An ISO 9001:2015 Certified Company

Schroeder Industries

Mobile Pocket Guide
Advanced Fluid Conditioning Solutions®

Hydraulic & Lube Filtration
Fuel Filtration
Filter Systems & Diagnostic Tools
Process Filtration
Element Technology
Accessories
Fluid Engineering Services
As an ISO 9001:2015 certified company, Schroeder Industries has been designing, manufacturing, and marketing a complete range of Advanced Fluid Conditioning Solutions® for over 73 years.

With a comprehensive portfolio of filtration and diagnostic solutions, we have been recognized as the leader in fluid conditioning for markets that use:

**Hydraulic and Lube Filtration (pg. 40)**
A complete range of filter assembly types up to 6,500 psi (448 bar)

**Fuel Filtration (pg. 43)**
Elements, housings, and systems for challenging fuel cleanliness requirements

**Filter Systems & Diagnostic Tools (pg. 48)**
Mechanical and electronic fluid conditioning and diagnostic monitoring tools

**Element Technology (pg. 53)**
High-efficiency elements for lubrication and fluid power systems

*The purpose of this guide is to serve as a useful, simple, and compact reference of fluid contamination and best proactive practices for our customers and the markets we serve.*
What is Contamination?

Contamination is any foreign matter introduced into a fluid power (hydraulic) system. Fluid power system repairs represent a significant portion of annual maintenance dollars spent today. With electric controls and the tolerances becoming so tight, contamination becomes an enormous cause for system repairs.
Types of Contamination

**SOLID**

**LIQUID**

**GAS**

**GEL-LIKE**

Sources of Contamination

**Built in**
- During manufacturing / assembly

**Ingression**
- Leaking seals, breather caps, worn fittings, cylinders, etc.

**Internally Generated**
- Shavings created from the wearing and scoring of hydraulic components

**Introduced During Repair**
- Dirty parts on shelves, dust/dirt in the air, inadequate cleaning during re-assembly, etc.
Contamination May Be...

Particles We Can See:

- Weld Spatter
- Metal Cuttings
- Rubber Dust from Making Hoses
- Sludge
- Floor Sweepings
- Metal from Damaged Components
- Paint Chips
- Rust
- Rags and Plastic Caps Left in Component when Installed
Contamination May Be...

Particles We Cannot See (less than 40 microns (µm))
- Airborne Dust
- Metal Particles Internally Generated or Externally Induced
- Silt Particles

Fluids
- Water
- High Pressure Wash Down Cleaning Solutions
- Other Chemicals: Diesel Fuel, Anti-Freeze, Solvents, etc.

Just because it's "new" oil, doesn't mean it's "clean" oil!

Demanded by Modern Hydraulic Systems

New Oil as Delivered on Tanker

New Oil as Delivered in Mini-container

New Oil as Delivered in Barrels
Types of Contamination - Specs to keep in mind

Manufacturers are keeping up with the demand by utilizing newer technology in machine parts. This technology can help reduce material waste, promote improved production times, and the overall quality of work.

With the demand for higher efficiency, tolerances have become tighter, and parts have become smaller. Tolerances as tight as .0001 of an inch are more frequently used. **With that tight of a tolerance, contamination in fluids (even 10x smaller than a grain of table salt) can negatively affect critical system components.**

Consider the diameters of the following substances:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Microns</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain of table salt</td>
<td>100</td>
<td>.0039</td>
</tr>
<tr>
<td>Human hair</td>
<td>70</td>
<td>.0027</td>
</tr>
<tr>
<td>Talcum powder</td>
<td>10</td>
<td>.00039</td>
</tr>
<tr>
<td>Bacteria</td>
<td>2 (average)</td>
<td>.000078</td>
</tr>
</tbody>
</table>

A micron rating identifies the size of particles that a particular filtration media will remove. For instance, Schroeder Z10 filter media is rated at B10 ≥1000, meaning that it can remove particles of 10 μm and greater than 99.9% efficiency.
ISO Cleanliness Levels - Explained

ISO 4406:1999 provides guidelines for defining the level of contamination present in a fluid sample in terms of an ISO rating.

To structure an ISO Code, the amount of dirt particles measured in a 1 mL sample must be larger than these three specified sizes: 4 µm(c) / 6 µm(c) / 14 µm(c).
Comparison Photos of Fluid Contamination Classes
(1 Scale Mark = 40 μm)

ISO 12/9/6

ISO 13/10/7

ISO 14/12/9
NAS 1638: Class 3
SAE AS 4059(D): Class 4

ISO 15/13/10
NAS 1638: Class 4
SAE AS 4059(D): Class 5

ISO 16/14/11
NAS 1638: Class 5
SAE AS 4059(D): Class 6

ISO 17/15/12
NAS 1638: Class 6
SAE AS 4059(D): Class 7
It is important to note that the ISO 4406:1999 coding system is set up so that, for each number, the code increases the contamination level exponentially. For example: The particle count for ISO level 10 is 5–10 particles per mL; ISO level 11 is 10–20 particles per mL.
Types of Contamination

All photos are magnified 48x. Each line is a measurement of 45 µm.

