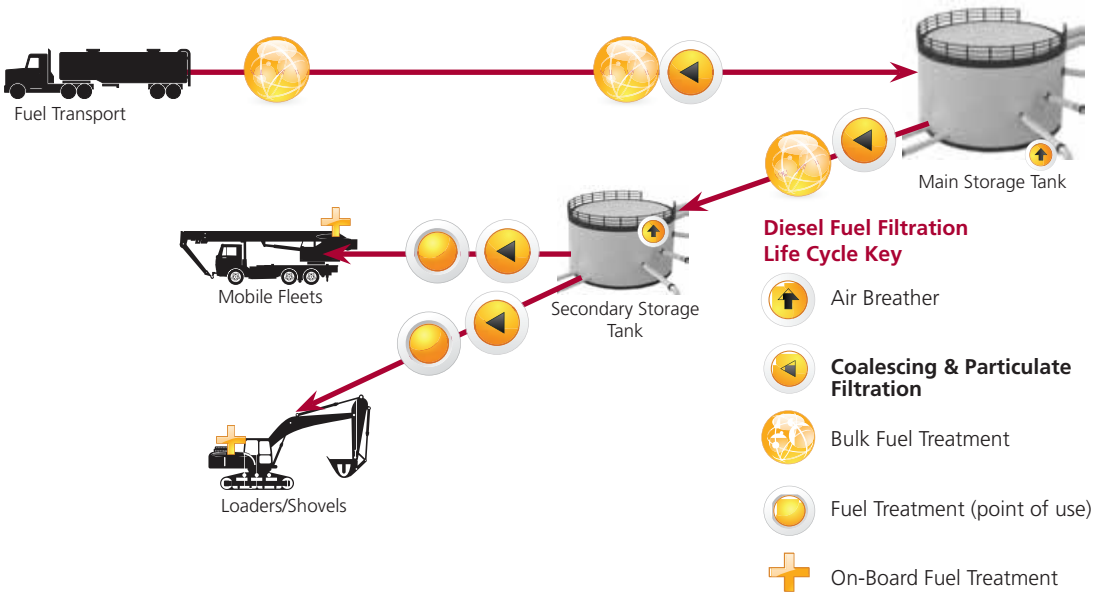
Prepare for, Tier 4 Off-Highway Engines Requirements

- Fuel injectors operate at high pressures to achieve emissions standards (30,000+ psi)
- Injector nozzles openings as small as 2 µm (for perspective 40 µm is visibility limit with human eye)
- Requirements for diesel fuel based on ISO Code cleanliness levels (18/16/13 storage, 12/9/6 or better at the injector)
- Requirements for water removal from fuel (levels down to 50 ppm)

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 µm.

Why is highly efficient particulate and coalescing fuel filtration a critical requirement in today's application?

- 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 3 & 4)
- 2011: Ultra Low Sulfur Diesel (ULSD15) became standard for all diesel fuel in the US, Canada & Europe
- 2013-2014 & Beyond: Tier 4 and Tier 4 final Engines are being shipped with fuel cleanliness requirements and enhanced water level removal needs
- Fuel cleanliness and ppm levels that were acceptable in Tier 3 and lower engines will most likely cause significant issues in today's Tier 4 Final engines. Injector manufacturers advise: No warranty coverage due to improper fuel filtration



Application Introduction: Better Bulk Fuel Filtration is now a critical competence in achieving cost effective engine performance

Coalescing[1] filtration can be a highly effective method to remove water from diesel fuels. Water is typically introduced into the fuel supply by condensation or water ingression during delivery or transfer. Water in a vehicle's fuel system can reduce lubricity causing seizure of close tolerance parts, increased TAN, reduced lubricity at the injector, lower burn efficiency, reduced power or emissions violations and corrosion. 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 4 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.

Bulk Diesel Coalescing Filtration Fundamentals

Application Introduction: Better Bulk Fuel Filtration is now a critical competence in achieving cost effective engine performance

Coalescing[1] filtration can be a highly effective method to remove water from diesel fuels. Water is typically introduced into the fuel supply by condensation or water ingression during delivery or transfer. Water in a vehicle's fuel system can reduce lubricity causing seizure of close tolerance parts, increased TAN, reduced lubricity at the injector, lower burn efficiency, reduced power or emissions violations and corrosion.. 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 4 fuel injection systems have tighter tolerances and require water removal, less than 200 ppm to minimize wear related failures.

We test to SAE J1488 and ISO16332 - Fuel Standards. Below are examples of Schroeder tests and results of third-party product testing.

SAE J1488 is a fuel/water separation test with continuous water injection of .25% of the fuel flow rate. The test is performed with the water injected upstream (suction side) of the pump resulting in emulsified or finely dispersed water droplets.

SAE J11839 is a fuel/water separation test with continuous water injection of .25% of the fuel flow rate. The test is performed with the water injected downstream (pressure side) of the pump resulting in larger water droplets.

ISO 16332 is a fuel/water separation test with continuous water injection of .15% of the fuel flow rate. The test is performed with the water injected either downstream (pressure side) or upstream (suction side) of the pump resulting in emulsified/finely dispersed or larger water droplets, respectively.

Third-party testing show the performance of the Schroeder ICF rated for 16 gpm and a competitor product rated for 25 gpm at a test flow rate of 10 gpm. Schroeder product is fully synthetic where competitor's is a combination of systolic and cellulose. As the test goes on, the competitor's element loses separation efficiency. The result is a clear sump sample (Figure 3) versus a cloudy sump sample with fuel and water (Figure 2).

Figure 1

Test Circuit Sample of UNFILTERED Sump Discharge:

(Tested without the coalescing element installed at 16 gpm flow) 0% removal efficiency and the unfiltered sump sample is milky and filled with fuel.

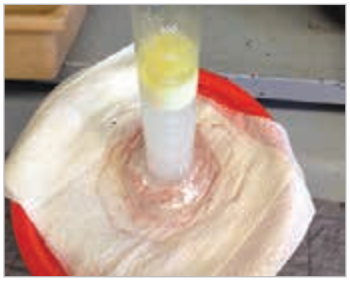


Figure 2

Competitive Fuel Filter:

Sample of Drain Discharge after Coalescing filtration at 16 gpm at an average efficiency of 61%. The sample is a mixture of fuel and water due to poor separation efficiency.

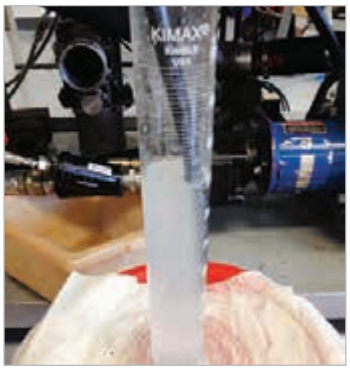


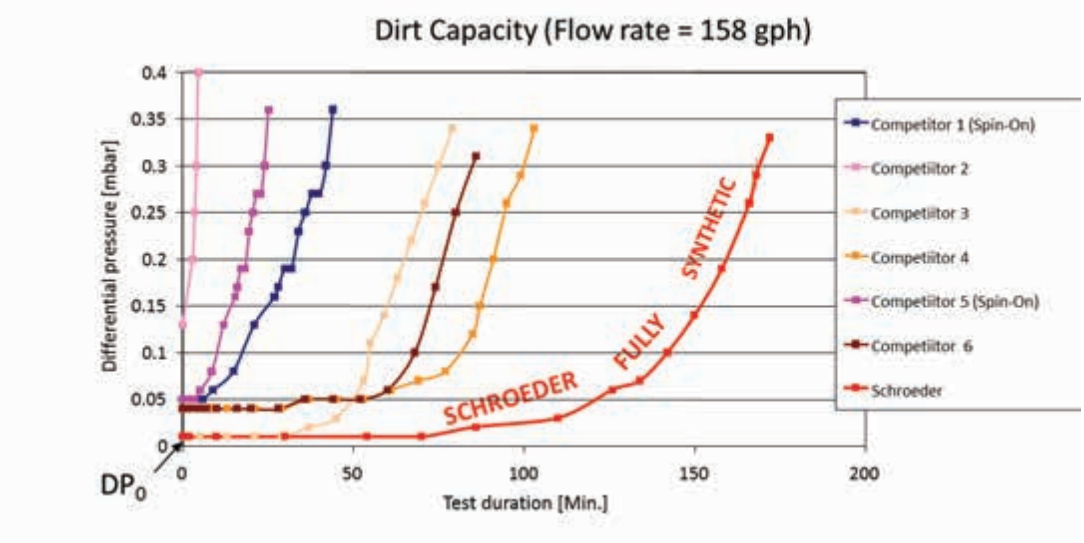
Figure 3

Schroeder ICF Coalescing Element:

Water removal performance at 25 gpm is 97.7% efficiency and as a result the sump drain output sample is clean and free of visible fuel.
NOTE: for comparison, competitor's filter efficiency at only 16 gpm is 61% and testing of the competitors unit at 25 gpm provided downstream results that were too saturated to measure on a Karl Fischer, showing reduced separation efficiency.

Bulk Diesel Coalescing Filtration Fundamentals

Cellulose vs Fully Synthetic Medium



Independent Testing (Sept. 2014) at Southwester Research Institute® (SWR)

- SAE J1488
- In-line fuel coalescing filter (ICF)
- Flow rate 16 gpm
- Water feed rate: 152 ml/min (2,500 ppm)
- Test Duration 150 minutes

Type	% Efficiency
ULSD	95.4%
Biodiesel (Simulated by SwRI)	98.1%

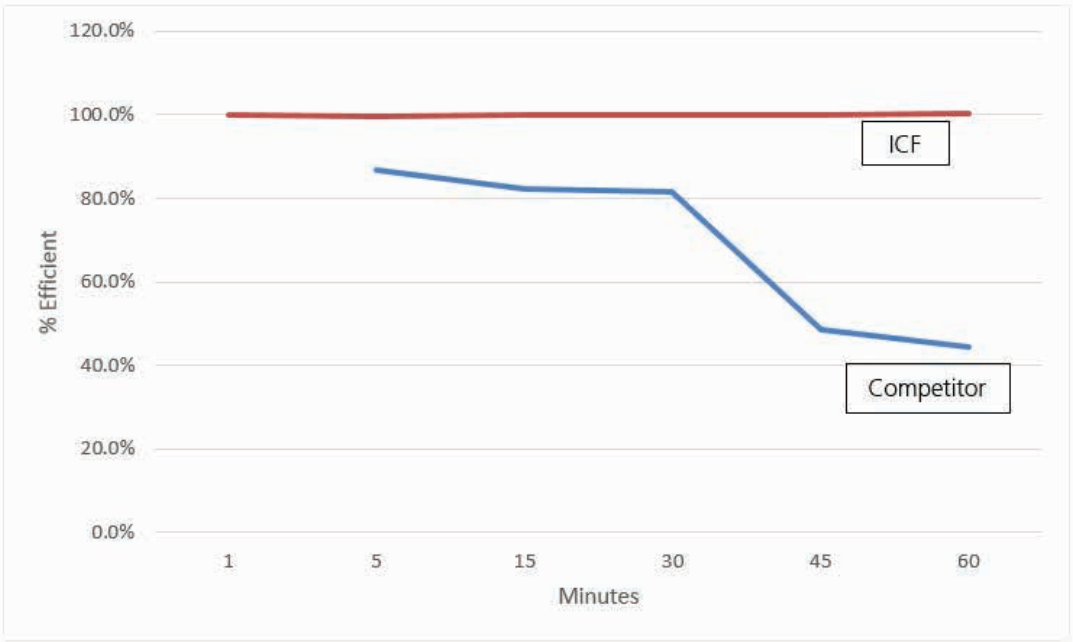
ICF vs Competition Efficiency Testing

Schroeder Coalescing Technology: the Difference in Performance

Equipment:

- MPT Multipurpose Stand
- 10 Gallon Reservoir
- Coulometric Karl Fischer Unit
- Controlled Environmental Conditions

Flow Rate 10 gpm



Diesel Fuel Filtration in the Engine-Why it Matters

Tier 4 Rail Injection Engine - Cutaway

- Bacterial Growth

- Blocked Fuel Filter

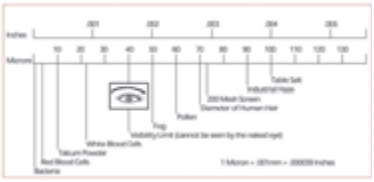
- Clogged Fuel Injectors

- Damaged Fuel Pump

- Oil Degradation/ Leakages

- Seal Failures

- Unseen Particles



Section 1:

BULK DIESEL FILTRATION

In-Line Bulk Fuel Coalescing Filter

**Coalescing Elements Patent-Pending*

16 gpm
60 L/min

150 psi
10 bar

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

Features and Benefits

- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from bulk fuel tanks to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- Housing design allows for field upgrade of any available option
- Schroeder Anti-Static Pleat Media (ASP®) is standard for all coalescing elements
- Pressure bypass indicator setting at 36 psi, with bypass valve cracking at 40 psi, allows for early indication before by-pass of filter for advanced time for maintenance
- In application >32°F (0°C) complete automation is achievable with fail-safe auto-drain feature using a remote 5 gallon (18L) or 20 gallon (75L) sump with alarm and auto shutdown

Model no. of filter in photograph is: ICFVP24LEP

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

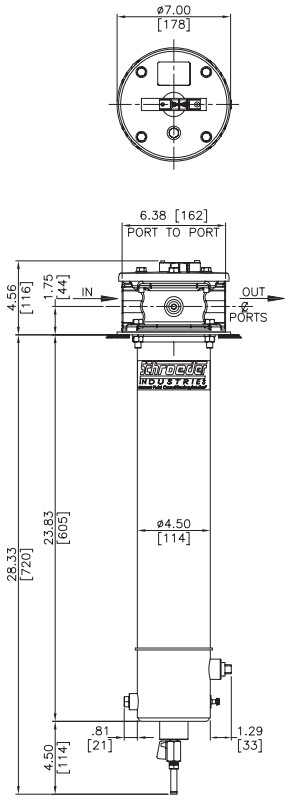
BULK FUEL FILTRATION

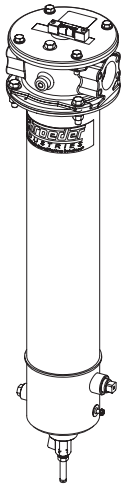
In-Line Bulk Fuel Coalescing Filter

ICF

Flow Rating:	Up to 16 gpm (60 L/min) for ULSD15
Inlet/Outlet Connection:	1 ½" NPTF Standard, -16 (ORB) SAE J1926 Optional
Max. Operating Pressure:	150 psi (10 bar)
Min. Yield Pressure:	450 psi (31 bar)
Rated Fatigue Pressure:	90 psi (6 bar), per NFPA T2.6.1-2005
Temp. Range:	32°F to 165°F (0°C to 74°C) standard and AWD option -20°F to 165°F (-29°C to 74°C) H option
Bypass Indication:	36 psi (2.5 bar) (Lower indication options available)
Bypass Valve Cracking:	40 psi (2.8 bar)
Porting Head/Cap: Element Bowl:	Aluminum - Coating Option see Box 7 Steel - Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard)
Filter Housing Weight:	15 lbs (6.8 kg) - Base unit without options or element
Element Change Clearance:	Access from top (remove cap) - 18" (457.2 mm) Access from below (remove bowl) - 2.5" (63.5 mm)
Housing Sump:	32 oz. (0.95 L)
Optional:	External water sump and non-immersion heater (power 120VAC, 235W), Sight glass, bracket, water in fuel sensor w/ or w/out remote mount light and 6' lead

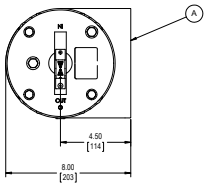
*Note: For other electrical options, contact factory
Element sold separately



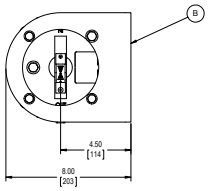


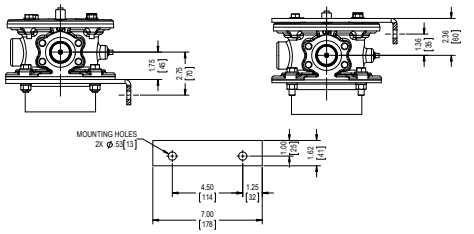
Optional Brackets:

Element top loading
Option 'B'



Element bottom loading
Option 'R'





MOUNTING BRACKET HOLE DIMENSIONS

Metric dimensions in ( ).

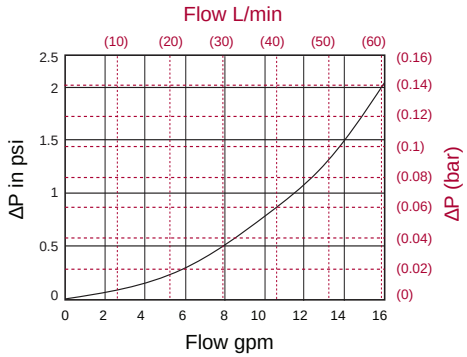
Filter Housing Specifications

ICF In-Line Bulk Fuel Coalescing Filter

Pressure Drop Information
Based on Flow Rate and Viscosity

$\Delta P_{housing}$

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



sp gr = specific gravity

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP factors @ 37 SUS (3 cSt).

C184Z3V = 0.2

C184Z5V = 0.2

C184Z7VE = 0.09

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

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

Notes

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

Exercise: Determine ΔP at 16 gpm (60 L/min) for ICFVP24LEP

Solution:

$\Delta P_{housing}$ = 2.05 psi = [0.14 bar]

$\Delta P_{coalescing\ element}$ = 16 x 0.2 = 3.2 psi [0.22 bar]

ΔP_{total}= 2.05 + 3.2 = 5.25 psi [0.36 bar]

Filter Element Selection Coalescing Element Performance Information
Elements Sold Separately

Coalescing Element	Pressure Side Coalescing	
	Recommended Flow	Single Pass Water Removal Efficiency
C184Z5V	16 gpm	≥ 99.5%
C184Z3V	16 gpm	≥ 99.5%
C184Z7VE	16 gpm	Contact Factory for Element Data

Flow Direction: Inside Out

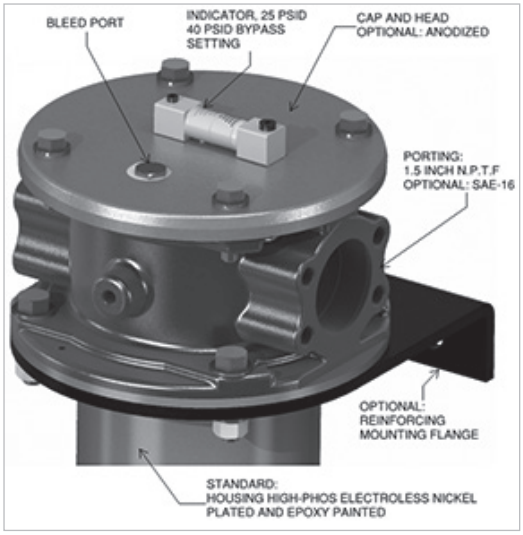
Element Nominal Dimensions: 4.0" (102 mm) O.D. x 18.5" (470 mm) long

*Schroeder Anti-Static Pleat Media (ASP®) is standard

*NOTE: Efficiency based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection. Discharge water concentration of <100 ppm free and emulsified water.

Highlighted product eligible for QuickDelivery

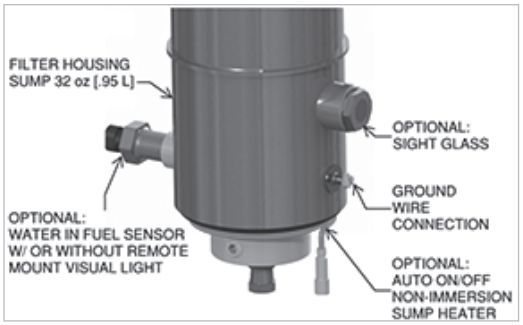
In-Line Fuel Coalescing Filter ICF



NOTES: Water in fuel sensor (WIF) supplied w/ or w/out remote mount indicator light to show full filter housing sump

T Option = WIF sensor only w/out filter housing sump full indication light or control panel

I Option = WIF sensor w/ remote mount filter housing sump full indicator light and NEMA 4X control panel supplied



NOTES: Filter Sump Heater Control Panel dimension:
6.5" W x 5.5" H x 6.5" D
(165 W x 140 H x 165 D)

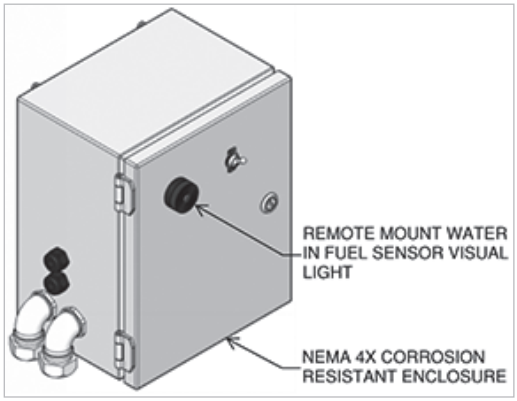
Automatic Water Drain Control Panel dimension:
10" W x 8" H x 12" D
(254 W x 203.20 H x 304.80 D)
*For use above 32°F (0°C) only

Electrical cable length (Control Panel to ICF): 4 ft. (1.22m)

Hose length for Automatic Water Drain feature (ICF to Tank): 6 ft.(1.83m)

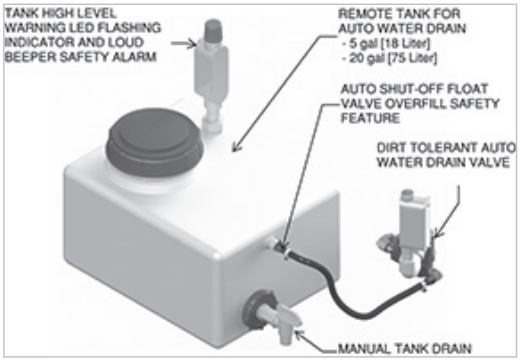
All control panels "NEMA 4X" rated

Metric dimensions in ( ).



NOTES: Remote Tank dimension:
5 Gallon Tank: 22" W x 9.25" L x 7.125" H
(558.80 W x 234.95 L x 180.97 H)
20 Gallon Tank: 15" W x 11" L x 31" H
(381 W x 279.40 L x 787.40 H)
Power supply for tank high level LED light: 9 VDC (battery included) Supplied w/ 9 VDC terminal for customer wiring provided.

Metric dimensions in ( ).



Shown w/ Automatic Sump (Manual Remote Sump is Optional but tank is the same)

ICF Options ICF

Filter Cap Assembly

BDF
BDFA
BDA
QCF
BDS
BDS2
BDS3
BDS4

Available Options

LVH-F
LVH-C
BDFC
BDC
HDP

Panel & Control for Automatic Drain with Safety Features

HDPD
EPM
EPTT
EWU
BCC

ICF In-Line Fuel Coalescing Filter

Filter Model Number Selection

Highlighted product eligible for QuickDelivery

How to Build a Valid Model Number for a Schroeder ICF without element:

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

Example: *NOTE:*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	
ICF	V	P24	L	B	S-I	EP-A		AWD5		= ICFVP24LBSIEPAAWD5

BOX 1

Filter Series
ICF

BOX 2

Sealing Material
V = Viton®

BOX 3

Porting	
P24 =	1½" NPTF (standard)
S16 =	-16 (ORB) SAE J1926

BOX 4

Coalescing Element Change Indicator
L = In cap bar indicator

BOX 5

Mounting Option	
B =	Bracket (Element top loading)
R =	Bracket (Element bottom loading)
Omit =	None

BOX 6

Filter Housing Sump Level Indicator Option	
S =	Sight Glass
I =	Water In Fuel sensor w/ remote mount light indicator and 6' lead for use in factory supplied control panel
T =	Water In Fuel sensor w/out remote light for use in customer supplied control panel
Omit =	None

BOX 7

Coating Option	
EP =	Epoxy paint and plating (standard)
A =	Anodized cap & head (optional)

BOX 8

Heating Option	
H =	Filter Sump Heater
Omit =	None

BOX 9

Automatic Drain & Remote Sump Options	
AWD5 =	Auto water drain 5 gal tank w/ failsafe (only offered for applications above 32°F (0°C) and units ordered without heater)
AWD20 =	Auto water drain 20 gal tank w/ failsafe (only offered for applications above 32°F (0°C) and units ordered without heater)
Omit =	None

BOX 10

Optional Manual Drain Remote Sump	
S5 =	5gal sump tank
S20 =	20gal sump tank
Omit =	None

NOTES:

Unless automatic drain option is specified, ICF units will come standard with manual drain

Coalescing element sold separately and selected below

Box 2. Viton® is a registered trademark of DuPont Dow Elastomers

Box 6 and 7. Only two boxes that allow combination of options (S + I or EP + A)

Box 8. Filter sump heater option only available when ordered w/out automatic water drain (AWD5 or AWD20)

Box 9. AWD fail safe is shown on page 25 (ICF)

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Element Part Number	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C184Z5V	16 gpm	≥ 99.5%
C184Z3V	16 gpm	≥ 99.5%
C184Z7VE	16 gpm	Contact Factory for Element Data

NOTE: Efficiency based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection. Discharge water concentration of <100 ppm free and emulsified water.

Flow Direction: Inside Out

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

*Schroeder Anti-Static Pleat Media (ASP®) is standard

Fluid Compatibility

Fuel Oils

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

Bulk Diesel Filter

**Coalescing Elements Patent-Pending*

BDF

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

Features and Benefits

- Designed with integrated particulate removal pre-filtration for maximum coalescing filter element life in the down stream housing
- Routine element change is only needed on KL3 particulate filter which saves time and money
- Particulate filtration at 1 or 3 microns utilizing Excel-ZPlus® synthetic Z-Media® element for contamination control
- Optional electrical Dirt Alarm® with, amber colored, particulate element change indicator light
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from the bulk fuel tank to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- Housing design allows for field upgrade of any available option
- Schroeder Anti-Static Pleat Media (ASP®) is standard for all coalescing elements
- Bypass indication for the coalescing ICF filter at 36 psi, with bypass cracking at 40 psi, and for the KL3 particulate filter bypass indication at 25 psi with bypass cracking at 30 psi, allows for early indication before by-pass of filter for advanced time for maintenance
- Complete automation is achievable with a water and fuel sensor and fail-safe auto-drain feature using a remote 5 gallons (18L) or 20 gallons (75L) sump with alarm and auto shutdown in application >32°F (0°C)
- Easy mounting and element service

Model no. of filter in photograph is: BDF1VS16LEEP

Model no. of filter in photograph is: BDF2VS16LEEP

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

BULK FUEL FILTRATION

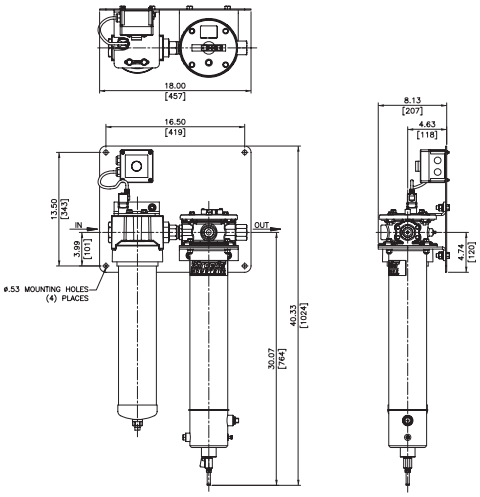
16-32 gpm
60-120 L/min
BDF
150 psi
10 bar

BDF Bulk Diesel Filter

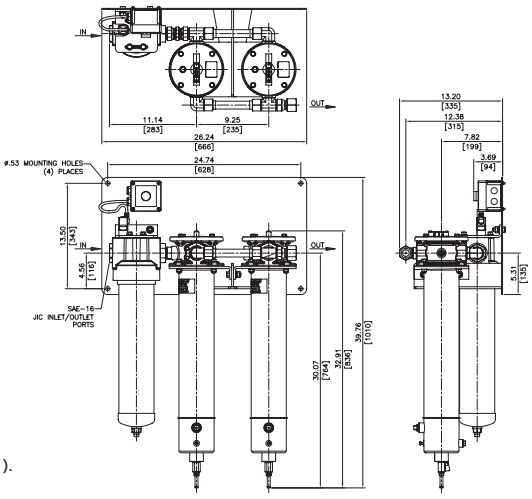
Filter Housing Specifications

Flow Rating:	BDF1: up to 16 gpm (60 L/min) BDF2: up to 32 gpm (120 L/min)	
Inlet/Outlet Connection:	-16 (ORB) SAE J1926	
Max. Operating Pressure:	150 psi (10 bar)	
Min. Yield Pressure:	450 psi (31 bar)	
Temp. Range:	-20°F to 165°F (-29°C to 74°C) w/ optional water sump heater 32°F to 165°F (0°C to 74°C) standard with AWD options	
Bypass Indication:	Particulate Filter 25 psi (1.7 bar)	Coalescing Filter 36 psi (2.5 bar)
Bypass Valve Cracking:	Particulate Filter 30 psi (2.1 bar)	Coalescing Filter 40 psi (2.8 bar)
Materials of Construction:	Particulate Filter Porting Head/Cap: Cast Aluminum Element Bowl: Steel	Coalescing Filter Aluminum - Coating Option see Box 8 Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard)
Weight:	BDF1: 46 lbs	BDF2: 78 lbs
Element Change Clearance:	Particulate Filter 2.50" (64 mm)	Coalescing Filter With mounting bracket - 18" (457.2 mm) - Access from top (remove cap) Without mounting bracket - Access from below 2.5" (63.5 mm) (remove bowl)
Housing Sump:	32 oz (95 L)	
Optional Water Sump Heater:	120VAC, 1 x 235W (BDF1) / 2 x 235W (BDF2)	
Optional Remote Mount Visual Electrical Indicator:	120VAC	

BDF1



BDF2



Metric dimensions in ( ).

Filtration Ratio per ISO 16889
Using APC calibrated per ISO 11171

Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
KKZ1V	224 grams	<4.0	4.2
KKZ3V	230 grams	<4.0	4.8

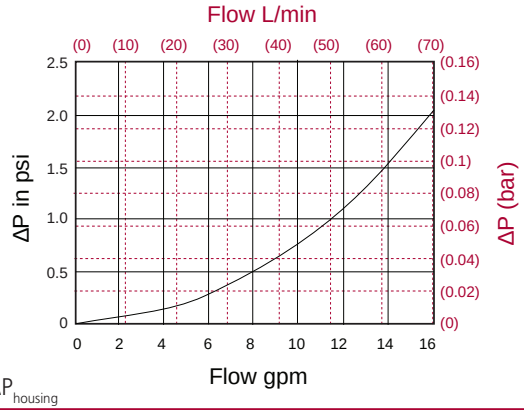
Coalescing Elements	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C184Z5V	16 gpm	≥ 99.5%
C184Z3V	16 gpm	≥ 99.5%

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

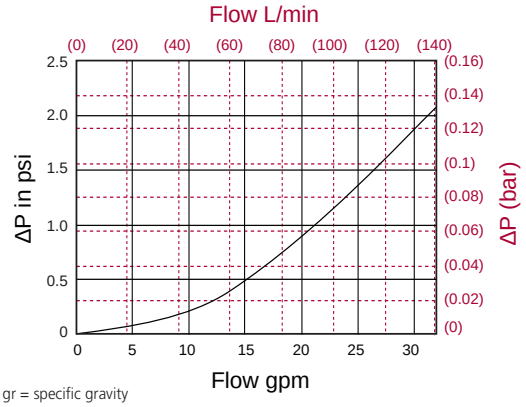
$\Delta P_{housing}$

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



$\Delta P_{housing}$

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



sp gr = specific gravity

Notes

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP factors @ 37 SUS (3 cSt).

C184Z3V = 0.2 C184Z5V = 0.2

KKZ1V = 0.02

KKZ3V = 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).

$\Delta P_{filter} = \Delta P_{housing} + \Delta P_{KKZ} + \Delta P_{C18}$

Exercise: Determine ΔP at 12 gpm (45 L/min) for BDF1VS16LVMEP Using (KKZ1)

Solution:

$\Delta P_{housing}$ = 1.1 psi = [0.08 bar]

$\Delta P_{element\ (KKZ1)}$ = 12 x 0.02 = .24 psi [.02 bar]

$\Delta P_{element\ (C184Z5V)}$ = 12 x 0.2 = 2.4 psi [.17 bar]

ΔP_{total}= 1.1 + 2.4 +.24 = 3.74 psi [.26 bar]

$\Delta P_{filter} = \Delta P_{housing} + \Delta P_{KKZ} + \Delta P_{C18}$

Exercise: Determine ΔP at 30 gpm (114 L/min) for BDF2VS16LVMEP Using (KKZ3)

Solution:

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

$\Delta P_{element\ (KKZ3)}$ = 30 x 0.01 = 0.3 psi [.02 bar]

$\Delta P_{element\ (C184Z5V)}$ = (30/2) x 0.2 = 15 x 0.2 = 3 psi [.21 bar]

ΔP_{total}= 1.8 + 0.3 + 3 = 5.1 psi [.35 bar]

Element Particulate Performance Information BDF
Element Water Coalescing Performance Information
Elements Sold Separately
Highlighted product eligible for QuickDelivery
Pressure Drop Information Based on Flow Rate and Viscosity
ICF BDFA BDA QCF BDS BDS2 BDS3 BDS4 LVH-F LVH-C BDFC BDC HDP HDPD EPM EPTT EWU BCC

Note:

Based on ULSD15 with 17 Dynes/cm surface tension and 0.25% (2500 ppm) water injection. Discharge water concentration of <100 ppm free and emulsified water.

BDF Bulk Diesel Filter

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder BDF housing without element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11
BDF										

Example: *NOTE:*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11	
BDF	1	V	S16	L	VM		EP				= BDF1VS16LVMEP

BOX 1 — Filter Series

BDF

BOX 2 — Flow rate & number of Coalescing Housings

1 = 16 gpm

2 = 32 gpm

BOX 3 — Housing Seal Material

V = Viton®

BOX 4 — Porting

S16 = -16 (ORB) SAE J1926

BOX 5 — Coalescing Element Change Indicator

L = In cap bar indicator

BOX 6 — KL3 Dirt Alarm® Option

VM = Visual Pop-up w/. Manual Reset (standard)

E = MS5 Electrical Indicator with Amber Light in NEMA4X box (option)

BOX 7 — Filter Housing Sump Level Indicator Option

S = Sight Glass

I = Water In Fuel probe w/ light indicator

Omit = None

BOX 8 — ICF Coating Options

EP = Epoxy Coated Bowl (standard)

A = Anodized Cap & Head (optional)

BOX 9 — Heating Option

H = Filter Sump Heater

Omit = None

BOX10 — Automatic Drain & Remote Sump Option

AWD5 = Auto water drain 5 gal tank w/ failsafe (only offered for applications above 32°F (0°C) and units ordered without heater

AWD20 = Auto water drain 20 gal tank w/ failsafe (only offered for applications above 32°F (0°C) and units ordered without heater

Omit = None

BOX 11 — Optional Sump for Manual Drain

S5 = 5gal sump tank

S20 = 20gal sump tank

Omit = None

NOTES:

Unless automatic drain option is specified, ICF unit will come standard with manual drain

Particulate and Coalescing element sold separately and selected below

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

Box 6. If MS5 electrical indicator is selected, heater (in Box 9) must be selected as well.

Box 7 and 8. Only two boxes that allow combination of options (S + I or EP + A)

Box 9. Filter sump heater option only available when ordered w/out automatic water drain (AWD5 or AWD20)

Box 10. AWD fail safe is shown on page 25 (ICF)

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171

Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
KKZ1V	224 grams	<4.0	4.2
KKZ3V	230 grams	<4.0	4.8

Coalescing Elements	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C184Z5V	16 gpm	≥ 99.5%
C184Z3V	16 gpm	≥ 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

Fluid Compatibility

Fuel Oils

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

In-Line Water Absorbing Diesel Fuel Filter

BDFA

**Coalescing Elements Patent-Pending*

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

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

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 Excel-ZPlus® Z-Media® in a particulate pre-filter, the KL3, with our fast-acting water absorbing filter, IRF, to fully protect vital diesel engine components 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 ideal for generator sets in a single-pass or kidney loop installation.

Model no. of filter in photograph is: BDFA1VVM

Model no. of filter in photograph is: BDFA2VVM

Features and Benefits

- Designed with integrated particulate removal pre-filter for maximum absorbent filter performance in the downstream housing
- Two stage filtration for particulate and water removal through absorption
- Particulate filtration at 1 or 3 microns utilizing Excel-ZPlus® synthetic Z-Media® element
- Water removal element capable of removing free and emulsified water
- Easy mounting and service

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

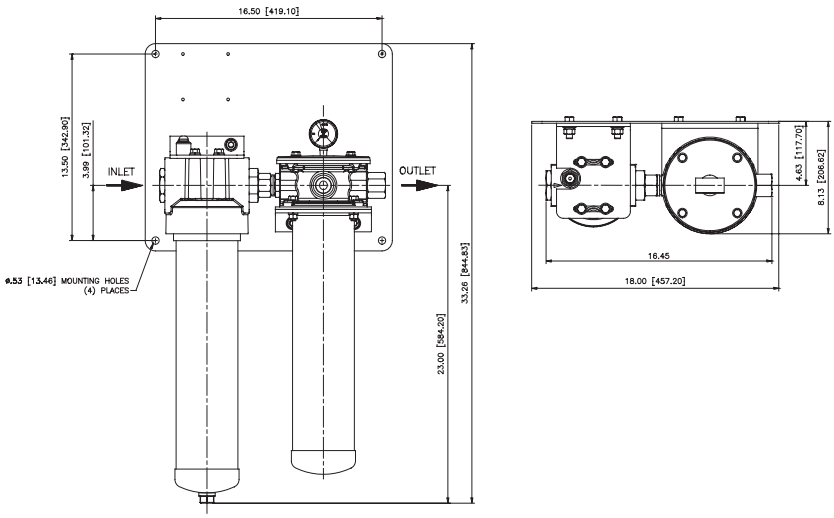
BULK FUEL FILTRATION

BDFA In-Line Water Absorbing Diesel Fuel Filter

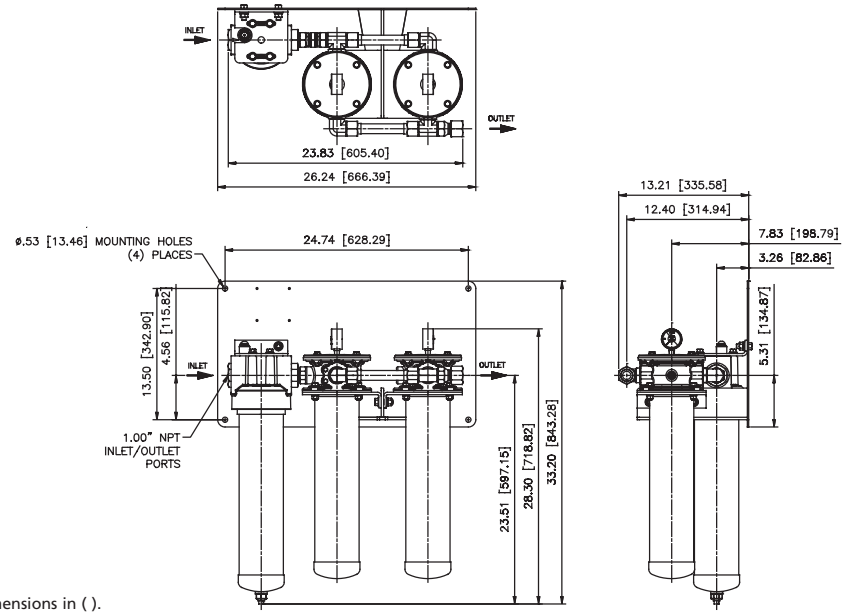
Filter Housing Specifications

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)	
Min. Yield Pressure:	450 psi (28 bar)	
Temp. Range:	-20°F to 165°F (-29°C to 74°C)	
Bypass Indication: (Lower indication options available)	Particulate Filter 25 psi (1.7 bar)	Water Absorbing Filter 20 psi (1.37 bar)
Bypass Valve Cracking:	Particulate Filter 30 psi (2 bar)	Water Absorbing Filter 25 psi (1.7 bar)
Materials of Construction:	Particulate Filter Porting Head/Cap: Cast Aluminum Element Bowl: Steel	Water Absorbing Filter Porting Head/Cap: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard)
Weight:	BDFA1: 45 lbs. (20.4 kg)	BDFA2: 90 lbs. (40.8 kg)
Element Change Clearance:	20" (508 mm) Note: Elements sold separately	

BDFA1



BDFA2



Metric dimensions in ( ).

In-Line Water Absorbing Diesel Fuel Filter

BDFA

Filtration Ratio per ISO 16889
Using APC calibrated per ISO 11171

Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
KKZ1V	224 grams	<4.0	4.2
KKZ3V	230 grams	<4.0	4.8

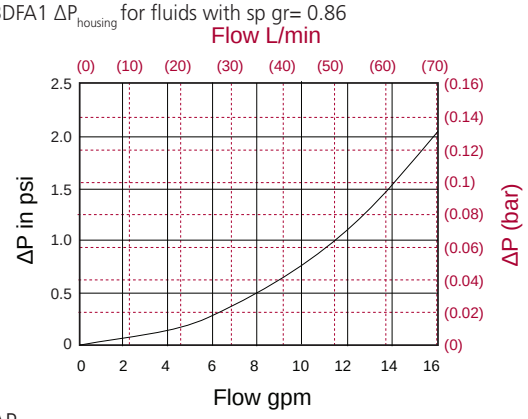
Water Absorbing Element	Flow Rate gpm (L/min)	Water Holding Capacity ml (ounces)
KKWV	16 (60)	400 (13.5)
KKZW5V	16 (60)	232 (7.8)

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

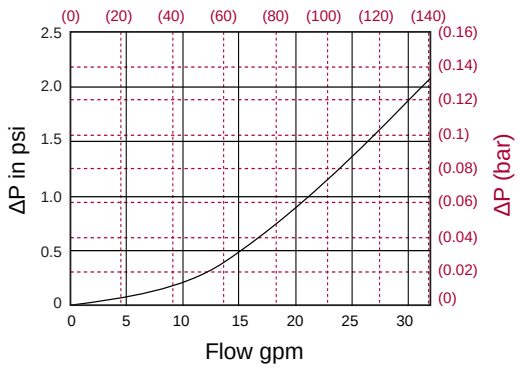
$\Delta P_{housing}$

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



$\Delta P_{housing}$

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



sp gr = specific gravity

Notes

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP factors @ 37 SUS (3 cSt).
KKWV = 0.01
KKZW5V = 0.02
KKZ1V = 0.02
KKZ3V = 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).

$\Delta P_{filter} = \Delta P_{housing} + \Delta P_{particulate\ element} + \Delta P_{water\ removal\ element}$

Exercise: Determine ΔP at 12 gpm (45 L/min) for BDFA1VVM Using KKZ1

Solution:

$\Delta P_{housing}$ = 1.1 psi = [0.07 bar]

$\Delta P_{element\ (KKZ1V)}$ = 12 x 0.02 = 0.24 psi [.02 bar]

$\Delta P_{element\ (KKWV)}$ = 12 x 0.01 = 0.12 psi [.01 bar]

ΔP_{total}= 1.1 + 0.24 + 0.12 = 1.46 psi [.10 bar]

$\Delta P_{filter} = \Delta P_{housing} + \Delta P_{particulate\ element} + \Delta P_{water\ removal\ element}$

Exercise: Determine ΔP at 30 gpm (114 L/min) for BDFA2VVM Using KKZ3

Solution:

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

$\Delta P_{element\ (KKZ3V)}$ = 30 x 0.01 = 0.3 psi [.02 bar]

$\Delta P_{element\ (KKWV)}$ = (30/2) x 0.01 = 15 x 0.01 = 0.15 psi [.01 bar]

ΔP_{total}= 1.8 + 0.3 + 0.15 = 2.25 psi [.16 bar]

BDFA In-Line Water Absorbing Diesel Fuel Filter

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder BDFA housing without element:

BOX 1	BOX 2	BOX 3	BOX 4
BDFA			

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	
BDFA	1	V	VM	= BDFA1VVM

BOX 1	BOX 2	BOX 3	BOX 4
Filter Series	**Flow rate & number of Water Absorbing Housings**	**Housing Seal Material**	**Dirt Alarm®**
BDFA	1 = 16 gpm 2 = 32 gpm	V = Viton®	VM = Visual pop-up w/ Manual Reset (particulate); Visual tricolor gauge (water absorbing)

NOTES:

Particulate and Water Absorbing element sold separately and selected below

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Particulate Elements	DHC	Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171 β_x (c) ≥ 200	β_x (c) ≥ 1000
KKZ1V	224 grams	<4.0	4.2
KKZ3V	230 grams	<4.0	4.8

Water Absorbing Element	Flow Rate gpm (L/min)	Water Holding Capacity ml (ounces)
KKWV	16 (60)	400 (13.5)
KKZW5V	16 (60)	232 (7.8)

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

Fluid Compatibility

Fuel Oils

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

In-Line Water Absorbing Diesel Fuel Bag Filter

BDA

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

BULK TANK KIDNEY LOOP / RECIRCULATION

Application Introduction:

The BDA provides a high capacity water absorbing solution for diesel fuel in a familiar process filtration housing configuration. The BDA combines the high volume particulate filtration performance of a bag housing element with a high capacity water absorbent media to provide an economic solution for particulate and water removal in diesel fuel systems. The BDA can be used for dispensing or kidney-loop installations. The filter is designed for use with standard diesel fuel as well as bio-based blends.

Model no. of filter in photograph is: BDA-H-2-V-P32

Features and Benefits

- One housing and bag filter provides both high capacity particulate and water removal performance
- A particulate filtration rating of 10 µm is standard
- Housings are high quality stainless steel, CE Marked vessels
- A positive bag seating mechanism helps to minimize the risk of seal bypass
- Fixed legs with height and 360° rotational adjustment allow for various mounting options

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

BULK FUEL FILTRATION

35 or 70 gpm
132 or 265 L/min

145 psi
10 bar

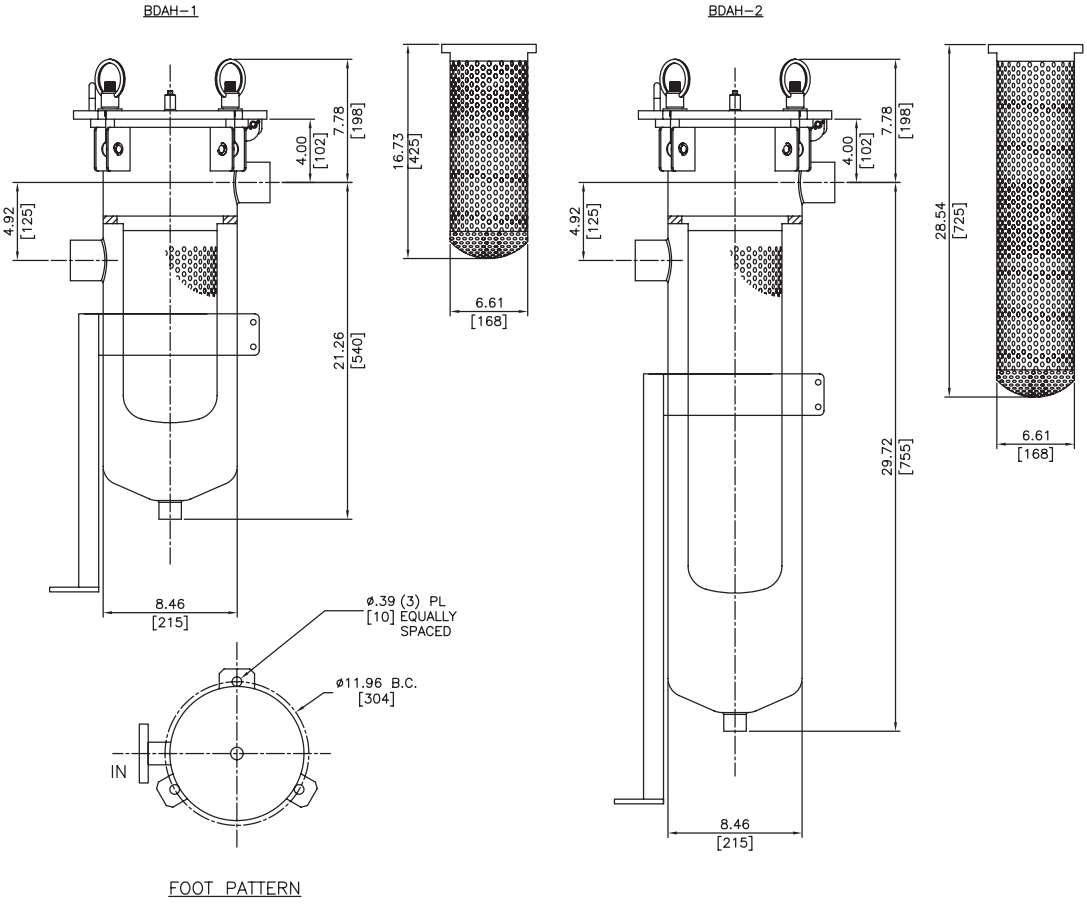
BDA In-Line Water Absorbing Diesel Fuel Filter

Filter Housing Specifications

Max Flow Rating:	BDAH1: 35 gpm (132 L/min) BDAH2: 70 gpm (265 L/min)	
Inlet/Outlet Connection:	2" NPTF 2" SAE 4-Bolt Flange Code 61 2" BSPF	
Max. Operating Pressure:	145 psi (10.3 bar)	
Recommended Element Change Differential Pressure:	22 psi (1.5 bar)	
Max. Element Differential Pressure:	55 psi (4 bar)	
Temp. Range:	-20°F to 176°F (-29°C to 80°C)	
Available Gauge Porting:	(2) ¼" BSP	
Materials of Construction:	304 Stainless Steel	
Weight:	BDAH1: 66 lbs. (30 kg)	BDAH2: 84 lbs. (38 kg)
Element Change Clearance:	Min. required 14" (356 mm)	

*Note: Elements sold separately

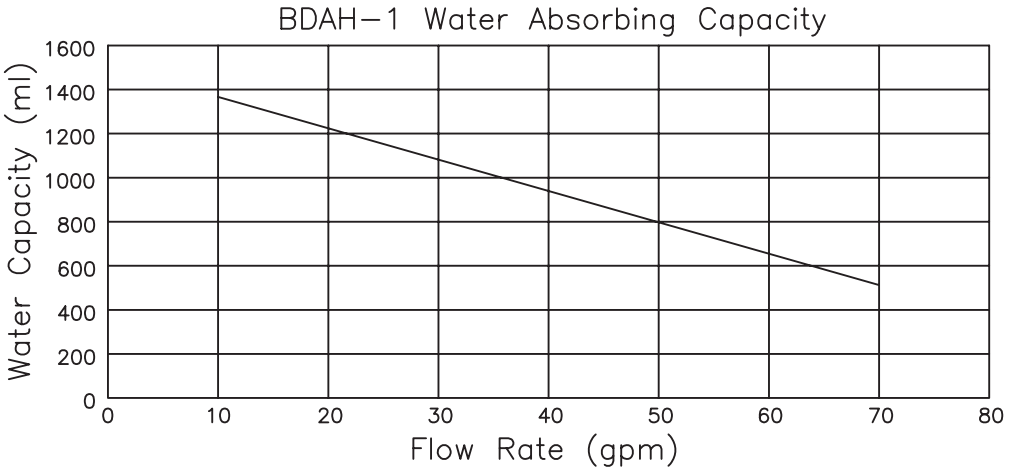
BDA-H

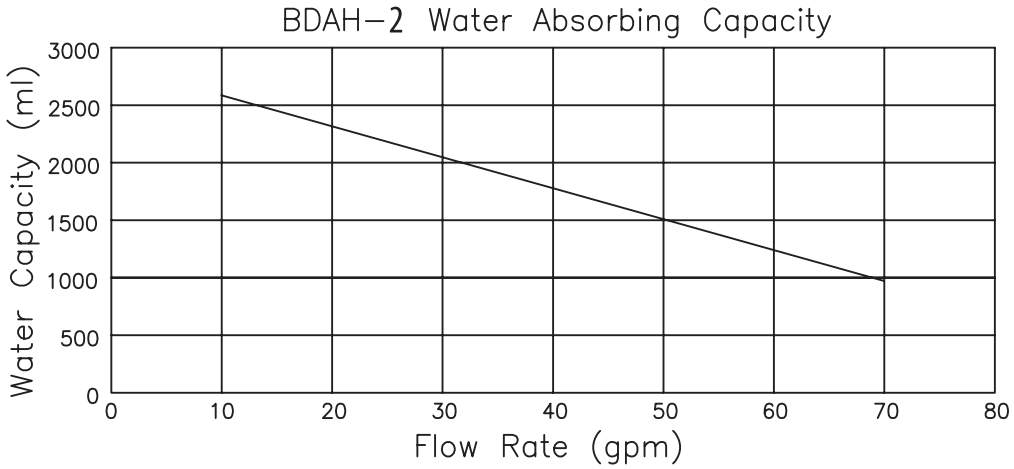


Metric dimensions in ( ).

In-Line Water Absorbing Diesel Fuel Filter

Water Absorbing Bag Element	Bag Housing Size	Micron Rating	Bag Element Dimensions
FA210P1PW	Size 1	10 µm	7" (178 mm) O.D. x 17" (432 mm) long
FA210P2PW	Size 2	10 µm	7" (178 mm) O.D. x 32" (813 mm) long





Pressure Drop Information: $\Delta P_{housing}$<0.5 psi

Notes

Replacement Element Information

Elements Sold Separately

Pressure Drop Information

Based on Flow Rate and Viscosity

BDA In-Line Water Absorbing Diesel Fuel Filter

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder BDFA housing without element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDA					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
BDA	H	1	V	P32	DPG	= BDAH1VP32DPG

BOX 1

Filter Series
BDA

BOX 2

Product Configuration
H = Housing

BOX 3

Bag Element Size
1 = Size 1
2 = Size 2

BOX 4

Housing Seal Material
V = Viton®

BOX 5

Porting
P32 = 2" NPTF
F32 = 2" SAE 4-Bolt Flange, Code 61
B32 = 2" BSPF

BOX 6

Filter Indicator
Omit = None
DPG = Differential Pressure Gauge

NOTES:

Bag Filters sold separately and are listed below

Element Part Number Selection

Water Absorbing Element	Bag Housing Size	Max Flow Rate gpm (L/min)	Micron Rating	Bag Element Dimensions
FA210P1PW	Size 1	35 (132)	10 µm	7" (178 mm) O.D. x 17" (432 mm) long
FA210P2PW	Size 2	70 (265)	10 µm	7" (178 mm) O.D. x 32" (813 mm) long

Fluid Compatibility

Fuel Oils

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

Bulk Diesel Fuel Coalescing Filter

QCF

**Coalescing Elements Patent-Pending*

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

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 injectors produce 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, engine performance with lower noise. Higher pressure fuel injector systems have tighter tolerances and require the highest efficiency, single-pass particulate and water removal to minimize wear related failures.

Model no. of filter in photograph is: QCFC5VS24VM

Features and Benefits

- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from the bulk fuels tanks to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- Complete automation is achievable with fail-safe auto-drain feature using a remote 5 gallon (18L) or 20 gallon (75L) sump with alarm and auto shutdown in application above 32°F (0°C)

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

BULK FUEL FILTRATION

70 gpm
265 L/min
100 psi
7 bar

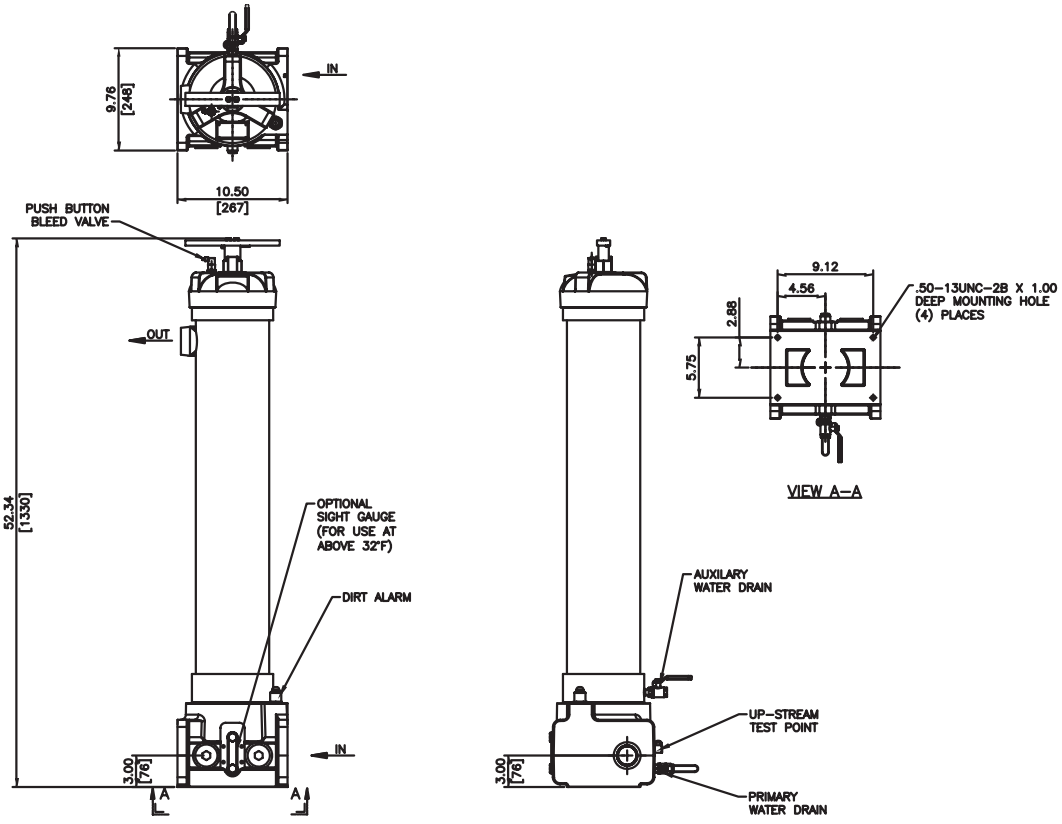
QCF Bulk Diesel Fuel Coalescing Filter

Filter Housing Specifications

Flow Rating:	Up to 70 gpm (265 L/min) for ULSD15
Inlet/Outlet Connection:	-24 (ORB) SAE J1926
Drain Connection Upper:	1/4" NPT Ball Valve
Drain Connection Lower:	1/4" NPT Ball Valve
Max. Operating Pressure:	100 psi (7 bar)
Min. Yield Pressure:	400 psi (27.6 bar) without 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 optional sight gauge
Bypass Indication:	25 psi (1.7 bar) (Lower indication options available)
Bypass Valve Cracking:	30 psi (2 bar)
Materials of Construction:	Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Nickel Coated Ductile Iron
Weight:	155 Lbs. (77 kg)
Element Change Clearance:	33.8" (858 mm)

NOTES:

Element is sold with housing



Metric dimensions in ( ).

Bulk Diesel Fuel Coalescing Filter

QCF

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

Flow Direction: Inside Out

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

Element Coalescing Performance Information

Element Sold with Housing

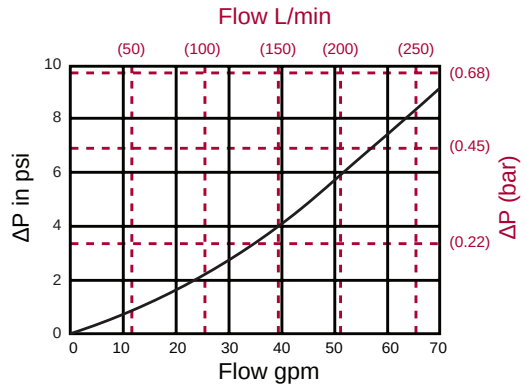
Highlighted product eligible for QuickDelivery

Pressure Drop Information

Based on Flow Rate and Viscosity

$\Delta P_{housing}$

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



sp gr = specific gravity

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP 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).

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

Exercise: Determine ΔP at 70 gpm (265 L/min) for QCFC5V24VM

Solution:

$\Delta P_{housing}$ = 9.2 psi = [0.63 bar]

$\Delta P_{element}$ = 70 x 0.17 = 11.9 psi [.82 bar]

ΔP_{total} = 9.2 + 11.9 = 21.1 psi [1.46 bar]

Notes

QCF Bulk Diesel Fuel Coalescing Filter

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder QCF Housing with Element:

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 — Filter Series
QCF

BOX 2 — Coalescing Element Series
C = C396Z5V

BOX 3 — Element Media Type
5 = 5 µm Coalescing

BOX 4 — Housing Sealing Material
V = Viton®

BOX 5 — Porting
S24 = -24 (ORB) SAE J1926

BOX 6 — Bypass Indicator Series
VM = Visual Pop-Up w/ Manual Reset

BOX 7 — Additional Options
Omit = None (standard)
H = Sump Heater
S = Sight Gauge
AWD5 = Auto water drain 5 gal tank w/ failsafe
AWD20 = Auto water drain 20 gal tank w/ failsafe

NOTES:

Optional sight gauge and AWD's for use only >32° F (0°C)

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

Box 7. For automatic drain option, contact factory

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

Flow Direction: Inside Out

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

Fluid Compatibility

Fuel Oils

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

Bulk Diesel Fuel Skid BDS

**Coalescing Elements Patent-Pending*

70 gpm
265 L/min
100 psi
7 bar

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

Features and Benefits

- Designed with integrated particulate removal pre-filtration for maximum coalescing filter element life in the downstream housing
- Sized for high flow or highly contaminated fluid applications
- Routine element change is only needed on Pre-filter (the particulate filter) which saves time and money
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from the bulk fuel tank to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- In applications >32°F (0°C) complete automation is achievable with a water in fuel sensor and fail-safe auto-drain feature using a remote 5 gallons (18L) or 20 gallons (75L) sump with alarm and auto shutdown
- Schroeder Anti-Static Pleat Media (ASP®) is standard for all coalescing elements

Model no. of filter in photograph is: BDS39QPMLZ3VVM

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

BULK FUEL FILTRATION

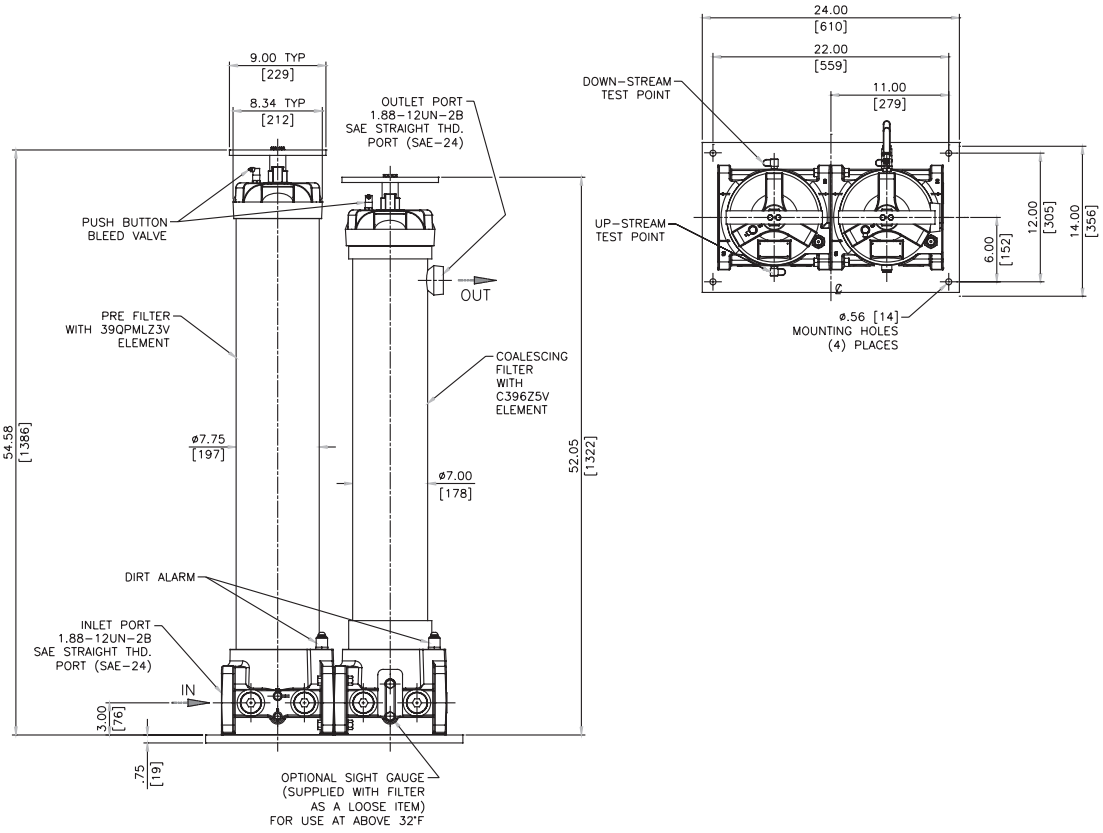
BDS Bulk Diesel Fuel Skid

Filter Housing Specifications

Flow Rating:	Up to 70 gpm (265 L/min) for ULSD15	
Inlet/Outlet Connection:	-24 (ORB) SAE J1926	
Drain Connection Upper:	1/4" NPT Ball Valve	
Drain Connection Lower:	1/4" NPT Ball Valve	
Max. Operating Pressure:	100 psi (7 bar)	
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 optional sight gauge or AWD option	
Bypass Indication: (Lower indication options available)	Particulate Filter Particulate: 15 psi (1.03 bar)	Coalescing Filter Coalescing: 25 psi (1.7 bar)
Bypass Valve Cracking:	Particulate Filter Particulate: 20 psi (1.37 bar)	Coalescing Filter Coalescing: 30 psi (2 bar)
Materials of Construction:	Particulate Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel	Coalescing Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel
Weight:	441 Lbs. (200 kg)	
Element Change Clearance:	33.8" (858 mm)	

NOTES:

Elements are sold with the housing



Metric dimensions in ( ).

Element Particulate Performance Information

Filtration Ratio per ISO 16889
Using APC calibrated per ISO 11171

Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Element Coalescing Performance Information

Elements Sold with Housing

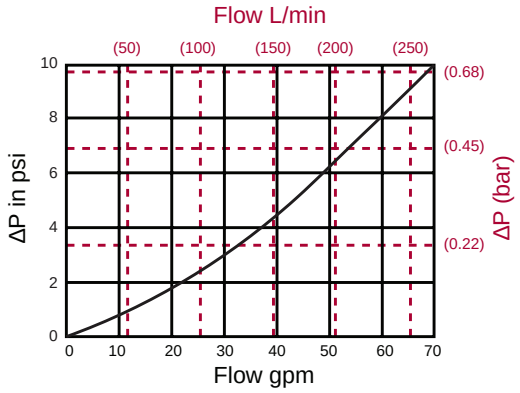
Highlighted product eligible for QuickDelivery

Pressure Drop Information

Based on Flow Rate and Viscosity

$\Delta P_{housing}$

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



sp gr = specific gravity

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP factors @ 37 SUS (3 cSt).

C396Z5V = .17

39QPMLZ1V = .01

39QPMLZ3V = .01

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

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

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

Exercise: Determine ΔP at 70 gpm (265 L/min) for BDS39QPMLZ3VVM

Solution:

$\Delta P_{housing}$ = 10 psi = [0.69 bar]

$\Delta P_{element\ (39QPML)}$ = 70 x 0.01 = 0.7 psi [.05 bar]

$\Delta P_{element\ (C396)}$ = 70 x 0.17 = 11.9 psi [.82 bar]

ΔP_{total} = 10 + 0.7 + 11.9 = 22.6 psi [1.56 bar]

Notes

BDS Bulk Diesel Fuel Skid

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder BDS supplied with coalescing element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5
BDS				

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	
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

BOX 5

Additional Options	
Omit =	None (standard)
H =	Sump Heater
S =	Sight Gauge
AWD5 =	Auto water drain 5 gal tank w/ failsafe
AWD20 =	Auto water drain 20 gal tank w/ failsafe
C =	Cla-Val® Flow Control Valve (2" ANSI 150# flange)

NOTES:

Optional sight gauge and AWD's for use only >32° F (0°C)
Box 4. Viton® is a registered trademark of DuPont Dow Elastomers

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Particulate Elements	DHC	Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171 β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Fluid Compatibility

Fuel Oils

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

Bulk Diesel Multi-Skid

BDS2

**Coalescing Elements Patent-Pending*

70-140 gpm
248-530 L/min
100 psi
7 bar

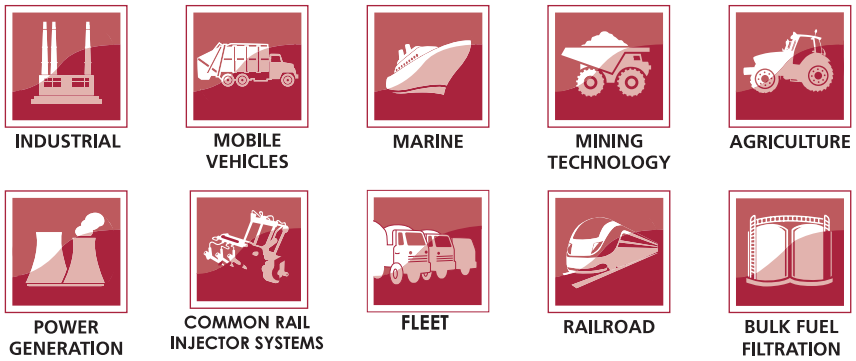
Applications

Features and Benefits

- Designed with integrated particulate removal pre-filtration for maximum coalescing filter element life in the downstream housing
- Sized for higher flows or highly contaminated fluid applications
- Routine element change is only needed on pre-filter (the particulate filter) which saves time and money
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from the bulk fuel tank to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- In applications >32°F (0°C) complete automation is achievable with a water in fuel sensor fail-safe auto-drain feature using a remote 5 gallon (18L) or 20 gallon (75L) sump with alarm and auto shutdown
- Schroeder Anti-Static Pleat Media (ASP®) is standard for all coalescing elements

Model no. of filter in photograph is:
BDS239QPMLZ3VVM

Markets



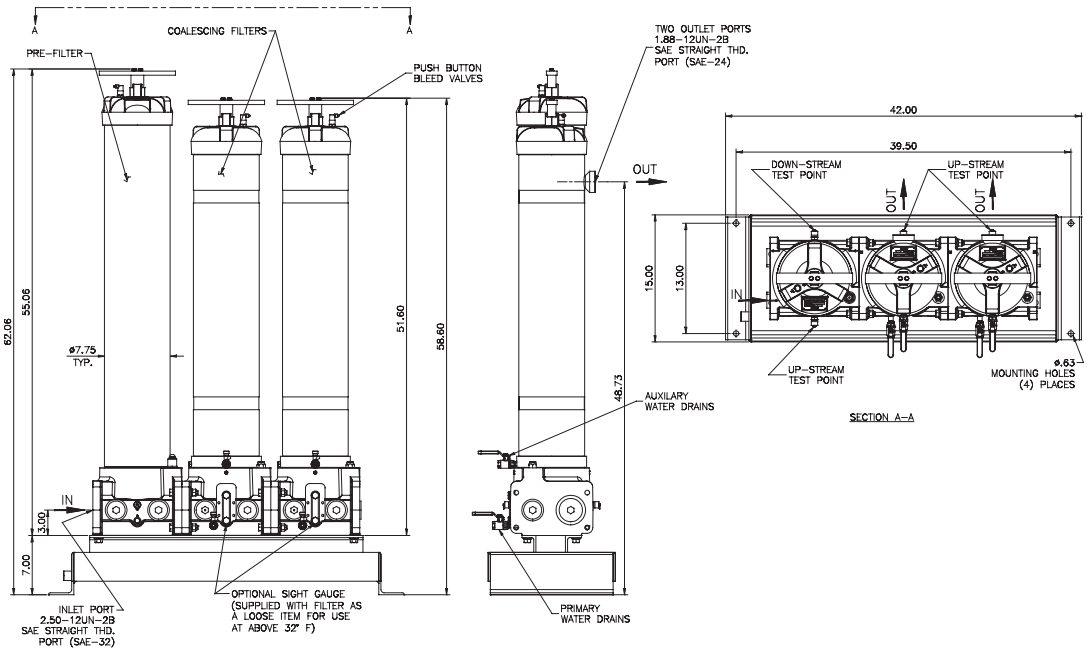
BDS2 Bulk Diesel Multi-Skid

Filter Housing Specifications

Flow Rating:	Up to 140 gpm (530 L/min) for ULSD15	
Inlet/Outlet Connection:	-32 (ORB) SAE J1926	
Drain Connection Upper:	1/4" NPT Ball Valve	
Drain Connection Lower:	1/4" NPT Ball Valve	
Max. Operating Pressure:	100 psi (7 bar)	
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 optional sight gauge or AWD option	
Bypass Indication: (Lower indication options available)	Particulate Filter Particulate: 15 psi (1.03 bar)	Coalescing Filter Coalescing: 25 psi (1.7 bar)
Bypass Valve Cracking:	Particulate Filter Particulate: 20 psi (1.37 bar)	Coalescing Filter Coalescing: 30 psi (2 bar)
Materials of Construction:	Particulate Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel	Coalescing Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel
Weight:	596 Lbs. (270 kg)	
Element Change Clearance:	33.8" (858 mm)	

NOTES:

Element are sold with the housing



Metric dimensions in ( ).

Element Particulate Performance Information

Filtration Ratio per ISO 16889
Using APC calibrated per ISO 11171

Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

Element Coalescing Performance Information
Elements Sold with Housing

Highlighted product eligible for QuickDelivery

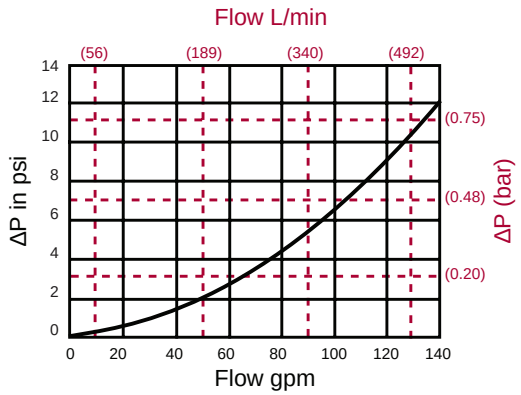
Particulate Element
Flow Direction: Outside In
Element Nominal Dimensions: 6.0" (150 mm) O.D. x 37.80" (960 mm) long

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

Pressure Drop Information
Based on Flow Rate and Viscosity

$\Delta P_{housing}$

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



sp gr = specific gravity

Notes

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP factors @ 37 SUS (3 cSt).

C396Z5V = .17

39QPMLZ1V = .01

39QPMLZ3V = .01

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

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

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

Exercise: Determine ΔP at 70 gpm (265 L/min) for BDS239QPMLZ3VVM

Solution:

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

$\Delta P_{element\ (39QPML)}$ = 70 x 0.01 = 0.7 psi [.05 bar]

$\Delta P_{element\ (C396)}$ = 70 x 0.17 = 11.9 psi [.82 bar]

ΔP_{total} = 3.0 + 0.7 + 11.9 = 15.6 psi [1.07 bar]

BDS2 Bulk Diesel Multi-Skid

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder BDS Housing Supplied with Element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDS					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
BDS	2	39QPMLZ3	V	VM		**= BDS239QPMLZ3VVM**

BOX 1

Filter Series
BDS

BOX 2

No. of Coalescing Filters
2 = 140gpm

BOX 3

Particulate Filter Micron Rating
39QPMLZ1 = 1µm
39QPMLZ3 = 3µm

BOX 4

Housing Seal Material
V = Viton®

BOX 5

Dirt Alarm®
VM = Visual Pop-Up w/ Manual Reset

BOX 6

Sump Options	
Omit =	None (standard)
H =	Sump Heater
S =	Sight Gauge
AWD5 =	Auto water drain 5 gal tank w/ failsafe
AWD20 =	Auto water drain 20 gal tank w/ failsafe
C =	Cla-Val® Flow Control Valve (2" ANSI 150# flange)

NOTES:

Optional sight gauge and AWD's for use only >32° F (0°C)
Box 4. Viton® is a registered trademark of DuPont Dow Elastomers

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Particulate Elements	DHC	Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171 β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Fluid Compatibility

Fuel Oils

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

Bulk Diesel Multi-Skid BDS3

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

Features and Benefits

- Designed with integrated particulate removal pre-filtration for maximum coalescing filter element life in the downstream housing
- Sized for higher flows or highly contaminated fluid applications
- Routine element change is only needed on pre-filter (the particulate filter) which saves time and money
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from the bulk fuel tank to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- In applications >32°F (0°C) complete automation is achievable with a water in fuel sensor fail-safe auto-drain feature using a remote 5 gallon (18L) or 20 gallon (75L) sump with alarm and auto shutdown
- Schroeder Anti-Static Pleat Media (ASP®) is standard for all coalescing elements

Model no. of filter in photograph is: BDS339QPMLZ3VVM

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

BULK FUEL FILTRATION

140-210 gpm
530-795 L/min
100 psi
7 bar

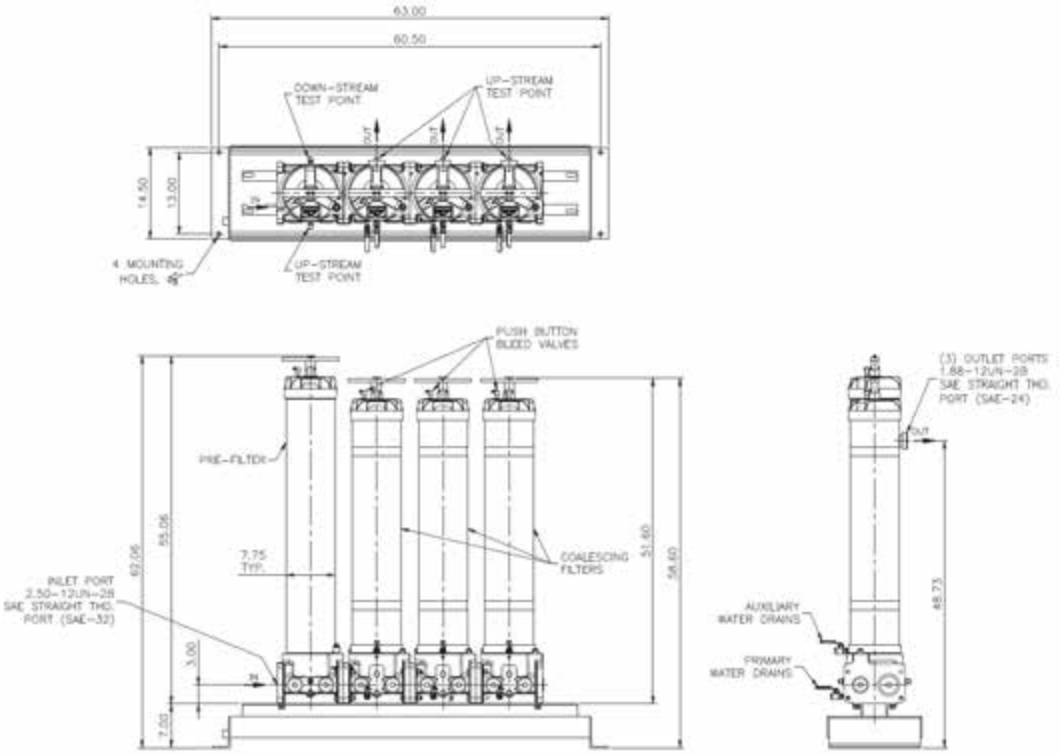
BDS3 Bulk Diesel Multi-Skid

Filter Housing Specifications

Flow Rating:	Up to 140 gpm to 210 gpm (530 to 795 L/min) for ULSD15	
Inlet/Outlet Connection:	-32 (ORB) SAE J1926	
Drain Connection Upper:	1/4" NPT Ball Valve	
Drain Connection Lower:	1/4" NPT Ball Valve	
Max. Operating Pressure:	100 psi (7 bar)	
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) with heater option 32°F to 165°F (0°C to 74°C) standard, with optional sight gauge or AWD option	
Bypass Indication: (Lower indication options available)	Particulate Filter Particulate: 15 psi (1.03 bar)	Coalescing Filter Coalescing: 25 psi (1.7 bar)
Bypass Valve Cracking:	Particulate Filter Particulate: 20 psi (1.37 bar)	Coalescing Filter Coalescing: 30 psi (2 bar)
Materials of Construction:	Particulate Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel	Coalescing Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel
Weight:	596 Lbs. (270 kg)	
Element Change Clearance:	33.8" (858 mm)	

NOTES:

Elements are sold with the housing



Metric dimensions in ( ).

Element Particulate Performance Information

Filtration Ratio per ISO 16889
Using APC calibrated per ISO 11171

Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Element Coalescing Performance Information

Elements Sold with Housing

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Highlighted product eligible for QuickDelivery BDS3

Pressure Drop Information

Based on Flow Rate and Viscosity

$\Delta P_{housing}$

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

Note: Contact Factory for deltaP housing data

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP factors @ 37 SUS (3 cSt).

C396Z5V = .17

39QPMLZ1V = .01

39QPMLZ3V = .01

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

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

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

Exercise: Determine ΔP at 70 gpm (265 L/min) for BDS239QPMLZ3VVM

Solution:

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

$\Delta P_{element\ (39QPML)}$ = 70 x 0.01 = 0.7 psi [.05 bar]

$\Delta P_{element\ (C396)}$ = 70 x 0.17 = 11.9 psi [.82 bar]

ΔP_{total}= 3.0 + 0.7 + 11.9 = 15.6 psi [1.07 bar]

Notes

BDS3 Bulk Diesel Multi-Skid

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder BDS Housing Supplied with Element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDS					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
BDS	3	39QPMLZ3	V	VM		**= BDS339QPMLZ3VVM**

BOX 1 – Filter Series

Filter Series
BDS

BOX 2 – No. of Coalescing Filters

No. of Coalescing Filters
3 = 210gpm

BOX 3 – Particulate Filter Micron Rating

Particulate Filter Micron Rating
39QPMLZ1 = 1µm
39QPMLZ3 = 3µm

BOX 4 – Housing Seal Material

Housing Seal Material
V = Viton®

BOX 5 – Dirt Alarm®

Dirt Alarm®
VM = Visual Pop-Up w/ Manual Reset

BOX 6 – Sump Options

Omit =	None (standard)
H =	Sump Heater
S =	Sight Gauge
AWD5 =	Auto water drain 5 gal tank w/ failsafe
AWD20 =	Auto water drain 20 gal tank w/ failsafe
C =	Cla-Val® Flow Control Valve (2" ANSI 150# flange)

NOTES:

Optional sight gauge and AWD's for use only >32° F (0°C)
Box 4. Viton® is a registered trademark of DuPont Dow Elastomers

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Particulate Elements	DHC	Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171 β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Fluid Compatibility

Fuel Oils

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

Bulk Diesel Multi-Skid BDS4

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

Features and Benefits

- Designed with integrated particulate removal pre-filtration for maximum coalescing filter element life in the downstream housing
- Sized for higher flows or highly contaminated fluid applications
- Routine element change is only needed on pre-filter (the particulate filter) which saves time and money
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from the bulk fuel tank to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- In applications >32°F (0°C) complete automation is achievable with a water in fuel sensor fail-safe auto-drain feature using a remote 5 gallon (18L) or 20 gallon (75L) sump with alarm and auto shutdown
- Schroeder Anti-Static Pleat Media (ASP®) is standard for all coalescing elements

Model no. of filter in photograph is: BDS439QPMLZ3VVM

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

RAILROAD

BULK FUEL FILTRATION

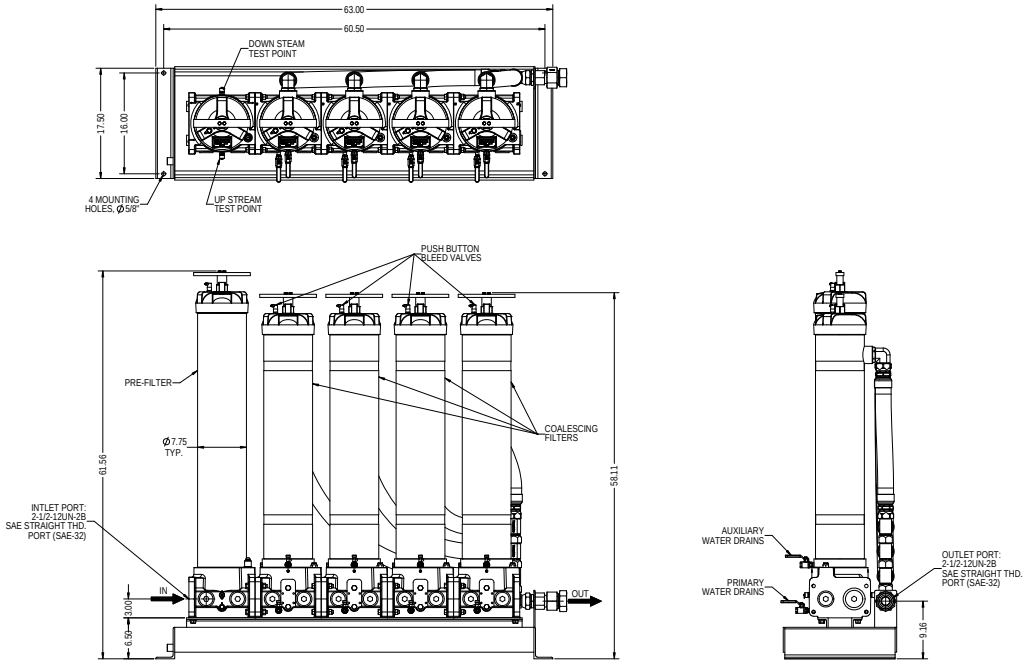
210-280 gpm
795-1060 L/min
100 psi
7 bar

BDS4 Bulk Diesel Multi-Skid

Flow Rating:	From 210 gpm to 280 gpm (795 to 1060 L/min) for ULSD15	
Inlet/Outlet Connection:	-32 (ORB) SAE J1926	
Drain Connection Upper:	1/4" NPT Ball Valve	
Drain Connection Lower:	1/4" NPT Ball Valve	
Max. Operating Pressure:	100 psi (7 bar)	
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) with heater option 32°F to 165°F (0°C to 74°C) standard, with optional sight gauge or AWD option	
Bypass Indication: (Lower indication options available)	Particulate Filter Particulate: 15 psi (1.03 bar)	Coalescing Filter Coalescing: 25 psi (1.7 bar)
Bypass Valve Cracking:	Particulate Filter Particulate: 20 psi (1.37 bar)	Coalescing Filter Coalescing: 30 psi (2 bar)
Materials of Construction:	Particulate Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel	Coalescing Filter Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel
Weight:	904 Lbs. (410 kg)	
Element Change Clearance:	33.8" (858 mm)	

NOTES:

Elements are sold with the housing



Metric dimensions in ( ).

Filtration Ratio per ISO 16889
Using APC calibrated per ISO 11171

Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

$\Delta P_{housing}$

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

Note: Contact Factory for deltaP housing data

$\Delta P_{element}$

$\Delta P_{element}$ = flow x element ΔP factor x viscosity factor

El. ΔP factors @ 37 SUS (3 cSt).

C396Z5V = .17

39QPMLZ1V = .01

39QPMLZ3V = .01

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

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

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

Exercise: Determine ΔP at 70 gpm (265 L/min) for BDS239QPMLZ3VVM

Solution:

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

$\Delta P_{element\ (39QPML)}$ = 70 x 0.01 = 0.7 psi [.05 bar]

$\Delta P_{element\ (C396)}$ = 70 x 0.17 = 11.9 psi [.82 bar]

ΔP_{total}= 3.0 + 0.7 + 11.9 = 15.6 psi [1.07 bar]

Notes

Element Particulate Performance Information

Element Coalescing Performance Information
Elements Sold with Housing

Highlighted product eligible for QuickDelivery

Pressure Drop Information
Based on Flow Rate and Viscosity

ICF BDF BDFA BDA QCF BDS BDS2 BDS3 BDS4 LVH-F LVH-C BDFC BDC HDP HDPD EPM EPTT EWU BCC

BDS4 Bulk Diesel Multi-Skid

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder BDS Housing Supplied with Element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDS					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
BDS	4	39QPMLZ3	V	VM		**= BDS439QPMLZ3VVM**

BOX 1

Filter Series
BDS

BOX 2

No. of Coalescing Filters
4 = 280gpm

BOX 3

Particulate Filter Micron Rating
39QPMLZ1 = 1µm
39QPMLZ3 = 3µm

BOX 4

Housing Seal Material
V = Viton®

BOX 5

Dirt Alarm®
VM = Visual Pop-Up w/ Manual Reset

BOX 6

Sump Options	
Omit =	None (standard)
H =	Sump Heater
S =	Sight Gauge
AWD5 =	Auto water drain 5 gal tank w/ failsafe
AWD20 =	Auto water drain 20 gal tank w/ failsafe
C =	Cla-Val® Flow Control Valve (2" ANSI 150# flange)

NOTES:

Optional sight gauge and AWD's for use only >32° F (0°C)
Box 4. Viton® is a registered trademark of DuPont Dow Elastomers

Element Part Number Selection

Highlighted product eligible for QuickDelivery

Particulate Elements	DHC	Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171 β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Fluid Compatibility

Fuel Oils

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

High Flow | Low Viscosity Housing Filter

LVHF

**Coalescing Elements Patent-Pending*

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

211- 951 gpm

799-3600 L/min

150 psi

10 bar

Standard

Features and Benefits

- Excellent filtration performance in a single pass
- Low pressure loss due to innovative element technology
- Easy to service thanks to intelligent element design
- Easy to adapt to filter housings for the removal of the fine particles in diesel
- The Low Viscosity-Housing Filter LVH-F is mainly used to filter low-viscosity fluids. It is especially suitable for applications with large amounts of dirt that need to be removed in just a single pass
- The Optimicron® filter elements used here ensure that both the required cleanliness and a long service life are achieved.
- Available in various sizes, the filters can be optimally integrated into new or existing systems.
- The filters are designed according to ASME Code Section VIII rules and regulations for pressure vessels as well as the ability to certify to other global standards upon request.

Model no. of filter in photograph is: LVHF340NBRFZ

Markets

INDUSTRIAL

BULK FUEL FILTRATION

MARINE

MINING TECHNOLOGY

AGRICULTURE

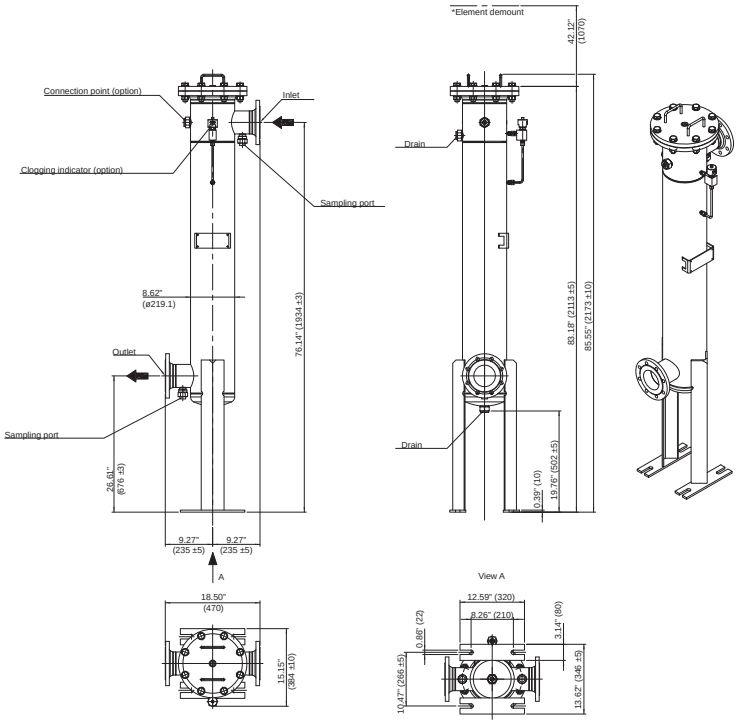
POWER GENERATION

LVHF High Flow | Low Viscosity Housing Filter

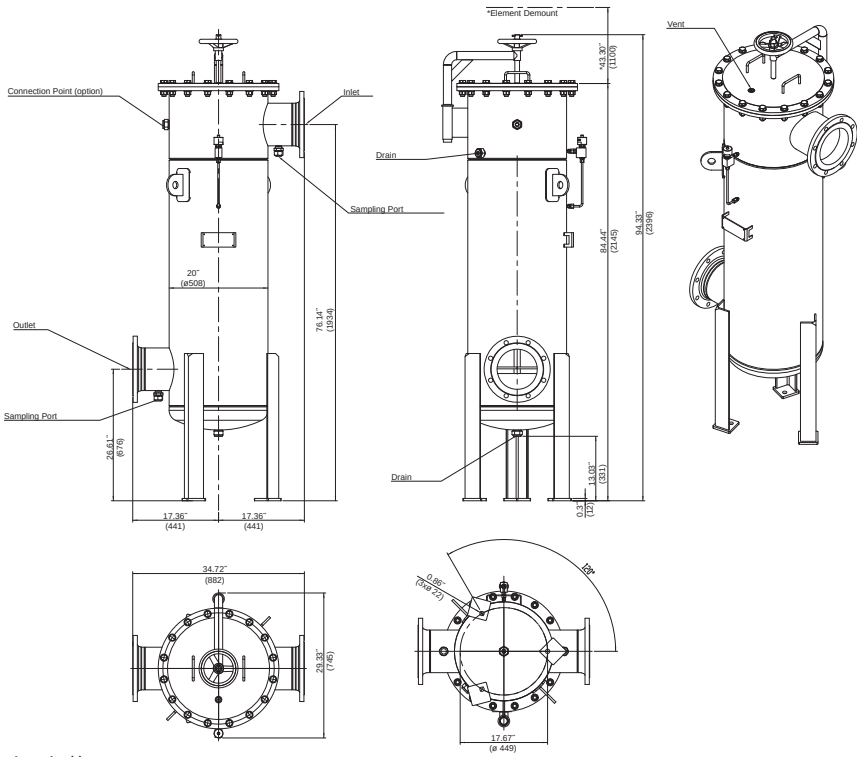
Filter Housing Specifications

Flow Rating:	211-951 gpm (799-3600 L/min)
Inlet/Outlet Connection:	ANSI 150#: 2"-12" DIN: DN50-DN300
Max. Operating Pressure:	150 psi (10 bar)
Max. Ambient Temperature:	122°F (50°C)
Max. Operating Temperature:	158°F (70°C)
Material Housing:	Stainless Steel or Carbon Steel

Dimensions LVH-F1



Dimensions LVH-F8



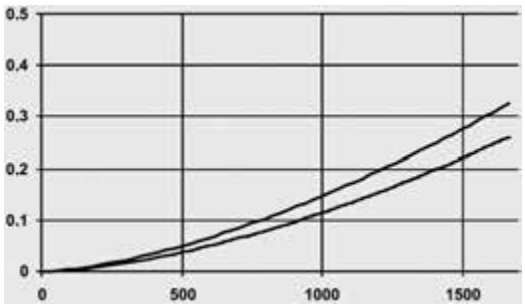
Metric dimensions in ( ).

High Flow | Low Viscosity Housing Filter LVHF

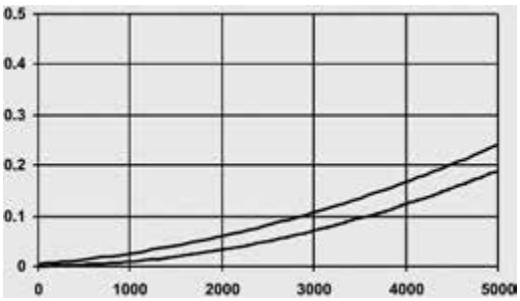
The lower curve applies to diesel at 20°C (the upper curve is for mineral oil with viscosity to 30 cSt for comparison).

Housing Pressure Drop Graphs (Housing ΔP)

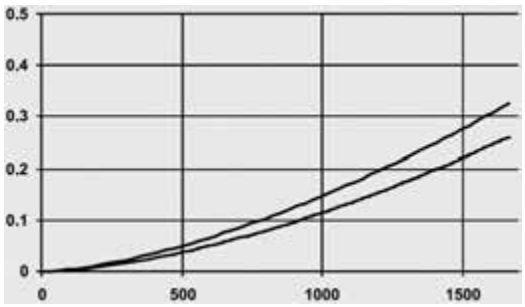
LVH-F-140



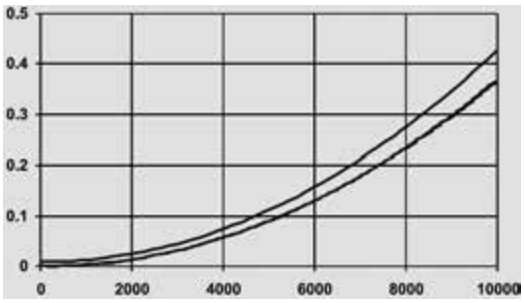
LVH-F-440



LVH-F-340



LVH-F-840



Y-axis: Pressure Drop (bar)

X-axis: Flow Rate (L/min)

Filter Calculation

Filter Size (Model)	Maximum Flow Rate	Number of Filter Elements
LVH-F-1 40	211 gpm	1 pc.
LVH-F-3 40	317 gpm	3 pcs.
LVH-F-4 40	476 gpm	4 pcs.
LVH-F-5 40	632 gpm	5 pcs.
LVH-F-8 40	951 gpm	8 pcs.

Filter Element Selection

Filter elements must be ordered separately and installed before initial operation on-site

Element	Designation	Part No.
Filter Element 40”	N42ON-DF003-FA40F	3965085
	N42ON-DF005-FA40F	3916691
	N42ON-DF010-FA40F	4055947

* Contact Factory for More Details

LVHF High Flow | Low Viscosity Housing Filter

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder LVH-F Supplied with Element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11
LVH										

Example: *NOTE:*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11	
LVH	F	3	40	E	V	C	V	F	D12	ZA	= LVHF340EVCVFD12ZA

BOX 1

Filter Series
LVH

BOX 2

Functions
F = Filter

BOX 3

Filter Size
1 = 1 filter element
3 = 3 filter elements
4 = 4 filter elements
5 = 5 filter elements
8 = 8 filter elements

BOX 4

Filter Element Length
40 = 40"

BOX 5

Housing Material
E = Stainless Steel
N = Carbon Steel

BOX 6

Mounting
V = Vertical
H = Horizontal

BOX 7

Pressure Range
B = 150 psi (10 bar)
C = 232 psi (16 bar)

BOX 8

Hydraulic Connection
A2 = 2" ANSI 150# SORF
A3 = 3" ANSI 150# SORF
A4 = 4" ANSI 150# SORF
A6 = 6" ANSI 150# SORF
A8 = 8" ANSI 150# SORF
L = DIN DN 50
R = DIN DN 100
V = DIN DN 150
W = DIN DN 200
Y = DIN DN 300

For flanges not listed, contact factory.

BOX 9

Sealing
F = Viton®

BOX10

Clogging Indicator
C12 = Differential pressure indicator, electrical
D17 = Differential pressure indicator, visual/electrical (230V)
D18 = Differential pressure indicator, visual/electrical (240V)
D32 = Differential pressure indicator, visual/electrical (PVL2GW.0/ V-113)
D33 = Differential pressure indicator, visual/electrical (PVL2GW.0/ 111-16)
Z = Without clogging indicator

BOX 11

Available Certification
ZA = ASME Certification

NOTES:

Filter elements must be ordered separately and installed before initial operation on site

Fluid Compatibility

Fuel Oils

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

High Flow | Low Viscosity Housing Coalescer

LVHC

**Coalescing Elements Patent-Pending*

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

211- 476 gpm

799-1802 L/min

150 psi

10 bar

Standard

Features and Benefits

- Excellent filtration performance in a single pass
- Low pressure loss due to innovative element technology
- Easy to service thanks to intelligent element design
- The Low Viscosity-Housing Coalescer LVH-C is mainly used for dewatering of diesel, making it especially suitable for applications with large amounts of water that need to be removed in just a single pass
- The Optimicron® filter elements used ensure that both the required cleanliness and long service life are achieved.
- Available in various sizes, the filters can be optimally integrated into new or existing systems.
- The filters are designed according to the ASME Code Section VIII rules and regulations for pressure vessels as well as the ability to certify to other global standards upon request.

Model no. of filter in photograph is: LVHCD440NVBTFZ

Markets

INDUSTRIAL

BULK FUEL FILTRATION

MARINE

MINING TECHNOLOGY

AGRICULTURE

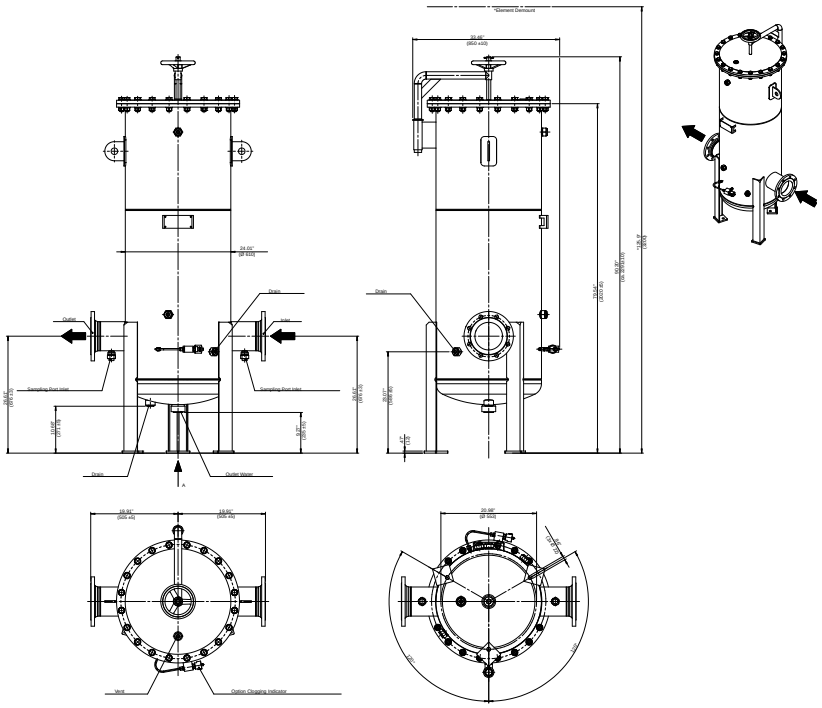
POWER GENERATION

LVHC High Flow | Low Viscosity Housing Coalescer

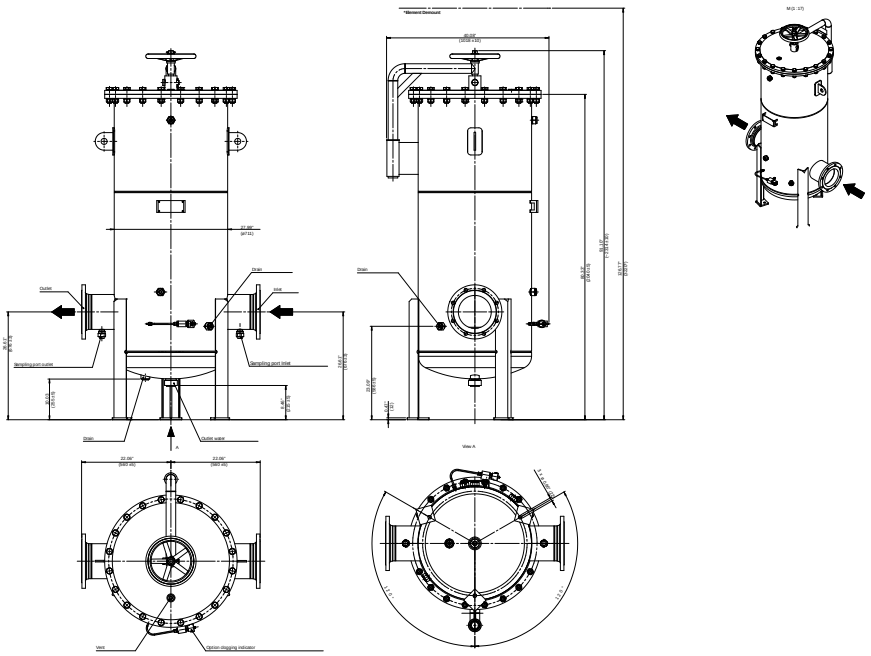
Filter Housing Specifications

Flow Rating:	211-476 gpm (799-1802 L/min)
Inlet/Outlet Connection:	ANSI 150#: 2”-12” DIN: DN50-DN300
Max. Operating Pressure:	150 psi (10 bar)
Max. Ambient Temperature:	122°F (50°C)
Max. Operating Temperature:	122°F (50°C)
Material Housing:	Stainless Steel or Carbon Steel

Dimensions LVH-C-D-4-40



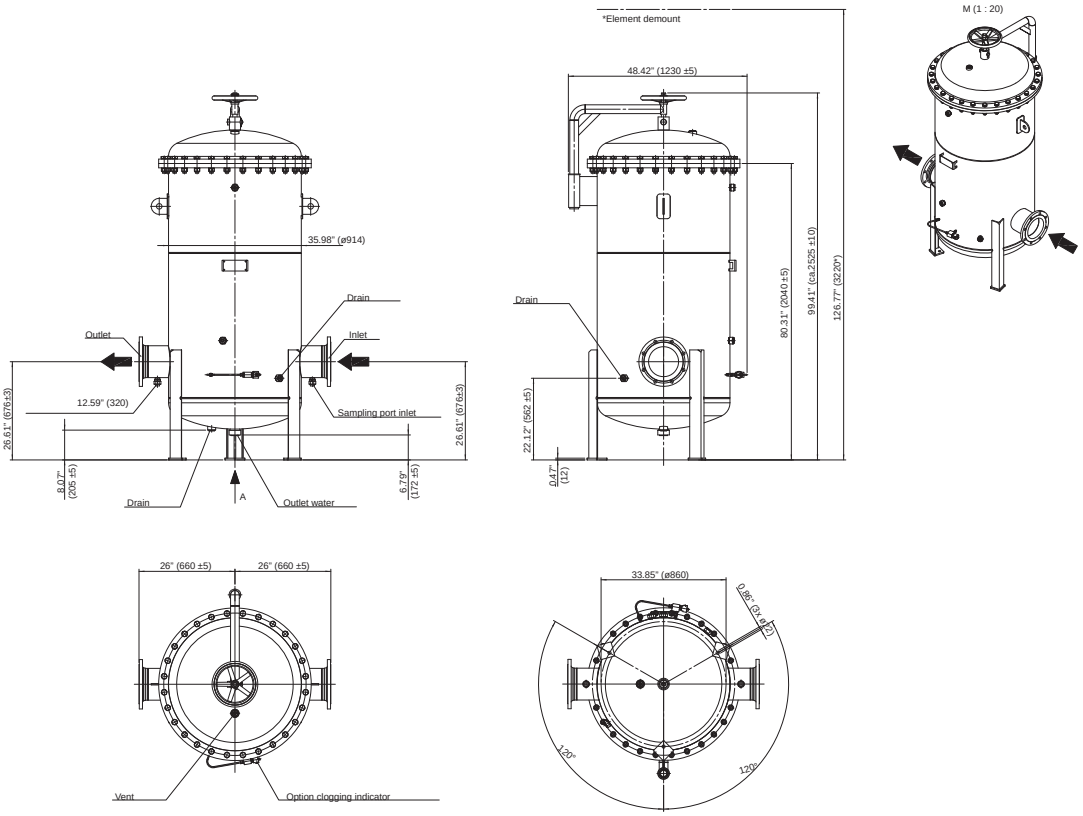
Dimensions LVH-C-D-6-40



Metric dimensions in ( ).

High Flow | Low Viscosity Housing Coalescer LVHC

Dimensions LVH-C-D-9-40



Filter Calculation

Filter Size (Model)	Maximum Flow Rate	Number of Coalescing Elements	Number of Separator Elements
LVH-CD-4 40	211 gpm	4 pcs.	3 pcs.
LVH-CD-6 40	317 gpm	6 pcs.	4 pcs.
LVH-CD-9 40	476 gpm	9 pcs.	6 pcs.

Filter Element Selection

Filter elements must be ordered separately and installed before initial operation on-site

Element	Model Code	Part No.
Separation Element 30”	N32ON-DSZ-SA80F	3910259
Coalescing Element 40”	N42ON-DCZ-CA60F	3910257

LVHC High Flow | Low Viscosity Housing Coalescer

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder LVH-C Supplied with Element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11
LVH										

Example: *NOTE:*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9	BOX 10	BOX 11	
LVH	CD	4	40	E	V	B	V	F	D32	ZA	= LVHCD440EVBVFD32ZA

BOX 1 – Filter Series

LVH

BOX 2 – Functions

CD = Coalescing, Diesel Fuel

BOX 3 – Filter Size & Number of Elements per Housing

4 = 4 coalescing & 3 separator elements
6 = 6 coalescing & 4 separator elements
9 = 9 coalescing & 6 separator elements

BOX 4 – Filter Element Length

40 = 40"

BOX 5 – Housing Material

E = Stainless Steel
N = Carbon Steel

BOX 6 – Mounting

V = Vertical

BOX 7 – Pressure Range

B = 150 psi (10 bar)

BOX 8 – Hydraulic Connection

A2 = 2" ANSI 150# SORF
A3 = 3" ANSI 150# SORF
A4 = 4" ANSI 150# SORF
A6 = 6" ANSI 150# SORF
A8 = 8" ANSI 150# SORF
L = DIN DN 50
T = DIN DN 100
V = DIN DN 150
W = DIN DN 200
Y = DIN DN 300

For flanges not listed, contact factory.

BOX 9 – Sealing

F = Viton®

BOX10 – Clogging Indicator

C12 = Differential pressure indicator, electrical
D17 = Differential pressure indicator, visual/electrical (230V)
D18 = Differential pressure indicator, visual/electrical (240V)
D32 = Differential pressure indicator, visual/electrical (PVL2GW.0/ V-113)
D33 = Differential pressure indicator, visual/electrical (PVL2GW.0/ 111-16)
Z = Without clogging indicator

BOX 11 – Available Certification

ZA = ASME Certification

NOTES:

Filter elements must be ordered separately and installed before initial operation on site

Fluid Compatibility

Fuel Oils

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

Section 2:

BULK DIESEL MOBILE FILTRATION UNITS

Bulk Diesel Mobile Filtration Units

Bulk Diesel Mobile Filtration Units

Mobile units provide a fuel filtration solution that address the particulate contamination and water removal in an easy to use package. Because of its mobility, it can be deployed in remote sites or moved between different bulk diesel storage tanks on a facility site.

Bulk Diesel Tanks where contaminated diesel fuel is left in a tank, can jeopardize all of the effort that were put in cleaning the fuel prior to filling up the tank. Over time, fuel in bulk diesel storage tanks can ingress particulate and water contamination from the environment.

Water, over time, results in organic growth such as bacteria and/or fungus. Bacteria or fungus can cause effects similar to free water on fuel systems. This includes rust, corrosion or emissions problems. The effects can be accelerated as the fuel ages and the level of acidity and oxidation can be shown with the Total Acid Number TAN (mg KOH/g) Acid Number. These contaminants may also coat the water in fuel sensors in a system and prevent the proper detection of water.

Natural Gas Drilling Site Example

A bulk diesel fuel storage tank on a remote Natural Gas Drilling site, used to fuel the generator was found with heavy sludge buildup. The sludge and dirt caused loss of production (generator not running) and damage to diesel engine components totaling over $100,000 in lost production in one hour.

Due to the severe contamination, the fuel was pumped into another, clean tank by the BDC bulk diesel filter cart and cleaned in a single pass. With this single pass. Particulate and free water were removed in one step. The first stage Bag Filter on the BDC was ideal for the gross removal of microbial bloom/growth, rust and large particulates from the fuel. With the addition of a bag housing, the BDC can handle the high dirt loads often found in on-site service tanks.

After the original tank was emptied, the sludge at the bottom of the tank (pictured)was removed and the tank was throughly cleaned to have it ready for the next delivery of fuel. To maintain a clean tank and clean fuel, the BDC is ideal as a kidney loop system that polishes the fuel on a regular basis or can be permanently installed.

BDC

Fuel Contamination types:

Contamination Type:	Sources	Effects	Solutions
Particulates:	■ Contaminated fuel delivery ■ Missing tank breather ■ Tank corrosion ■ Dirt left from tank installation	■ Wear and tear of diesel engine components ■ Premature failure	■ Fuel Filtration ■ Periodic tank cleaning/fuel polishing ■ Add desiccant breathers ■ Filtration at each stage of fuel movement
Water:	■ Contaminated fuel delivery ■ Condensation ■ Leaks and outside influences	■ Engine combustion and/or injector problems ■ Corrosion ■ Clogged/saturated filters ■ Organic/Biological growth	■ Fuel Filtration ■ Close any openings on tank ■ Periodic tank cleaning/fuel polishing
Organic Growth:	■ Generated by presents of water and air	■ Clogs filters, engine parts ■ Increased TAN number (corrosive effect)	■ Periodic tank cleaning/fuel polishing ■ Prevent water from entering tank ■ Use desiccant breathers

Bulk Diesel Fuel Filter Cart

BDFC

**Coalescing Elements Patent-Pending*

14 gpm
53 L/min

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

Application Introduction:

The Reason for Better Bulk Fuel Filtration

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

Model no. of filter in photograph is: BDFCKKZ1VVM

Features and Benefits

- Designed with integrated particulate removal pre-filtration for maximum coalescing filter element life in the downstream housing
- Routine element change only needed on KL3 particulate filter, saving time and money
- Patent-pending, three-phase, particulate and fuel/water separation media technology
- A revolutionary element designed for the highest single-pass water and particulate removal efficiencies in today's ultra-low sulfur diesel (ULSD) fluids
- Protects expensive Tier 3 and Tier 4 engine components against failures caused by particulate and water transferred from the bulk fuels tanks to the vehicle
- Allows users to achieve or exceed the particulate and water removal specifications of the injection system OEMs
- Previously acceptable industry standard products no longer provide the high-efficiency separation needed in today's ULSD fluids
- Schroeder Anti-Static Pleat Media (ASP®) is standard for all coalescing elements
- 10' Hoses with 3' wands
- At just 22" wide, cart will fit through standard doorways
- Pump motor is 115VAC with resettable overload and 7' power cord
- Pressure indicator setting for the coalescing ICF filter at 25 psi bypass indication, with bypass valve cracking at 40 psi, and for the KL3 particulate filter at 25 psi bypass indication with bypass valve cracking at 30 psi, allows for early indication before by-pass of filter for advanced time for maintenance

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

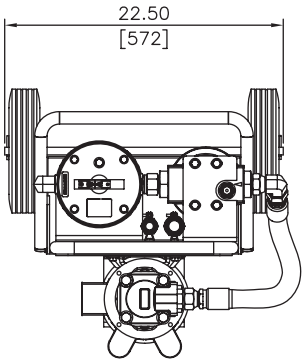
RAILROAD

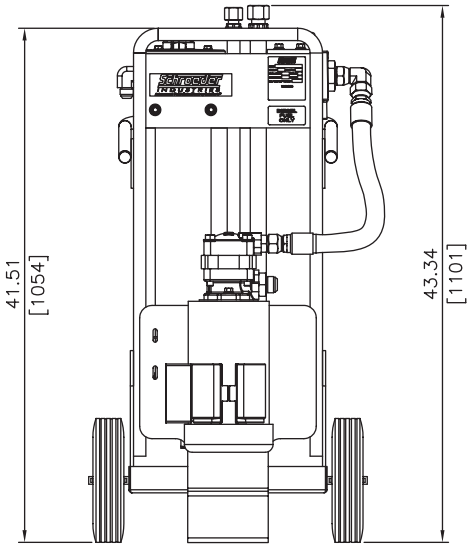
BULK FUEL FILTRATION

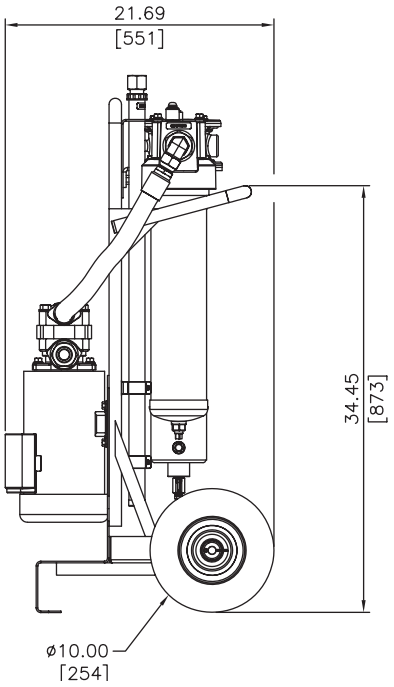
BDFC Bulk Diesel Fuel Filter Cart

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	
Ambient Environment Temperature Range:	-20°F to 104°F (-29°C to 40°C)	
Bypass Indication:	Particulate Filter Particulate: 25 psi (1.7 bar)	Coalescing Filter Coalescing: 36 psi (2.5 bar)
Bypass Valve Cracking:	Particulate Filter Particulate: 30 psi (2 bar)	Coalescing Filter Coalescing: 40 psi (2.8 bar)
Materials of Construction:	Particulate Filter Porting Head/Cap: Cast Aluminum Element Bowl: Steel	Coalescing Filter Porting Head/Cap: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard)
Weight:	131 lbs. (59.4 kg)	
Element Change Clearance:	18″ (457.2 mm) **(Elements sold with the filter cart)**	







Metric dimensions in ( ).

Bulk Diesel Fuel Filter Cart

BDFC

Element Particulate Performance Information

Particulate Elements	DHC	Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171 β_x (c) ≥ 200	β_x (c) ≥ 1000
KKZ1V	224 grams	<4.0	4.2
KKZ3V	230 grams	<4.0	4.8

Element Water Coalescing Performance Information

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C184Z5V	16 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

Particulate and Coalescing Elements Sold with Cart

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

Highlighted product eligible for QuickDelivery

Notes

BDFC Bulk Diesel Fuel Filter Cart

Filter Model Number Selection

Highlighted product eligible for QuickDelivery

How to Build a Valid Model Number for a Schroeder BDFC Cart Supplied with Elements:

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	SM	= BDFCKKZ3VVMSM

BOX 1

Filter Series
BDFC

BOX 2

Particulate Filter Micron Rating
KKZ1 = 1 µm
KKZ3 = 3 µm

BOX 3

Housing Seal Material
V = Viton®

BOX 4

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

BOX 5

Options
S = Sight Glass
M = Suction "Y" Strainer
N = Fuel Nozzle with Integrated Flow Meter
Omit = None

NOTES:

For 50Hz applications, contact factory

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

Box 5. Only box that will allow a combination of options

Element Part Number Selection

Highlighted product eligible for QuickDelivery

		Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171	
Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
KKZ1V	224 grams	<4.0	4.2
KKZ3V	230 grams	<4.0	4.8

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C184Z5V	16 gpm	≥ 99.5%

Note:

Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500) water injection

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

Fluid Compatibility

Fuel Oils

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

Bulk Diesel Fuel Filter Cart

BDC

**Coalescing Elements Patent-Pending*

25 or 70 gpm

95 or 275 L/min

Applications

POINT OF USE FUEL DISPENSING

FLEET FILL / BULK FUEL TRANSFER

BULK FUEL UNLOADING

PROTECTION FOR HIGH-FLOW FUEL INJECTION SYSTEMS

BULK TANK KIDNEY LOOP / RECIRCULATION

Application Introduction:

The Reason for Better Bulk Fuel Filtration

The BDC provides exceptional single pass or kidney loop diesel particulate filtration and continuous water removal. All 3 filters combine Schroeder's fully synthetic media and patent-pending fuel water separation technology. The BDC is ideal for fuel maintenance operations.

Model no. of filter in photograph is: BDC39QPMLZ3VAVM

Features and Benefits

- Great for kidney loop clean-up of highly contaminated reservoirs and single pass transfer
- Incorporates a bag element pre-filter down to 5 micron, for gross removal of microbial bloom contamination and rust
- 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
- Designed because prior generation coalescing products no longer provide high-efficiency separation in ULSD and Biofuels
- 10' Hoses with 3' wand ends
- Pump motor is 115VAC with re-settable overload and 7' power cord for 25 gpm models and available as 220V Single Phase, 230V Three Phase, or 460V Three Phase for 70 gpm models
- Helps protect expensive, vital engine components against failures caused by water contaminated fuel
- Manual water drains and up and downstream test points

Markets

INDUSTRIAL

MOBILE VEHICLES

MARINE

MINING TECHNOLOGY

AGRICULTURE

POWER GENERATION

COMMON RAIL INJECTOR SYSTEMS

FLEET

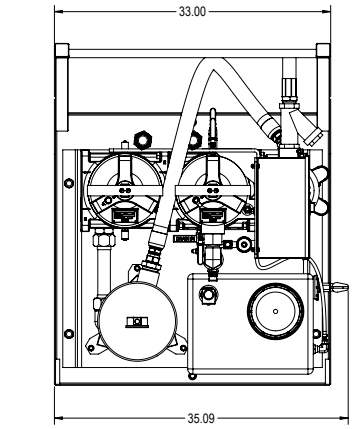
RAILROAD

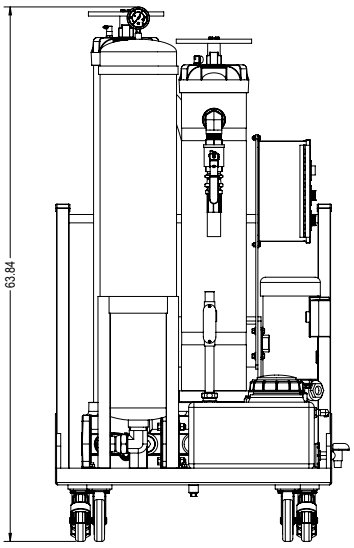
BULK FUEL FILTRATION

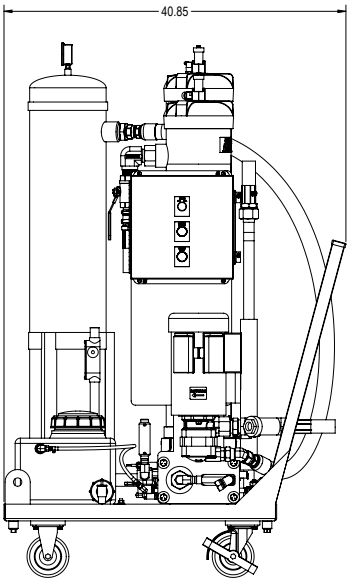
BDC Bulk Diesel Fuel Filter Cart

Filter Housing Specifications

Flow Rating:	Up to 25 gpm (95 L/min) or 70 gpm (265 L/min) for ULSD15 & biodiesel blends	
Fluid Temperature Range:	-20°F to 165°F (-29°C to 74°C) with heater option 32°F to 165°F (0°C to 74°C) standard, with sight gauge option, or with automatic water drain option	
Ambient Environment Temperature Range:	-20°F to 104°F (-29°C to 40°C) 32°F to 165°F (0°C to 74°C) standard, with sight gauge option, or with automatic water drain option	
Bypass Indication:	Particulate Filter Particulate: 15 psi (1.03 bar)	Coalescing Filter Coalescing: 25 psi (1.7 bar)
Bypass Valve Cracking:	Particulate Filter Particulate: 20 psi (1.37 bar)	Coalescing Filter Coalescing: 30 psi (2 bar)
Materials of Construction:	Porting Base: Anodized Aluminum Element Bowl: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Cap: Plated Steel Bag Housing: Stainless Particulate Filter Housing: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard) Coalescing Filter Housing: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard)	
Weight:	25 gpm model - 785 lbs. (356 kg), 70 gpm model - contact factory	
Element Change Clearance:	33.8" (858 mm)	







Metric dimensions in ( ).

Bulk Diesel Fuel Filter Cart BDC

Element Particulate Performance Information

Particulate Elements	DHC	Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171 β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Element Water Coalescing Performance Information

Coalescing Element	Pressure Side Coalescing	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	≥ 99.5%

Note:
Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Particulate and Coalescing Elements Sold with Cart

Highlighted product eligible for QuickDelivery

Optional Replacement Elements

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
PEF5P2PH	Bag Element	5 µm	50
PEF25P2PH	Bag Element	25 µm	50
PEF50P2PH	Bag Element	50 µm	50
PEF100P2PH	Bag Element	100 µm	50

Highlighted product eligible for QuickDelivery

BDC Bulk Diesel Fuel Filter Cart

Filter Model Number Selection

Highlighted product eligible for QuickDelivery

How to Build a Valid Model Number for a Schroeder BDC Cart Supplied with all 3 Element Options:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
BDC					

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
BDC	39QPMLZ3	V	A	VM		= BDC39QPMLZ3VAVM

BOX 1

Filter Series
BDC

BOX 2

Particulate Element Micron Rating
39QPMLZ1 = 1 µm
39QPMLZ3 = 3 µm

BOX 3

Housing Seal Material
V = Viton®

BOX 4

Bag Element Micron Rating
A = 5 µm
B = 25 µm
C = 50 µm
D = 100 µm

BOX 5

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

BOX 6

Options	
Omit =	None (standard)
H =	Sump Heater
AW =	Automatic Water Drain 5 gal Tank w/ Failsafe
70A =	70 gpm 230VAC Single Phase 60 Hz
70B =	70 gpm 230VAC Three Phase 60 Hz
70C =	70 gpm 460VAC Three Phase 60 Hz

NOTES:

Included, optional sight gauge or AWD's for use only >32°F (0°)

For 50Hz applications, contact factory

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

Element Part Number Selection

Highlighted product eligible for QuickDelivery

		Filtration Ratio per ISO 16889 Using APC calibrated per ISO 11171	
Particulate Elements	DHC	β_x (c) ≥ 200	β_x (c) ≥ 1000
39QPMLZ1V	1485 grams	<4.0	4.2
39QPMLZ3V	1525 grams	<4.0	4.8

Coalescing Element	**Pressure Side Coalescing**	
	Max Flow	Single Pass Water Removal Efficiency
C396Z5V	70 gpm	> 99.5%

Note:

Based on ULSD15 with 27 Dynes/cm surface tension and 0.25% (2500 ppm) water injection

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

Fluid Compatibility

Fuel Oils

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

Section 3:

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 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 provide this level of filtration.

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.

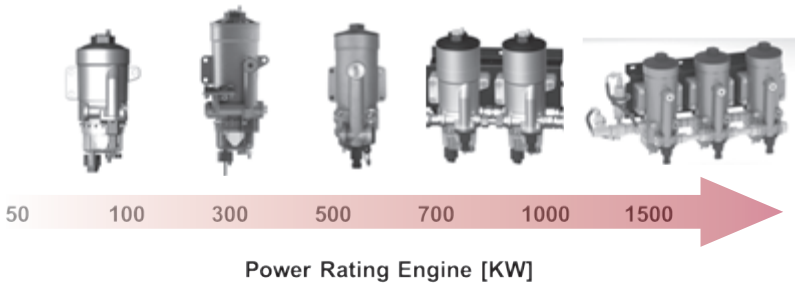
The Schroeder HDP On-Board Filter's product benefits are:

- 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

Engine Sizes vs. HDP On-Board Filter Solutions



On-Board Diesel Fuel Coalescing Filter HDP

Applications

INDUSTRIAL | MOBILE VEHICLES | MARINE | AGRICULTURE | BULK FUEL FILTRATION

Application Introduction:

The Reason for Better 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 drive system from damage, optimum diesel fuel conditioning is particularly important. Schroeder Fuel Filtration On-Board Diesel Coalescing filter offers a modern cartridge filter system design available in two configurations, in order to protect equipment operators from failures, breakdowns and expensive service interventions

Model No. of filter in photograph is:
HDP KF1 340 BC1 XX W 1.1 /-AS1-H2

Model No. of filter in photograph is:
HDP KF1 600 BC1 XX W 1.1 /-AS1-H2

Model No. of filter in photograph is:
HDP KF1 600 HT1 XX A 1.1 /-AS1-H2

Features and Benefits

- Manual or Fully Automatic water drain
- Optional fuel pre-heater and Water-In-Fuel (WIF) sensor
- Small envelope size offers greater flexibility in mounting locations
- Low investment cost due to the economical design
- Long service life of the element yields low operating costs
- Easy installation due to various porting configurations
- Easy adaption to the on-board power supply
- Unsurpassed water removal for ULSD

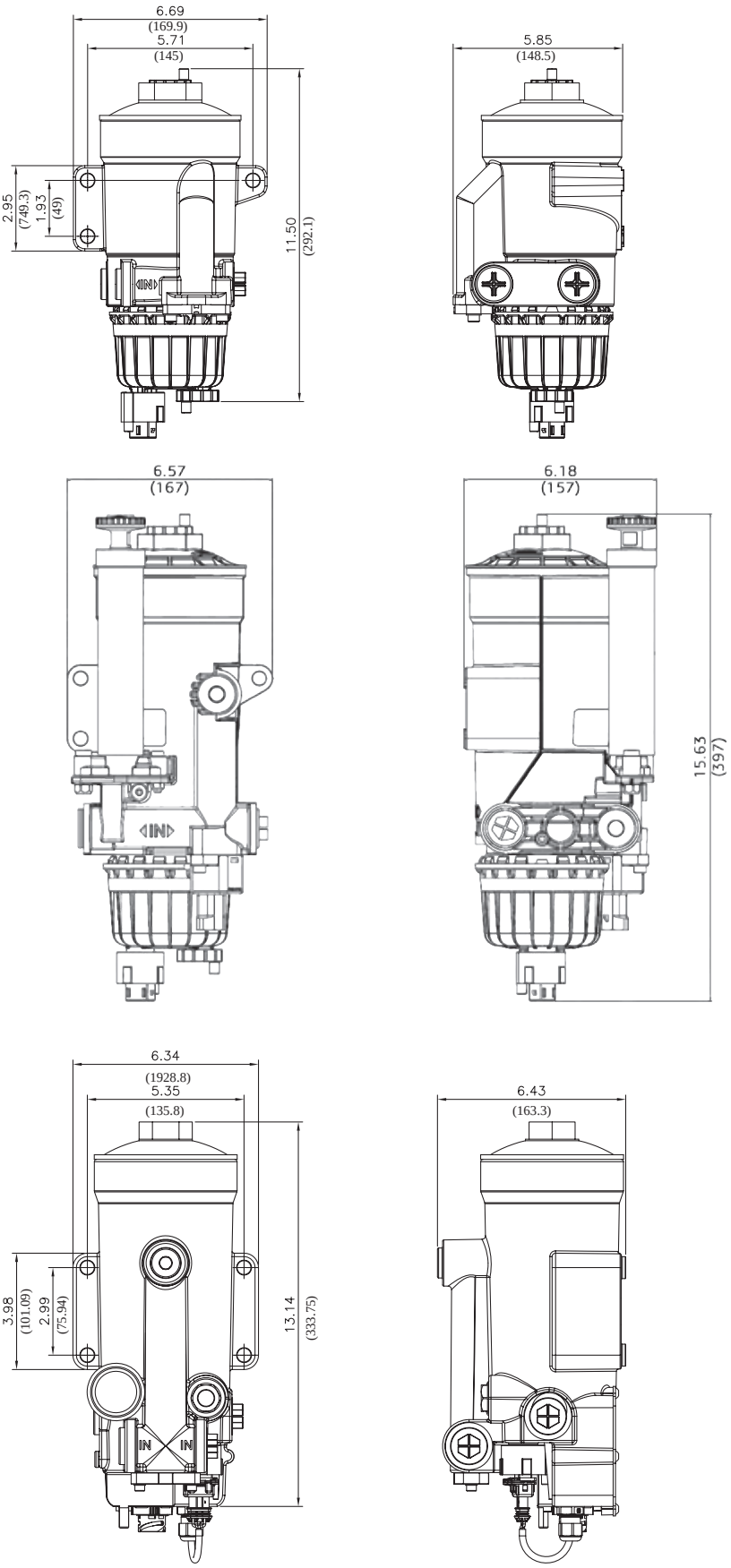
Flow Rating:	up to 476 gph (up to 1800 lph)
Operating Pressure:	<14.5 psia, (<1 bar absolute) suction side application
Temperature Range:	BC: -40°F to 194°F (-40°C to 90°C) HT: -4°F to 194°F (-20°C to 90°C) *for extended ranges, contact factory
Nominal Voltage:	24V DC (12V DC is optional for heater or water sensor)
Rated Power Fuel Preheating:	300W
Weight of incl. Element:	340 BC: 5.1 lbs (2.3 kg) 600 BC: 6.8 lbs (3.1 kg) 600 HT: 9.4 lbs (4.25 kg) *other models available upon request
Water Separation Efficiency:	>95% to ISO CD 16332
Porting Thread:	340 BC: M22x1.5 600 BC: M27x2.0, SAE - 12 ORB (optional) 600 HT: G 3/4" (BSPP)

up to 476 gph
up to 1800 lph

14.5 psia
1 bar absolute
Suction Side Application

Filter Housing Specifications

HDP On-Board Diesel Fuel Coalescing Filter



On-Board Diesel Fuel Coalescing Filter HDP

Element Particulate Performance Information

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

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

Element Water Coalescing Performance Information

Flow Direction: Outside In
Element Nominal Dimensions: 3.8" (95.6 mm) O.D. x 7.0" (177.2 mm) long - 340 Size
3.8" (95.6 mm) O.D. x 9.4" (238.2 mm) long - 600 Size

Note: For additional HDP performance information, please contact the factory

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

Fluid Compatibility

Fuel Oils

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

Note: For Flow and Pressure information, please contact the factory

Replacement Elements

Size	Evolution Stage	Filtration Rating	Filter Material
0340	BC1	7 = 7 µm	KF1
0600	HT1	10 = 10 µm	
		30 = 30 µm	

Highlighted product eligible for QuickDelivery

HDP On-Board Diesel Fuel Coalescing Filter

Filter Model Number Selection

Highlighted product eligible for QuickDelivery

How to Build a Valid Model Number for a Schroeder HDP Housing Supplied with Element:

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

= HDP KF1 340 BC1 10 W 1.X /-AS1

BOX 1

Filter Series
HDP

BOX 2

Filter Material
KF1 = Dieselmicron®

BOX 3

Size
340 = 90 gph
600 = 160 gph
1200 = 317 gph
1800 = 476 gph

BOX 4

Evolution Stage	
BC1 =	Manual Drain Configuration
HT1 =	Auto Drain Configuration

BOX 5

Filtration Rating
7 = 7 µm
10 = 10 µm
30 = 30 µm

BOX 6

Type of Clogging Indicator	
W =	no clogging indicator (340 & 600 BC only)
A =	blanking plug in indicator port (600 HT only)
UED =	vacuum gauge (600 HT only)

BOX 7

Type Code
1

BOX 8

Modification Number	
X =	latest version number always supplied

BOX 9

Options	
AS1 =	w/ integrated water sensor (12/24 VDC) *standard on 600 HT
H1 =	w/integrated fuel pre-heating (12 VDC)
H2 =	w/ integrated fuel pre-heating (24 VDC)
PH3 =	Hand priming pump (600 BC only)
Omit =	None

NOTES:

For other options or configurations not listed, please contact factory

Heavy-Duty Diesel PreCare Duplex Filter

HDPD

Applications

INDUSTRIAL | MOBILE VEHICLES | MARINE | AGRICULTURE | BULK FUEL FILTRATION

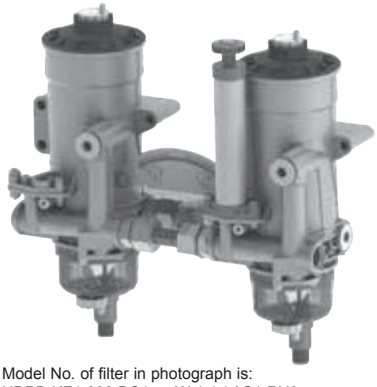
up to 476 gph
up to 1800 lph

14.5 psia
1 bar absolute
Suction Side Application

Application Introduction:

The Reason for Better Engine Filtration

The Heavy-Duty Diesel PreCare Duplex Filter is an advanced system for diesel pre-filtration which protects equipment OEMs and operators from costly service calls and downtime. The duplex configuration consists of an assembly with multiple filiter housings, which are connected by a change-over ball valve with a simple, single lever operation. The HDPD is available in the familiar BC (manual drain) or HT (auto drain) version.



Model No. of filter in photograph is:
HDPD KF1 600 BC1 xx W 1.1 /-AS1-PH3

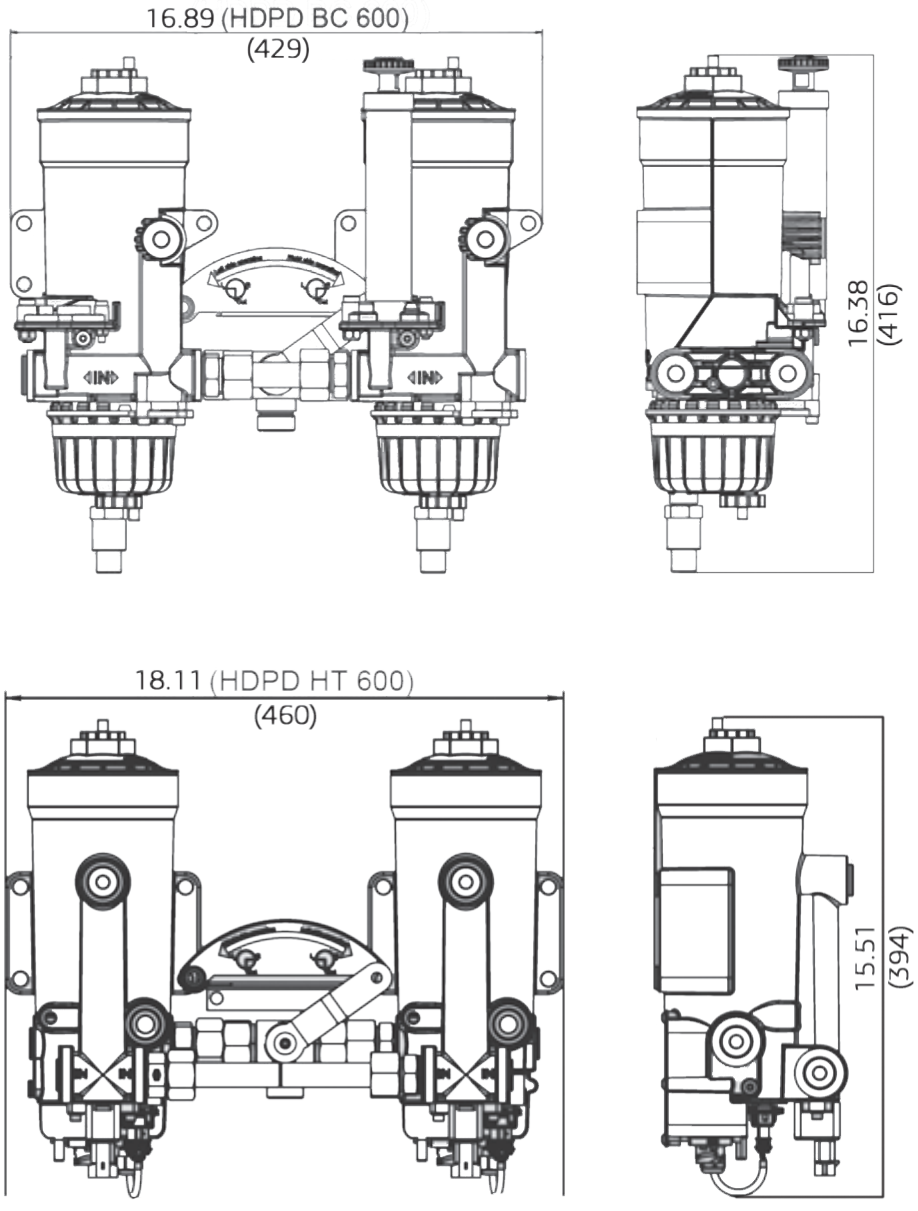
Features and Benefits

- Simple, single-lever change-over ball valve for seamless operation and service
- Manual or fully automatic Water-In-Fuel (WIF) sensor
- Optional fuel pre-heater and water sensor
- Small envelope size offers greater flexibility in mounting locations
- Low investment cost due to the economical design
- Long service life of the element yields low operating costs
- Easy installation due to various porting configurations
- Easy adaption to the on-board power supply
- Unsurpassed water removal for ULSD

Filter Housing Specifications

Flow Rating:	up to 476 gph (up to 1800 lph)
Operating Pressure:	14.5 psia, (<1 bar absolute) suction side application
Temperature Range:	BC: -40°F to 194°F (-40°C to 90°C) HT: -4°F to 194°F (-20°C to 90°C) *for extended ranges, contact factory
Nominal Voltage:	24V DC (12V DC is optional for heater or water sensor)
Rated Power Fuel Preheating:	300W
Weight:	contact factory for your specific model code weight
Water Separation Efficiency:	>95% to ISO CD 16332
Porting Thread:	340 BC: M22x1.5 600 BC: M27x2.0, SAE - 12 ORB (optional) 600 HT: G 3/4" (BSPP)

HDPD Heavy Duty Diesel PreCare Duplex Filter



Metric dimensions in ( ). Installation instructions included on element

Note: for dimensions of other configurations, please contact the factory

Note: for marine applications requiring filter housings constructed of ductile iron, please contact the factory

Heavy-Duty Diesel PreCare Duplex Filter

HDPD

Element Particulate Performance Information

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

Element Water Coalescing Performance Information

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

Flow Direction: Outside In
Element Nominal Dimensions: 3.8" (95.6 mm) O.D. x 7.0" (177.2 mm) long - 340 Size
3.8" (95.6 mm) O.D. x 9.4" (238.2 mm) long - 600 Size

Note: For additional HDP performance information, please contact the factory

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

Fluid Compatibility

Fuel Oils

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

Note: For Flow and Pressure information, please contact the factory

Replacement Elements

Size	Evolution Stage	Filtration Rating	Filter Material
0340	BC1	7 = 7 µm	KF1
0600	HT1	10 = 10 µm	
		30 = 30 µm	

Highlighted product eligible for QuickDelivery

HDPD Heavy Duty Diesel PreCare Duplex Filter

Filter Model Number Selection

How to Build a Valid Model Number for a Schroeder HDPD Housing Supplied with Element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
HDPD						.	/–	

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	
HDPD	KF1	600	HT1	10	A	1 .	X	/– AS1	**= HDPD KF1 600 HT1 10 A 1.X /-AS1**

BOX 1

Filter Series
HDPD

BOX 2

Filter Material
KF1 = Dieselmicron®

BOX 3

Size
340 = 90 gph
600 = 160 gph
1200 = 317 gph
1800 = 476 gph

BOX 4

Evolution Stage	
BC1 =	Manual Drain Configuration
HT1 =	Auto Drain Configuration

BOX 5

Filtration Rating
7 = 7 µm
10 = 10 µm
30 = 30 µm

BOX 6

Type of Clogging Indicator	
W =	no clogging indicator (340 & 600 BC only)
A =	blanking plug in indicator port (600 HT only)
UED =	vacuum gauge (600 HT only)

BOX 7

Type Code
1

BOX 8

Modification Number	
X =	latest version number always supplied

BOX 9

Options	
AS1 =	w/ integrated water sensor (12/24 VDC) *standard on 600 HT
H1 =	w/integrated fuel pre-heating (12 VDC)
H2 =	w/ integrated fuel pre-heating (24 VDC)
PH3 =	Hand priming pump (600 BC only)
Omit =	None

NOTES:

The HDPD will have the number of housings needed to support the flow rate specified on each side (ex. HDPD 1200 = 2x HDP 600 left side & 2x HDP 600 right side)

Section 4:

BIODIESEL PURIFICATION

Biodiesel Fuel Purification

Schroeder Fuel Filtration

For more than 60 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®.

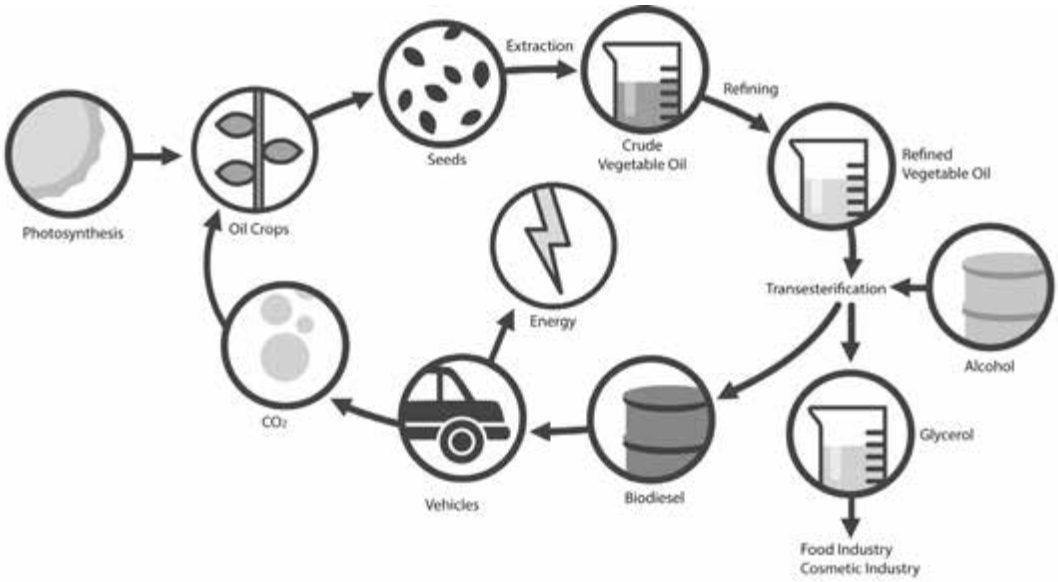
Importance of Biofuel Treatment

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 4 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 5:

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 though a column of the dried ion exchange resin to bind and remove ionic salts (such as Na+ and 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.

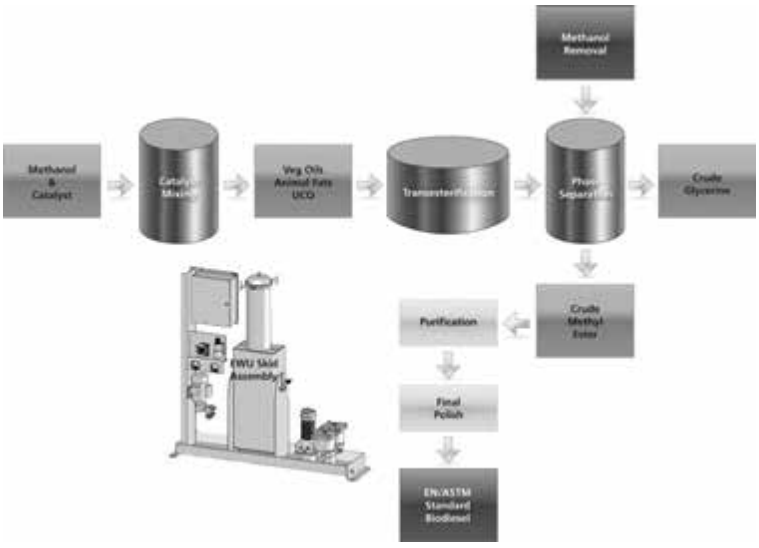


Diagram of a Biodiesel Production Process

Eco_2Pure Biodiesel Purification Media

EPM

The Standard of Drywash Technology

Eco_2Pure is a unique cellulose based, natural and sustainable composition of absorbent technologies, specifically formulated for biodiesel purification from any feedstock. Eco_2Pure's™ composition is designed to optimize purification efficiency and contamination removal, combined with increased flow enhancement characteristics.

Eco_2Pure 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_2Pure is capable of purifying between 41-82 gals of biodiesel (Each kilogram or pounds of Eco_2Pure is capable of purifying between 93-185 gallons of biodiesel*).

Eco_2Pure 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_2Pure 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[1]. At $0.03 cents per gallon[2], Eco_2Pure 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_2Pure is loaded, no other intervention is required. Once the Eco_2Pure is bedded in the Treatment Tower, it automatically purifies the biodiesel in a single passage of flow.

Eco_2Pure 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_2Pure required, according to your process conditions.

Eco_2Pure Media

15 kg Sack

NOTES:

1. Based on speed and price comparison of average resin prices on UK/USA mainland
2. Eco_2Pure life performance is determined by the initial starting quality of the crude biodiesel, base feed stocks, etc.

EPM Eco$_2$Pure Biodiesel Purification Media

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.schroederindustries.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

Eco_2Pure Treatment Towers

EPTT

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_2Pure media is fast and simple
- Eco2Pure Treatment Towers are built specifically to maximize the performance of the Eco2Pure purification process.

Application Introduction:

Eco_2Pure Treatment Towers can be configured to suit all production volumes. Available with 50 kg Eco2Pure 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_2Pure Treatment Tower, it passes through a fixed bed of Eco_2Pure 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_2Pure capable of purifying between 93-185 gallons of biodiesel, and each pound of Eco_2Pure 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			Flow	
Capacity	gpm	gph	12hr day (gallons)	24 hr day (gallons)
110 lbs (50 kg)	2.0	120	1,440	2,880

EPTT Eco$_2$Pure Treatment Towers

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 –	50K –	W	**= EPTT50KW**

BOX 1

Filter Series
EPTT

BOX 2

Eco$_2$Pure Media Capacity
50K = 110 lbs. (50 kg)

BOX 3

Mounting
W = Wheel Mounted
B = Base Mounted

Continuous Flow

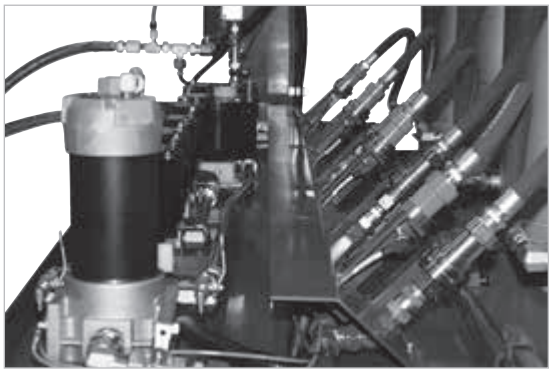
Schroeder Fuel Filtrations' unique design configurations enable continuous flow during the purification process, thereby eliminating any downtime. Any number of Eco$_2$Pure Treatment Towers can be built into system designs, complete with pump, control panel and safety features. Flow rates will be governed accordingly to suit the number of towers in operation.

Single Flow

As the unwashed biodiesel enters the Eco$_2$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$_2$Pure is scalable to any size.

Excel-ZPlus® Beta1000 Media



*Close-up of Hose Connections

EWU Eco_2Pure Purification Systems

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
110 lbs (50 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_2Pure 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$_2$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$_2$Pure media is fast and simple

Application Introduction:

The single tower Eco$_2$Purepurification system combines the performance of the second generation dry wash media, Eco$_2$Pure, the filtration performance of Schroeder Industries' Excel-ZPlus® 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:	Excel-ZPlus® 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	50K	2W	1	WQ	0	**= EWU150K2W1WQ0**

BOX 1

Filter Series
EWU

BOX 2

No. of Towers
1

BOX 3

Treatment Tower Capacity
50K = 110 lbs. (50 kg)

BOX 4

Filtration Stages
2W

BOX 5

Power Options
1 = 110V 60Hz
2 = 220V 60Hz 1 phase
3 = 460V/120V 3 phase
4 = 575V
5 = Air Diaphragm
6 = 110V 50Hz

BOX 6

Connector
WQ = Hoses w/ Quick Disconnect
16M = 1" NPT
16V = 1" Cam Lock
16Q = 1" Quick Disconnects

BOX 7

Quality Control
0 = Blank Port
1 = TCM Particle Monitor
2 = TWS Water Sensor
3 = TCM & TWS

NOTES:

Other sizes available upon request

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 contact the factory

EWU Eco$_2$Pure Purification Systems

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$_2$Pure media is fast and simple

Application Introduction:

The multi tower Eco$_2$Pure purification system combines the performance of the second generation dry wash media, Eco$_2$Pure, the filtration performance of Schroeder Industries' Excel-ZPlus® 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 50 kg Tower w/ Performance Filter	Four 50 kg Tower w/ Performance Filter	Eight 50 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:	Excel-ZPlus® Beta$_{1000}$ Media	Excel-ZPlus® Beta$_{1000}$ Media	Excel-ZPlus® Beta$_{1000}$ 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	50K	2W	1	WQ	0	**= EWU450K2W1WQ0**

BOX 1

Filter Series
EWU

BOX 2

No. of Towers
2
3
4
8

BOX 3

Treatment Tower Capacity
50K = 110 lbs. (50 kg)

BOX 4

Filtration Stages
2W
3W

BOX 5

Power Options
1 = 110V 60Hz
2 = 220V 60Hz 1 phase
3 = 460V/120V 3 phase
4 = 575V
5 = Air Diaphragm
6 = 110V 50Hz

BOX 6

Connector
WQ = Hoses w/ Quick Disconnect
16M = 1" NPT
16V = 1" Cam Lock
16Q = 1" Quick Disconnects

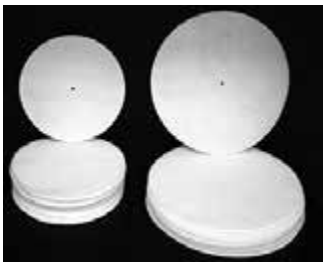
BOX 7

Quality Control
0 = Blank Port
1 = TCM Particle Monitor
2 = TWS Water Sensor
3 = TCM & TWS

NOTES:

Other sizes are available upon request

We can design, build and commission a purification system to suit your operation

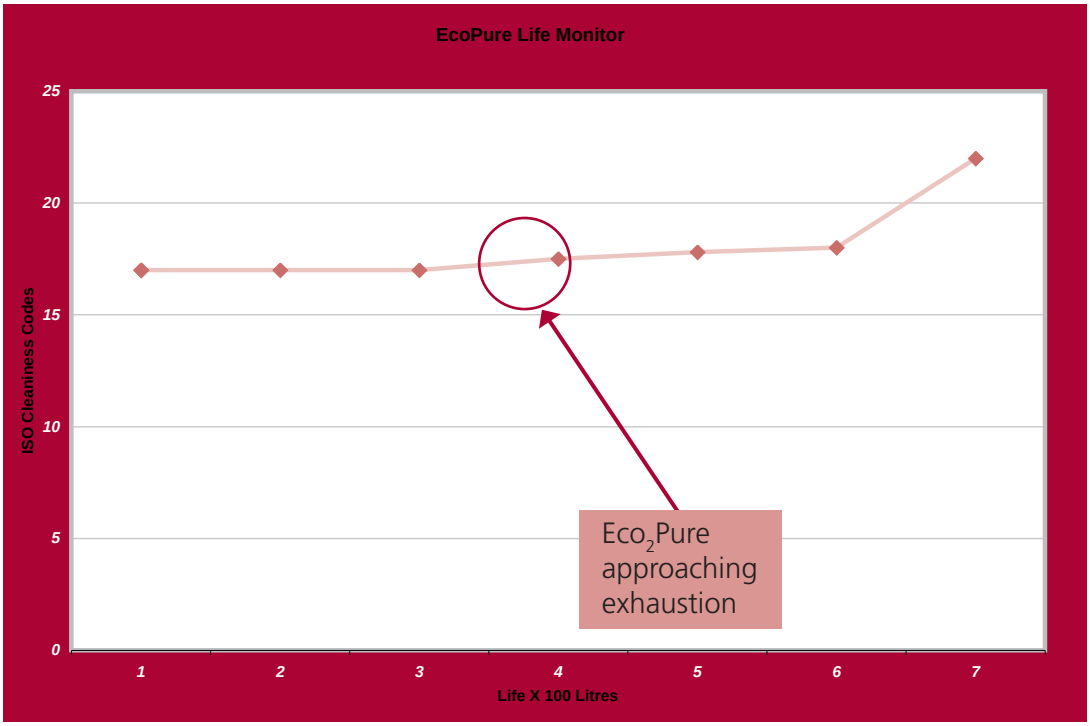


Filter Pads for EPTT Towers

Each part number listed below includes a single filter pad.

Part Number	Description
BD-192	25 micron filter pad for EPTT-50K

Life Monitoring & Quality Control



Eco2Pure Monitoring Using TCM Particle Monitor

Using the TCM Online particle monitor, biodiesel producers can effectively monitor the residual life of Eco_2Pure. The particle counts increase as the media approaches exhaustion, allowing for adequate notification for Eco_2Pure 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.

TCM Particle Monitor →

Transfer live data to PC for evaluation/ archiving →

Print off reports for your quality control program.

"Putting You in Control of Your Biodiesel Quality"

Eco$_2$Pure Performance Data

			Europe	USA	Rape Seed M.E		WVO	Methyl Ester
Parameter	Test method	Units	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_2Pure so unique?
Eco_2Pure is a natural and sustainable biodiesel purification media, and is a chemically inert absorptive media, designed for ease of use and landfill disposal. Eco_2Pure boasts one of the lowest purification costs per liter/gallon on the market today. Eco_2Pure is proven to assist in the attainment of EN/ASTM quality standards.

Is Eco_2Pure similar to ion exchange resin?
No, unlike ion exchange systems, Eco_2Pure is absorptive technology, which allow for removal of soaps, production residues, residual methanol and moisture from biodiesel.

Are Eco_2Pure Treatment Towers available loose?
Eco_2Pure Treatment Towers are available loose for producers to configure as they like or as part of a system.

What is an Eco_2Pure 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_2Pure 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_2Pure purify?
Each pound of Eco_2Pure 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_2Pure system?
Yes, a particle counter can be fitted to our systems to monitor fuel quality in real time.

How does the price of Eco_2Pure compare to other wash methods?
Eco_2Pure 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 6:

TO MEET ASTM STANDARDS FOR COLD FLOW PROPERTIES

ColdClear®

Background Information

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®

Description

- 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 Excel-ZPlus® 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.

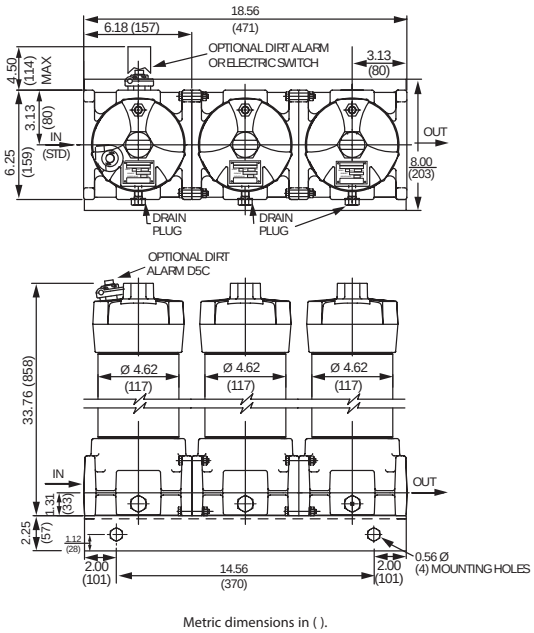
Specifications

	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 Bowl 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

Notes:

The above results are based on using the best feedstock available

BCC ColdClear® BCC100 Series



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

Filter Series
BCC100

BOX 2

Seals
V = Viton®

BOX 3

Inlet Porting
P16 = 1" NPT
F16 = 1"SAE 4-bolt flange code 61

BOX 4

Outlet Porting
P16 = 1" NPT
F16 = 1V" SAE 4-bolt flange code 61

BOX 5

Dirt Alarm®
Omit = None
D5 = Visual Pop-up
D5C = Visual Pop-up in cap
MS10 = Electrical w/ DIN connector (male end only)

BOX 6

Test Points
Omit = None
UU = Test Points in all housings

NOTES:

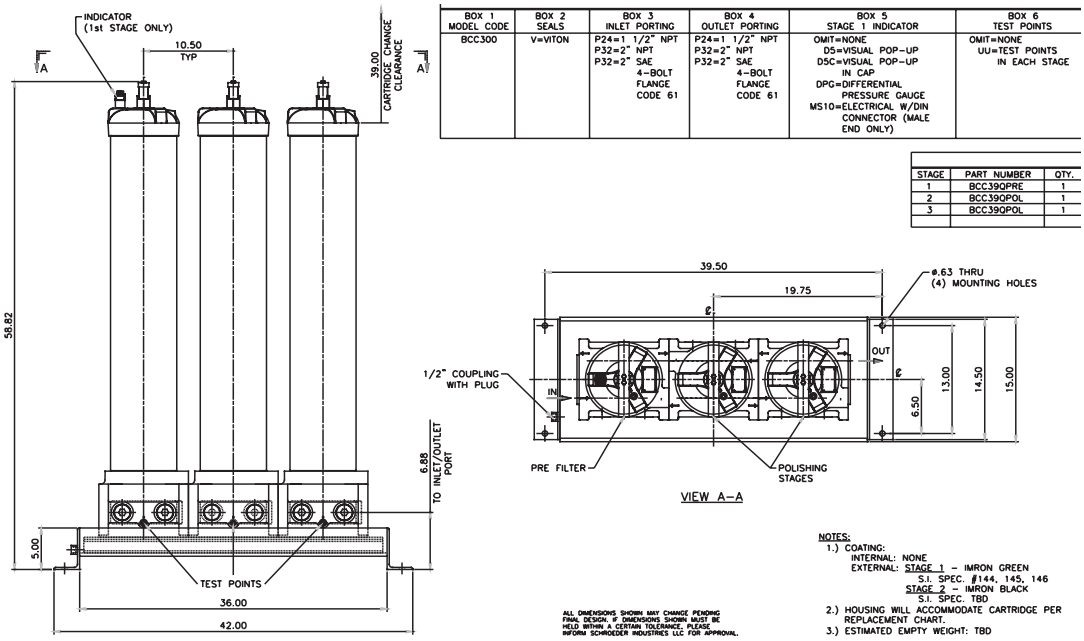
Option UU is not available with D5 or MS10 indicator

Box 2. Viton® is a registered trademark of DuPont Dow Elastomers

Replacement Cartridges

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

Stage 1 Cartridge:	BCCPREFILTER
Stage 2 & 3 Cartridges:	BCCPOLISH



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	BCC39QPRE	1
2	BCC39QPOL	1
3	BCC39QPOL	1

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

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

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

Filter Series
BCC300

BOX 2

Seals
V = Viton®

BOX 3

Inlet Porting
P24 = 1½" NPT
P32 = 2" NPT
F32 = SAE 4-bolt flange code 61

BOX 4

Outlet Porting
P24 = 1½" NPT
P32 = 2" NPT
F32 = SAE 4-bolt flange code 61

BOX 5

Dirt Alarm®
Omit = None
D5 = Visual Pop-up
D5C = Visual Pop-up in cap
DPG = Differential Pressure Gage
MS10 = Electrical w/ DIN connector (male end only)

BOX 6

Test Points
Omit = None
UU = Test Points in all housings

NOTES:

Box 2. Viton® is a registered trademark of DuPont Dow Elastomers

Replacement Cartridges

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

Filter Model Number Selection

ColdClear® BCC900 Series

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, ½" 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., ½" BALL VALVE

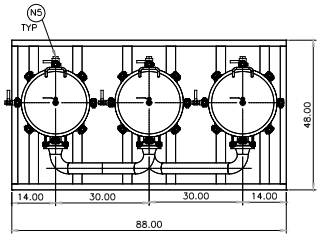
* PER MODEL CODE CHART

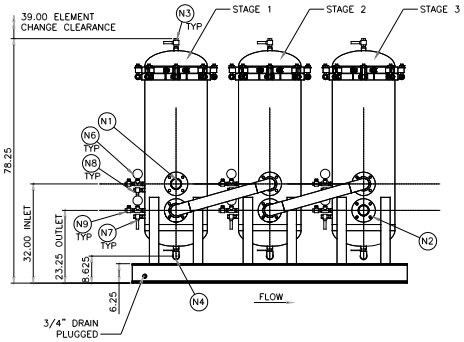
REPLACEMENT CARTRIDGE

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					





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
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

Filter Series
BCC900

BOX 2

Seals
V = Viton®

BOX 3

Inlet Porting
P48 = 3" NPT
A48 = 3" ANSI 150# Flange

BOX 4

Outlet Porting
P48 = 3" NPT
A48 = 3" ANSI 150# Flange

BOX 5

Dirt Alarm®
Omit = None
RD5 = Visual Pop-up
DPG1 = Differential Pressure Gage
RMS10 = Electrical w/ DIN connector (male end only)

BOX 6

Test Points
Omit = None
UU = Test Points in all housings

NOTES:

Box 2. Viton® is a registered trademark of DuPont Dow Elastomers

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, ½" 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., ½" BALL VALVE

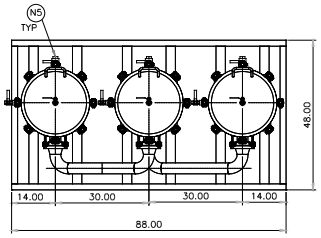
* PER MODEL CODE CHART

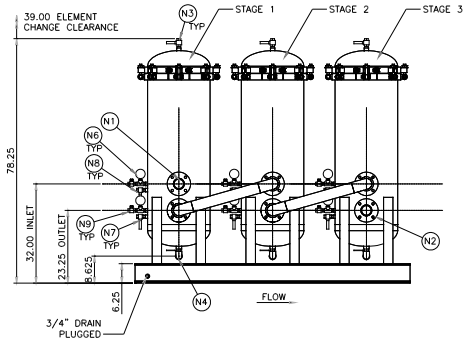
REPLACEMENT CARTRIDGE

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

Filter Series
BCC1200

BOX 2

Seals
V = Viton®

BOX 3

Inlet Porting
P48 = 3" NPT
A48 = 3" ANSI 150# Flange

BOX 4

Outlet Porting
P48 = 3" NPT
A48 = 3" ANSI 150# Flange

BOX 5

Dirt Alarm®
Omit = None
RD5 = Visual Pop-up
DPG1 = Differential Pressure Gage
RMS10 = Electrical w/ DIN connector (male end only)

BOX 6

Test Points
Omit = None
UU = Test Points in all housings

NOTES:

Box 2. Viton® is a registered trademark of DuPont Dow Elastomers

Replacement Cartridges

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

ColdClear® BCC1500 Series

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

VESSEL OPENING SCHEDULE ⚠

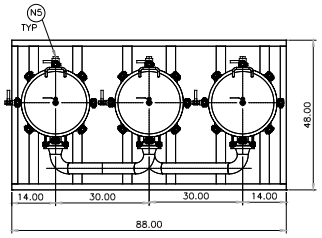
MK. NO.	SIZE	TYPE	REMARKS
N1	*	*	INLET
N2	*	*	OUTLET
N3	3/4"	FNPT	VENT, ½" BALL VALVE
N4	1"	FNPT	CLEAN DRAIN, 1" BALL VALVE
N5	1"	FNPT	DIRTY DRAIN, 1" BALL VALVE
N6/N7	1/2"	FNPT	DPI
N8/N9	1/2"	FNPT	TEST PT., ½" BALL VALVE

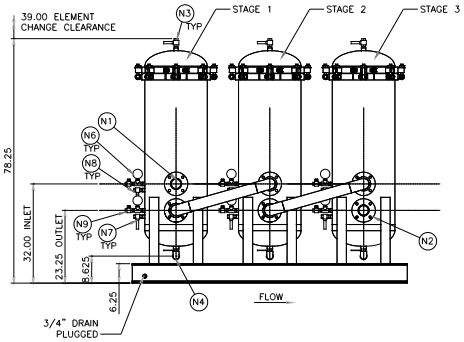
* PER MODEL CODE CHART

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					





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

Filter Series
BCC1500

BOX 2

Seals
V = Viton®

BOX 3

Inlet Porting
P48 = 3" NPT
A48 = 3" ANSI 150# Flange

BOX 4

Outlet Porting
P48 = 3" NPT
A48 = 3" ANSI 150# Flange

BOX 5

Dirt Alarm®
Omit = None
RD5 = Visual Pop-up
DPG1 = Differential Pressure Gage
RMS10 = Electrical w/ DIN connector (male end only)

BOX 6

Test Points
Omit = None
UU = Test Points in all housings

NOTES:

Box 2. Viton® is a registered trademark of DuPont Dow Elastomers

Replacement Cartridges

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

Section 7: FILTRATION CARTS, SKIDS & FUEL DIAGNOSTIC TOOLS

Advantages of Online Monitoring

There are advantages to using online monitoring in replacement of bottle sampling when testing for cleanliness requirements.

Consider the following factors when comparing bottling sampling to online sampling:

- What is the cost of a bottle sample (downtime, manpower, etc)?
- How hard is it to take a proper bottle sample?
- Three samples taken at the same time and all come back with different ISO codes
- What does the bottle sample really tell you?
- Can you relate the information from the bottle sample to the machine?

TestMate® Contamination Monitor | TCM

- Measures particles in four (4) sizes: >4, >6, >14, >21 microns
- In-line or manifold mounting
- ISO or SAE codes can be output in 4-20 mA analog signal
- Compatible with standard mineral fluids & phosphate esters
- Display and keypad can be rotated (up to 270°)
- Inlet and outlet ports are interchangeable (bi-directional, *without manifold only)

HY-TRAX® Manually Controlled Fluid Sampling System

- Provides local visibility to the fluid condition of critical systems while integrating micro VSD (Variable Speed Drive)
- Manual rheostat VSD pump controller allows user to adjust pump flow for optimal sensor readings in variable conditions
- L-ported (QLF) or Inline (QF) allows for installation flexibility
- It allows a user to retrieve ISO cleanliness levels from a reservoir tank or a low pressure line (50 psi max).

HY-TRAX® Telematics Communications Module with Remote Controlled Sampling System

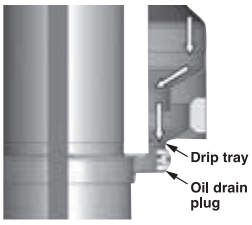
- Provides remote visibility to the fluid condition of critical systems.
- The HY-TRAX® Remote Oil Contamination Communications Module allows remote access via the Internet and smart devices to fluid particle counts, temperature and percent water saturation levels (optional) displayed on a customizable dashboard. The system collects data from any existing TestMate® Contamination Monitor (TCM) and/or TestMate® Water Sensor (TSM) and the communications module transmits this data via GSM cellular at scheduled intervals or on demand. Users can receive alerts via email when a fluid's ISO contamination code or water saturation level (optional) reaches user defined critical levels.
- The HY-TRAX® Communications Module will provide maintenance managers with the visibility and vital information necessary to pro-actively schedule preventative maintenance on local and remote equipment. Maintenance decisions can now be based on accurate and real-time data.
- The communications module components are mounted and housed in a rugged IP 40 enclosure.
- Can be utilized when the hydraulic system provides proper flow and pressure to TCM.

Other Fuel Conditioning Solutions

SAB70 Breather

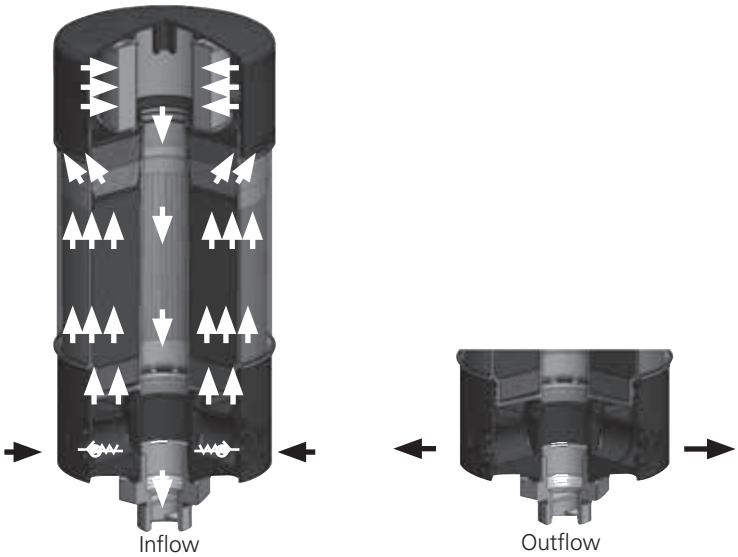
Features and Benefits

- Ideal for large reservoir with high return flow
- Durable steel housing
- Replaceable element
- Unique Oil Mist Trap design
- Optional pressure indicator



DBE

- Unique air flow design with suction tube as splash protection and protection against absorbent getting into the tank
- 2 stages of absorbent provide optimal combination of drying efficiency and water retention
- Pleated air filter with 2 µm filtration rating
- Reusable base with check (intake) and bypass (outflow) valves
- Check valves prevent absorbents being saturated during system downtime
- Bypass valves divert out flow away from water removal media to preserve its life
- Robust Zinc die-casting connection piece with integrated anti-splash baffles
- Replacement cartridge available in 3 different sizes



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

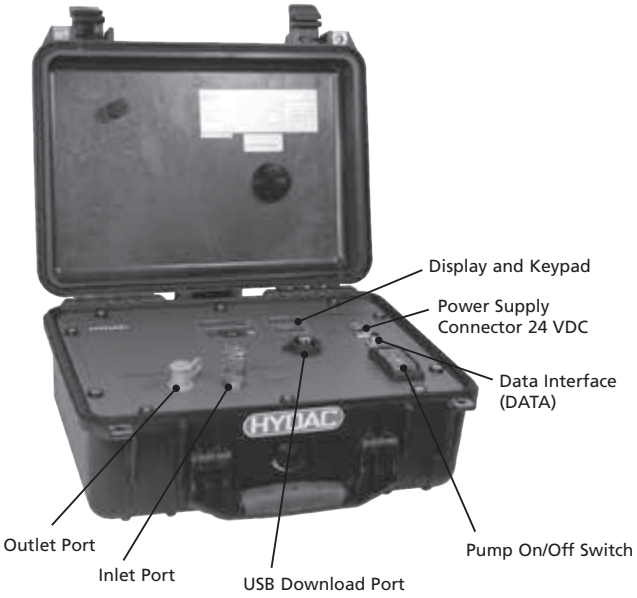
- Base-ported in-line filter available in three different lengths
- Extremely versatile multiple inlet and outlet porting possibilities
- Stacked K-size elements require less than 9" clearance to change elements
- Available with cleanable metal mesh or high efficiency synthetic Excel-ZPlus® elements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

QF5 In-Line Filter

- Element changeout from the top minimizes oil spillage
- Available with optional core assembly to accommodate coreless elements
- Offered with standard Q, QPML deep-plated and QCLQF coreless elements in 16" and 39" lengths with standard Viton® seals
- Offered in pipe, SAE straight thread, and flange porting
- Integral inlet and outlet test points are standard in all models
- WQF5 model for water service also available
- Various Dirt Alarm® options

Note:
1. Please see our Hydraulics and Lube Catalog (L-2520C) for drawings and complete sizing information.

FCU 1315 FluidControl Unit



Features and Benefits

- Particulate contamination is detected with an optical measurement cell
- Automatic measurement and display of cleanliness ratings as ISO 4406:1999; SAE AS 4059, and NAS 1638
- Measurement Accuracy +/- 1/2 ISO code
- Supply voltage 24 VDC
- Integrated pump for automatic control of oil flow
- Viscosity range: 33 to 1622 SUS (2 to 350 cSt)
- Water saturation (0 - 100%)

Description

The FluidControl Unit FCU 1315 series combines the advantages of the portable contamination measurement units with the measurement technology of the TestMate® Contamination Monitor (TCM) and TWS (TestMate® Water Sensor), in a portable, field-ready package for diesel fuel applications.

The FCU 1315 is a portable service unit and is designed for temporary measurement of solid particle contamination and water saturation in diesel storage, diesel transfer and diesel filling applications.

The FCU 1315 will measure contamination levels of diesel fuel, as well as mineral based hydraulic oils compatible with Viton® seals. The FCU 1315 is not compatible with water glycol fluids.

The integrated pump and the hoses with test point connections, which are included with the FCU 1315, allow operation on diesel fuel storage tanks and transfer circuits, as well as on hydraulic reservoirs, control circuits, and pressure circuits.

To ensure safe operation with diesel fuel, the FCU 1315 is equipped with a grounding wire, along with an integral temperature monitoring system to ensure the device switches off when operated above the critical temperature of diesel fuel (113°F, 45°C).

Applications

■ Diesel Storage ■ Diesel Transfer and Filling ■ Diesel Service and Maintenance

Specifications

General Data:	Self-Diagnosis:	Continuously with error indication via status LED and display
	Measured Value:	ISO code / SAE Class / NAS Class / Saturation Level / Temperature
	Measuring Range:	Display from ISO code 9/8/7 (MIN) to ISO code 25/24/23 (MAX) Calibrated within the range ISO 13/11/10 to 23/21/18 Saturation level 0 to 100 % / Temperature -13°F to 212°F (–25°C to 100°C)
	Accuracy:	± 1/2 ISO class in the calibrated range / ± 2 % Full scale max for Water Sat. and Temp.
	Material of Sealings:	FPM seals
	Ambient Temperature Range:	32°F to 113°F (0°C to 45°C)
	Storage Temperature Range:	-40°F to 176°F (-40°C to +80°C)
	Dimensions (cover closed):	9.06" H x 16.14" L x 13"D
	IP Class:	IP50 in operation, IP67 when closed
	Weight:	Approx. 29 lbs (13 kg) without accessories
	With Diesel According to ASTM D975 4-D or DIN EN 590:	IN: 0 psi (0 bar) OUT: 0 psi (0 bar)

Specifications

Hydraulic Data:	Hydraulic Fluid Operating Pressure:	IN: -7.25 to 650 psi (-0.5 to 45 bar) OUT: 0 to 7.5 psi (0 to 0.5 bar)
	with Adapter for Pressure Lines:	IN: 217 to 5000 psi (15 to 345 bar) OUT: 0 to 7.5 psi (0 to 0.5 bar)
	Pressure Max.:	5000 psi (345 bar)
	Permissible Viscosity Range:	33 to 1622 SUS (1.5 to 350 cSt)
	Fluid Temperature Range:	32°F to 158°F (0°C to +70°C), or up to 113°F (45°C) for diesel fuel
Electrical Data:	Power Supply Voltage:	24 VDC ± 20%, residual ripple < 10%
	Max. Power / Current Consumption:	100 Watt / 4 A
	Interface:	Plug connection, 5-pole, male, M12x1 and USB

Model Number Selection

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

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
FCU	1315 –		–	–	–

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
FCU	1315 –	4 –	U –	AS –	1	**= FCU 1315-4-U-AS-1**

BOX 1 – Model

Model
FCU

BOX 2 – Series

Series
1315 = ISO 4406:1999; SAE AS 4059/ > 4 µm(c) > 6 µm(c) > 14 µm(c) > 21 µm(c), For Use With Diesel According to ASTM D975 4-D and DIN EN 590, as well as Hydraulic and Lubrication Fluids Based on Mineral Oils

BOX 3 – Pump Option

Pump Option
4 = with Integral Pump

BOX 4 – Supply Voltage

Supply Voltage
U = 24 V DC

BOX 5 – Integral Sensor

Integral Sensor
AS = TestMate® Water Sensor

BOX 6 – Options

Options	
Omit =	None
1 =	100-240 V AC, 50/60 Hz, 1 Phase, 5 A Power Supply Adapter

We do not guarantee the accuracy or completeness of this information. The information is based on average working conditions. For exceptional operating conditions, please contact our technical department. All details are subject to technical changes.

Items supplied with FCU 1315-4-U-AS-1 include:

- FluidControl Unit (FCU 1315)
- Power supply AC adapter with connecting cables to supply voltage for Europe, USA/Canada, UK, Australia, and Japan
- Adapter for pressure lines
- Adapter for clear suction hose
- Inlet pressure hose with screw connection for 1620 test point, length = 2 meters (approx. 79 inches)
- Inlet suction pipe (metallic) for bottle sampling
- 2x suction/return hoses, clear, quick couple terminations, 1 meter (approx. 39 inches)
- Operation Manual & Calibration Certificate
- CD Rom of FluMoS Light Software
- USB Flash Drive (which includes Operation and Maintenance Instructions in other languages)
- Grounding Terminal

Accessories:

- Battery Pack (approx. 5 hours of use) Part No. 3504605
- Field Verification Startup Kit - Part No. 3443253
- Field Verification Kit (fluid only) - Part No. 3443249

Diesel Fuel Quality Analysis Kits

Troubleshooting Test Packages

Highlighted product eligible for QuickDelivery

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**
Complete Fuel Quality and fuel filter ability | Fuel Stability Bio Content Test

Complete Diesel Fuel Analysis	Schroeder P/N: 02098012	Includes	
• Complete fuel quality, fuel filter-ability, fuel stability and bio content test (8 critical ASTM tests with a single comprehensive relational summary NOTE: Test 0209812 only can be run with as little as 14 oz. (402 mL) sample		Filter Plugging Free Contamination	Computability | Loss of Power
		Filter Plugging | Injector Scoring | Corrosion	Flowability | Filterability | Di or Tri Glyceride Fall Out
		All Cultures of Microbes	Microscopic Composition
		Filter Plugging | Injector Scoring | Microbial Promoting | Cause of Water	Biodiesel Content

Contamination Tests	Schroeder P/N: 02098006	Includes	Sample Amount
• Identifies contamination from external sources - oil, biological growth, water, sediment • 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		ICP	2mL
		Flash Point	200mL
		Thermal Stability	120mL
		Water and Sediment	200mL
		Bacteria, Fungi, Mold	120mL

Smoking Tests	Schroeder P/N: 02098007	Includes	Sample Amount
• Identifies low cetane index or water contamination - loss of power, white smoke • Identifies excessive sulfur content - black smoke		Sulfur	50mL
		Cetane Index	100mL
		API Gravity	400mL
		Distillation	200mL
		Water and Sediment	200mL

Filter Plugging Tests	Schroeder P/N: 02093395	Includes	Sample Amount
• Identifies contamination from external sources specific to filter plugging - high particle count, biological growth • Identifies contamination due to a change in the fuel's physical properties - low thermal stability or insufficient cold weather capability for operating environment		Thermal Stability	120mL
		Bacteria, Fungi, Mold	120mL
		Pour Point	100mL
		Cloud Point	100mL
		Cold Filter Plug Point	100mL
		Particle Count	80mL

Cleanliness Tests	Schroeder P/N: 02098008	Includes	Sample Amount
• Identifies water contamination - can lead to smoking, biological growth and corrosion • Identifies particulate contamination - can result in extreme wear in high pressure fuel systems which may cause premature injector failure		Karl Fischer	10mL
		Particle Count	80mL

Wear Prevention Tests	Schroeder P/N: 02098009	Includes	Sample Amount
• Identifies cause of wear - water contamination, excessive particles or insufficient lubricity		Karl Fischer	10mL
		Particle Count	80mL
		Lubricity	20mL

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

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

Fuel Quality Test Packages

Summer Tests — Schroeder P/N: 02098010	Includes	Sample Amount
• Identifies contamination from external sources - oil, biological growth, water, sediment • 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	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
• Identifies low cetane index or water contamination - loss of power, white smoke • Identifies excessive sulfur content - black smoke	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

Biofuel Quality Measurement Tools

Online Quality Control

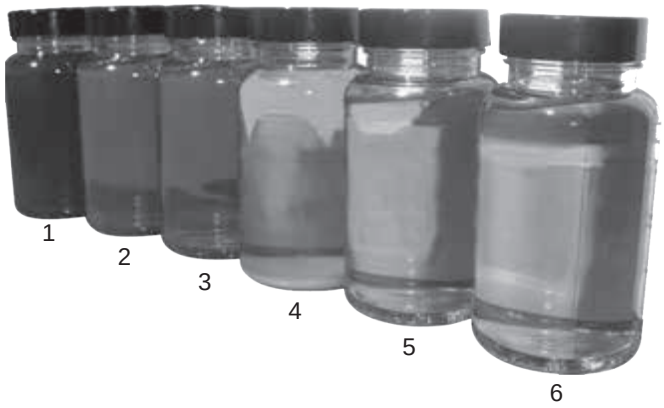
If you are a high volume producer, minutes count. Finding that you have produced dirty fuel an hour late can leave you with thousands of gallons of problem fuel. Online sensors can help you catch the problem before your customer does. While particle and moisture sensors will not tell you if your centane 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."

Section 8:

COALESCING ELEMENTS

Betterfit Elements

Features and Benefits

- Good price/performance ratio
- Lower maintenance costs due to longer service lives
- Significant reduction in pressure loss and integrated pleat stabilization due to Helios pleated geometry
- High level of fluid cleanliness due to graduated structure of depth filter
- High contamination retention due to large depth effect of the filter material
- High media compatibility
- Filter element geometry suitable for use in housings made by other manufacturers

Description

The filter elements in the Betterfit Diesel filter element series are particularly suitable for removing particles of dirt from diesel fuels. In this process, the Optimicron® diesel material with Helios pleated geometry is applied, which was developed especially for use with diesel fuels.

- Kaydon
- Parker
- Facet
- Gulfgate
- Murphy
- Racor
- Velcon
- And others

* Contact Factory for Crossovers not listed.

www.schroederindustries.info/crossreference.aspx or please contact factory.

Element Specifications

Differential Pressure Rating:	Up to 75 psid (dependent on part number)
Maximum Operating Temperature Range:	225ºF (ºC)
End 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)
Filter Element Length, Typical:	20", 40", 60" (others on request)
Filtration Rating:	5, 10, 20 µm (others on request)
Degree of Separation:	> 99.5%
Permissible Fluid temperature	14ºF to 176ºF (-10ºC to 80ºC)

Notes: See PDF document of coalescing elements cross reference by manufacture and Betterfit Cross reference for specific inquires at **www.schroederindustries.com**

Betterfit Elements

Element Specifications

Part Number	Model Code	Competitor	Competitor Code
Contact Factory	1.25.20 D 03 ON/DF /-V	Pall	HFU620GF020H13
Contact Factory	1.25.20 D 05 ON/DF /-V	Pall	HFU620GF060H13
Contact Factory	1.25.20 D 10 ON/DF /-V	Pall	HFU620GF100H13
Contact Factory	1.25.40 D 03 ON/DF /-V	Pall	HFU640GF020H13
3829783	1.25.40 D 05 ON/DF /-V	Pall	HFU640GF060H13
3877700	1.25.40 D 10 ON/DF /-V	Pall	HFU640GF100H13
3882380	1.25.40 D 20 ON/DF /-V	Pall	HFU640GF200H13
3828184	1.25.60 D 05 ON/DF /-V	Pall	HFU660GF060H13
3877699	1.25.60 D 19 ON/DF /-V	Pall	HFU660GF100H13
3952283	1.25.60 D 20 ON/DF /-V	Pall	HFU660GF200H13
3875491	1.32.20 D Z ON/DC /-V	Pall	LCS2H1AH
3875488	1.32.40 D Z ON/DC /-V	Pall	LCS4H1AH
3875110	1.33.20 D Z ON/DS /-V	Pall	LSS2F2H
3872179	15.01.29 D 05 ON/DF /-V	Velcon	DFO-629PLF6
3907748	15.03.44 D Z ON/DC /-V	Velcon	I-6444 TB
3907750	15.04.29 D Z ON/DS /-V	Velcon	SO-629PLF3
3866983	4.15.28 D 05 ON/DF /-V	Parker	HFS-28605-S
3907751	4.17.43 D Z ON/DC /-V	Parker	HCP-43601-TB
3907752	4.18.33 D Z ON/DS /-V	Parker	HSP-33605-S
3907754	45.01.33 D Z ON/DC /-V	Faudi	A.4-842
3907753	45.02.40 D Z ON/DS /-V	Faudi	60.644-1012

Betterfit Elements

Filtration

Filter: Optimicron® ON/DF

BetterFit filter elements for diesel applications have been specially developed to filter high volumes of contamination from diesel fuel. The meshpack is made from the latest Optimicron® Diesel material and incorporates the innovative Helios technology for:

- Excellent dirt holding capacity
- Stable pleat structure
- Low Δp

Dewatering

Coalescer: Optimicron® ON/DC

BetterFit dewatering elements use materials specifically designed for coalescing and for separating water from diesel:

- Optimicron® Diesel element technology for possible two stage dewatering
- Coalescer elements with high efficiency pleated materials
- Separator elements with new innovative coating for safe water separation
- The Optimicron® Diesel element technology enables secure and efficient dewatering even when the water content of the diesel is low

Filter Model Number Selection

How to Build a Valid Model Number for a BetterFit Element:

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6
1.25 –		–		–	–

Example: *NOTE: One option per box*

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	
1.25 –	60 –	D –	05 –	ON/DF –	V	= **1.2560D05ON/DFV**

BOX 1

Filter Element Type
1.25 = Pall HFU6
1.32 = Pall LCS
1.33 = Pall LSS
15.01 = Velcon DFO
15.03 = Velcon I
15.04 = Velcon SO
4.15 = Parker HFS
4.17 = Parker HCP
4.18 = Parker HSP
45.01 = Faudi A.4
45.02 = Faudi 60

BOX 2

Length
20 = 20"
40 = 40"
60 = 60"

*for others, contact factory

BOX 3

Version
D = Standard

BOX 4

Filtration Rating
05 = 5 µm
10 = 10 µm
20 = 20 µm

BOX 5

Filter Material
ON/DF = Optimicron® / Diesel Filtration
ON/DC = Optimicron® / Diesel Coalescing
ON/DS = Optimicron® / Diesel Separation

BOX 6

Sealing Material
V = FPM (FKM, Viton®)

Glossary

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 transesterfied 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/m3 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 mm2/s at 40°C vs 2.00-4.50 mm2/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.

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_2Pure 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.

Glossary

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 5 ppm. 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 5 ppm. 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 %, Cloudpoint or cold filter plug point (CFFP), 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), ashphaltines (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.

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.

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.

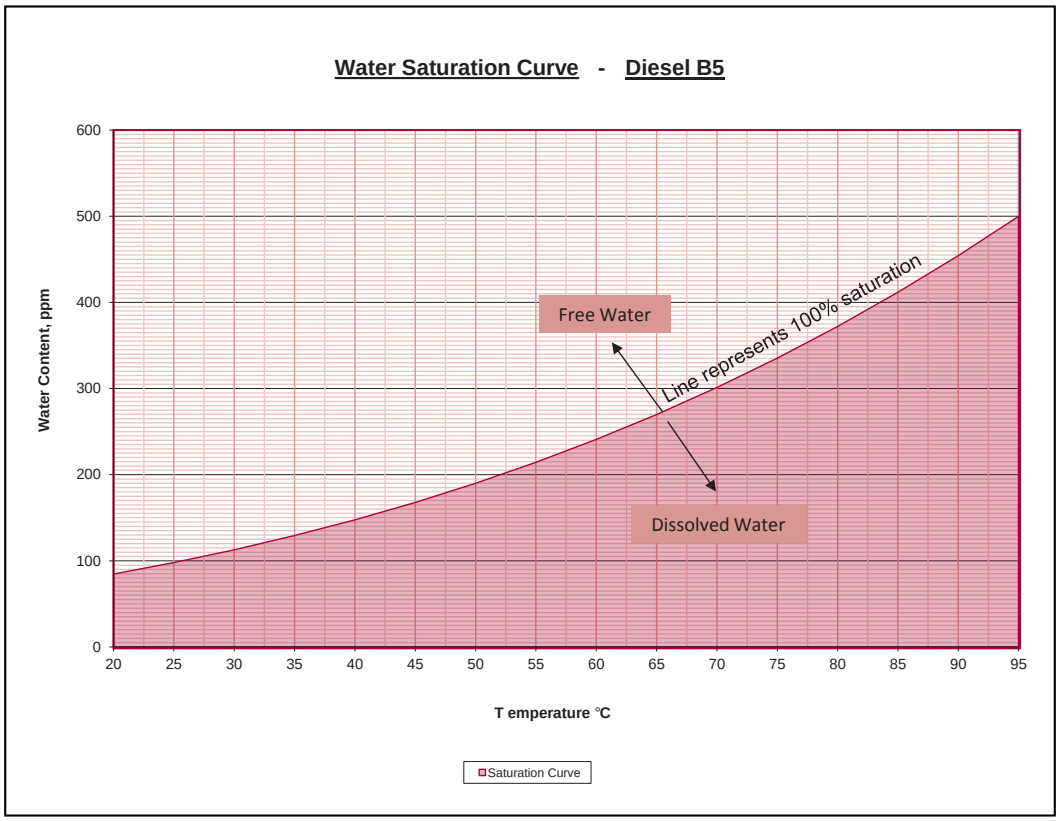
Relative Humidity-Absolute Water Content

T-5582
Conversion Table
Relative Humidity - Absolute Water Content (ppm)
Diesel B5

Rel. Humidity [%]	Temperature (C) 25	30	35	40	45	50	55	60	65	70	75
5	5	6	6	7	8	10	11	12	13	15	17
10	10	11	13	15	17	19	21	24	27	30	34
15	15	17	19	22	25	29	32	36	40	45	50
20	20	23	26	30	34	38	43	48	54	60	67
25	24	28	32	37	42	48	54	60	67	75	84
30	29	34	39	44	50	57	64	72	81	90	101
35	34	39	45	52	59	67	75	84	94	105	117
40	39	45	52	59	67	76	86	96	108	121	134
45	44	51	58	66	76	86	96	108	121	136	151
50	49	56	65	74	84	95	107	120	135	151	168
55	54	62	71	81	92	105	118	133	148	166	184
60	59	68	78	89	101	114	129	145	162	181	201
65	64	73	84	96	109	124	139	157	175	196	218
70	69	79	91	103	117	133	150	169	189	211	235
75	73	85	97	111	126	143	161	181	202	226	252
80	78	90	103	118	134	152	172	193	216	241	268
85	83	96	110	125	143	162	182	205	229	256	285
90	88	101	116	133	151	171	193	217	243	271	302
95	93	107	123	140	159	181	204	229	256	286	319
100	98	113	129	148	168	190	214	241	270	301	335

Absolute water content (interpolated) at different temperatures and relative humidities

Determination of the water saturation curve



Understanding EN14214 /ASTM D6751 | Specifications

In recent years, the US Biodiesel Standard ASTMD6751, 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	$mm^2/sec.$
Sulfated Ash	D 874	0.02 maximum	% mass
Sulfur S 15 Grade S 500 Grade	 D 5453 D 5453	 0.0015 max. (15) 0.05 max. (500)	 % mass (ppm) % 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 For use in temperatures below -12°C	D7501 D7501	360 maximum 200 maximum	seconds 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 stated of the European Union. In particular this standard give 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

* requirements: 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

Appendix C

Worldwide Fuel Charter

Worldwide Fuel Charter

The Worldwide Fuel Charter provides fuel quality recommendations published by the members of the Worldwide Fuel Charter Committee as a service to worldwide legislators, fuel users and producers.

Five different categories of fuel quality, have been established for unleaded gasoline and diesel fuel. Below are the properties for the most relevant two categories for Diesel fuel.

Category 4:

Markets with advanced requirements for emission control, for example, markets requiring US Tier 2, US Tier 3 (pending), US 2007 / 2010 Heavy Duty On-Highway, US Non-Road Tier 4, California LEV II, EURO 4/IV, EURO 5/V, EURO 6/VI, JP 2009 or equivalent emission standards. Category 4 fuels enable sophisticated NOx and particulate matter after-treatment technologies:

Footnotes: Category 4: Diesel Fuel

(1) Cetane Index is acceptable instead of Cetane Number if a standardized engine to determine the Cetane Number is unavailable and Cetane improver's are not used. When Cetane improver's are used, the estimated Cetane Number must be greater than or equal to the specified value and the Cetane Index must be greater than or equal to the number in parenthesis.

(2) May relax the minimum limit to 800 kg/m3 when ambient temperatures are below -30°C. For environmental purposes, a minimum of 815 kg/m3 can be adopted.

(3) May relax the minimum limit to 1.5 mm2/s when ambient temperatures are below -30°C or to 1.3 mm2/s when ambient temperatures are below -40°C.

(4) The unit mg/kg is often expressed as ppm.

(5) Examples of trace metals include, but are not limited to, Cu, Fe, Mn, Na, P, Pb, Si and Zn. Another undesirable element is Cl. No trace metal should exceed 1 mg/kg. No intentional addition of metal-based additives is allowed.

(6) Compliance with either T90 or T95 is required.

(7) If compliance is demonstrated by meeting CFPP, then it must be no more than 10°C less than cloud point.

(8) Methods 2a and 2b must be used with fuels containing FAME. Method 2c correlation data are based on fuels containing FAME.

(9) Alternative test methods, with appropriate limits for "no biological growth," can be used.

(10) For FAME, both EN14214 and ASTM D6751, or equivalent standards, should be considered. Where FAME is used, the blend-stock should meet the B100 Guidelines published by the WWFC Committee, and fuel pumps should be labeled accordingly.

(11) Other biofuels include HVO and BTL. Blending level must allow the finished fuel to meet all the required specifications.

(12) At or below detection limit of the test method used.

(13) Limit and test method are under review to assure DPF endurance.

Worldwide Fuel Charter

Diesel Fuel

Properties	Units	Min.	Limit	Max.
Cetane Number	-	55.0	-	-
Cetane Index [1]	-	55.0 (52.0) [1]	-	-
Density at 15°C	kg/m3	820 [2]	-	840
Viscosity at 40°C	mm2/s	2.0 [3]	-	4.0
Sulphur	mg/kg [4]	-	-	10
Trace metal [5]	mg.kg	-	-	1 or non-detectable, whichever is lower
Total aromatics	% m/m	-	-	15
PAH (di+, tri+)	% m/m	-	-	2.0
T90 [6]	°C	-	-	320
T95 [6]	°C	-	-	340
Final Boiling Point	°C	-	-	350
Flash point	°C	55	-	-
Carbon residue	% m/m	-	-	0.20
CFPP or LTFT or CP (7)	°C	-	-	Equal to or lower than the lowest expected ambient temp.
Water	mg/kg	-	-	200
Oxidation Stability		-	-	-
Method 1	g/m3	-	-	25
Method 2a (Rancimat, modified) [8], or	Hours	35	-	-
Method 2b (Delta TAN) [8], or	mg KOH/g	-	-	0.12
Method 2c (PetroOxy) [8]	Minutes	65	-	-
Foam volume	ml	-	-	100
Foam vanishing time	sec.	-	-	15
Biological growth [9]	-	-	No growth	-
FAME [10]	% v/v	-	-	5 [10]
Other biofuels [11]	% v/v	-	-	[11]
Ethanol/Methanol	% v/v	-	Non-detectable [12]	-
Total acid number	mh KOH/g	-	-	0.08
Ferrous corrosion		-	-	Light rusting
Copper corrosion	Rating	-	-	Class 1
Ash	%m/m	-	-	0.001 [13]
Particulate contamination, total	See test method	-	-	10
Particulate contamination, size distribution	Code rating	-	-	18/16/13 per ISO 4406
Appearance	-	-	Clear and bright; no free water or particulates	-
Injector cleanliness (Method 1)	% air flow loss	-	-	85
Injector cleanliness (Method 2)	% power loss	-	-	2
Lubricity (HFRR wear scar dia. at 60°C)	Micron	-	-	400

Worldwide Fuel Charter

Category 5:
Markets with highly advanced requirements for emission control and fuel efficiency, for example, those markets that require US 2017 light duty fuel economy, US heavy duty fuel economy, California LEV III or equivalent emission control and fuel efficiency standards in addition to Category 4-level emission control standards

Footnotes: Category 5: Diesel Fuel

(1) Cetane Index is acceptable instead of Cetane Number if a standardized engine to determine the Cetane Number is unavailable and Cetane improver's are not used. When Cetane improver's are used, the estimated Cetane Number must be greater than or equal to the specified value and the Cetane Index must be greater than or equal to the number in parenthesis.

(2) May relax the minimum limit to 800 kg/m3 when ambient temperatures are below -30°C. For environmental purposes, a minimum of 815 kg/m3 can be adopted.

(3) May relax the minimum to 1.5 mm2/s when ambient temperatures are below -30°C or to 1.3 mm2/s when ambient temperatures are below -40°C.

(4) The unit mg/kg is often expressed as ppm.

(5) Examples of trace metals include, but are not limited to, Cu, Fe, Mn, Na, P, Pb, Si and Zn. Another undesirable element is Cl. No trace metal should exceed 1 mg/kg. No intentional addition of metal-based additives is allowed.

(6) Compliance with either T90 or T95 is required.

(7) If compliance is demonstrated by meeting CFPP, then it must be no more than 10°C less than cloud point.

(8) Alternative test methods, with appropriate limits for "no biological growth," can be used.

(9) Other biofuels include HVO and BTL. Blending level must allow the finished fuel to meet all the required specifications.

(10) At or below detection limit of the test method used.

(11) Limit and test method are under review to assure DPF endurance.

Worldwide Fuel Charter

Diesel Fuel

Properties	Units	Min.	Limit	Max.
Cetane Number	-	55.0	-	-
Cetane Index [1]	-	55.0 (52.0) [1]	-	-
Density at 15°C	kg/m3	820 [2]	-	840
Viscosity at 40°C	mm2/s	2.0 [3]	-	4.0
Sulphur	mg/kg [4]	-	-	10
Trace metal [5]	mg.kg	-	-	1 or non-detectable, whichever is lower
Total aromatics	% m/m	-	-	15
PAH (di+, tri+)	% m/m	-	-	2.0
T90 [6]	°C	-	-	320
T95 [6]	°C	-	-	340
Final Boiling Point	°C	-	-	350
Flash point	°C	55	-	-
Carbon residue	% m/m	-	-	0.20
CFPP or LTFT or CP	°C	-	-	Equal to or lower than the lowest expected ambient temp. [7]
Water	mg/kg	-	-	200
Oxidation Stability, Method 1		-	-	25
Foam volume	ml	-	-	100
Foam vanishing time	sec.	-	-	15
Biological growth [8]	-	-	No growth	-
FAME		-	Non-detectable	-
Other biofuels [9]		-	-	[9]
Ethanol/Methanol	% v/v	-	Non-detectable [10]	-
Total acid number	mh KOH/g	-	-	0.08
Ferrous corrosion		-	-	Light rusting
Copper corrosion	rating	-	-	Class 1
Ash	%m/m	-	-	0.001 [11]
Particulate contamination, total	See test method	-	-	10
Particulate contamination, size distribution	Code rating	-	-	18/16/13 per ISO 4406
Appearance	-	-	Clear and bright; no free water or particulates	-
Injector cleanliness (Method 1)	% air flow loss	-	-	85
Injector cleanliness (Method 2)	% power loss	-	-	2
Lubricity (HFRR wear scar dia. at 60°C)	Micron	-	-	400

Appendix D

Schroeder Technical Cleanliness Testing & Research Capabilities

Advanced Fluid Conditioning Solutions® Using the Fluid Care Center

As both customer requirements and government regulations continue to drive more efficient filtration, developing new products requires a state-of-the-art testing laboratory. Schroeder has leveraged 65 years of filtration knowledge and brought well known standard tests and custom engineered testing capabilities in a single location to form what we are now proud to call the Fluid Care Center or FCC.

The custom engineered equipment and tests are developed to reconstruct our customers' operating environments while measuring the implications of choosing different fluid conditioning solutions. This newly available data allows designers to optimize tank design as well as reduce cavitation, size, and the cost of their hydraulic systems. The FCC will allow Schroeder to deliver innovative, high quality solutions to our customers and help them to deliver better machines at lower cost by testing performance rigorously, quickly and efficiently.

Standard Housing Testing

Schroeder tests the performance of its housings to the recognized, but more stringent, NFPA standards for pressure performance, giving our customers peace of mind. Static burst pressure and cyclic rated fatigue pressure (RFP) testing per NFPA/T2.6.1 conservatively determines rated pressures for filter housings.

Schroeder publishes pressure drop vs. flow testing as specified in ISO 3968. Lower pressure drop reduces power requirements, which means energy savings and reduced fuel costs. Schroeder also uses the same equipment to verify cracking and full flow pressure settings of filter bypass valves and indicators.

Flow Bench

Cyclic Testing

Standard Element Testing

Multi-Pass Test Stand

Schroeder tests to industry standards for element performance so our customers can compare our element to our competition. The most common and important test for filters is the multi-pass testing (MPT) per ISO 16889. This test provides critical performance data for filter elements: filter efficiency(ß), beta stability, and dirt holding capacity(DHC). In addition to testing the performance of elements, Schroeder also tests filter integrity. Filter element collapse/burst testing per ISO 2941 tests the strength of the element construction itself, including the media, support layers, tube, and end caps and provides assurance that an element will hold up in high differential pressure. Schroeder uses a pull tester to check the bond strength of the epoxy/end cap adhesion. Additionally, SI has a bubble point tester which provides a non-destructive filter element integrity test.

Fuel Coalescing Filter & Element Testing

For fuel coalescing filters and elements Schroeder tests according to three industry standards in order to develop filter and element technology and for benchmarking against competitor products. The three standards are as follows:

- SAE J1488 is a fuel/water separation test with continuous water injection of .25% of the fuel flow rate. The test is performed with the water injected upstream (suction side) of the pump resulting in emulsified or finely dispersed water droplets.
- SAE J11839 is a fuel/water separation test with continuous water injection of .25% of the fuel flow rate. The test is performed with the water injected downstream (pressure side) of the pump resulting in larger water droplets.
- ISO 16332 is a fuel/water separation test with continuous water injection of .15% of the fuel flow rate. The test is performed with the water injected either downstream (pressure side) or upstream (suction side) of the pump resulting in emulsified/finely dispersed or larger water droplets, respectively.

	Outputs	Standard	Application Specific
Multi-Pass Test Stand	Filter Efficiencies (ß), Dirt holding Capacity (DHC), Beta Stabilities, Collapse/Burst and Pressure Drop	✓	
Hydraulic Load Cycle Test Stand	Filter Efficiencies (ß), Beta Stabilities, Dirt Holding Capacity (DHC)		✓
Air-in-Oil	Comparative improvement in deaeration performance		✓
Static Burst Testing/Proof Pressure Testing	Burst pressure rating	✓	
Fatigue/Cycle Pressure Testing	Rated Fatigue Pressure (RFP)	✓	
Flow Bench	Pressure drop across a housing, element and assembly as a function of flow, Cracking and full flow pressure setting of a bypass valve	✓	
Multi-Purpose Test Stand	Coalescing (continuous injection and draw-down), Custom testing	✓	✓

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