**Rust and Additives**
The photo to the left shows rust and other particles that are white. There are also additives in this photo. These particles result in premature aging of the oil, damage to pumps, seals, and valves, as well as other wear and tear.

**Oil Aging Products**
These particles block the filter element and cause silting within the system.

**Metal**
These particles cause wear on pumps, seals, and other components, as well as increase the aging rate of oil.

**Bronze, Copper, and Brass**
These particles cause wear on pumps, seals, and other components, as well as increase the aging rate of oil.

**Gel-type Residue from Filter Element**
These block the filter by silting up the element causing the filter to go into bypass or collapse.
Silicates
They are caused by lack of/or an inadequate air breather filter. This produces heavy component wear, pump, and valve breakdowns, as well as wearing of seals.

Colored/Synthetic Particles
They cause breakdowns in pumps, and valves, as well as wearing of the seals.

Fibers
They enter through open tanks, cleaning clothes, etc. Fibers block nozzles and cause leaking from valve seats.

As seen in the pictures above, contamination takes many different shapes, consistencies and sizes. It is obvious that some of these contaminants cause more damage than others; however, all cause damage and need to be removed from circulating flow as quickly as possible.

For this reason, Schroeder Industries recommends multiple filtration locations in a circuit so that all components are protected. [Continued on Next Page]
## Components, ISO Codes, and Filter Media

### Recommended Cleanliness Levels (ISO Codes) for Fluid Power Components

<table>
<thead>
<tr>
<th>Components</th>
<th>Cleanliness Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic Fixed Gear Pump</td>
<td>18/16/13</td>
</tr>
<tr>
<td>Hydraulic Fixed Piston Pump</td>
<td>17/15/12</td>
</tr>
<tr>
<td>Hydraulic Variable Vane Pump</td>
<td>17/15/12</td>
</tr>
<tr>
<td>Hydraulic Fixed Vane Pump</td>
<td>18/16/13</td>
</tr>
<tr>
<td>Hydraulic Proportional Valves</td>
<td>16/14/12</td>
</tr>
<tr>
<td>Hydraulic Servo Valves</td>
<td>15/13/11</td>
</tr>
</tbody>
</table>

### Schroeder Element Media Recommendations

<table>
<thead>
<tr>
<th>Desired Cleanliness Levels (ISO Code)</th>
<th>Schroeder Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/18/15-19/17/14</td>
<td>Z25</td>
</tr>
<tr>
<td>19/17/14-18/16/13</td>
<td>Z10</td>
</tr>
<tr>
<td>18/16/13-15/13/10</td>
<td>Z5</td>
</tr>
<tr>
<td>15/13/10-14/12/9</td>
<td>Z3</td>
</tr>
<tr>
<td>14/12/9-13/11/8</td>
<td>Z1</td>
</tr>
</tbody>
</table>

### Recommended Schroeder Media to Achieve Desired Cleanliness Level*

<table>
<thead>
<tr>
<th>Desired Cleanliness Levels (ISO Code)</th>
<th>Ingression Rate</th>
<th>Schroeder Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/18/15</td>
<td>High</td>
<td>Z25</td>
</tr>
<tr>
<td>19/17/14</td>
<td>Low</td>
<td>Z25</td>
</tr>
<tr>
<td>19/17/14</td>
<td>High</td>
<td>Z10</td>
</tr>
<tr>
<td>18/16/13</td>
<td>Low</td>
<td>Z10</td>
</tr>
<tr>
<td>18/16/13</td>
<td>High</td>
<td>Z5</td>
</tr>
<tr>
<td>15/13/10</td>
<td>Low</td>
<td>Z5</td>
</tr>
<tr>
<td>15/13/10</td>
<td>High</td>
<td>Z3</td>
</tr>
<tr>
<td>14/12/9</td>
<td>Low</td>
<td>Z3</td>
</tr>
<tr>
<td>14/12/9</td>
<td>High</td>
<td>Z1</td>
</tr>
<tr>
<td>13/11/8</td>
<td>Low</td>
<td>Z1</td>
</tr>
</tbody>
</table>

*Based on Ingression Rate*
Types of Contamination - Specs to be aware of

<table>
<thead>
<tr>
<th>Component</th>
<th>Typical Critical Clearance (µ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gear Pump (J1, J2)</td>
<td>0.5-5</td>
</tr>
<tr>
<td>2. Vane-cell Pump (J1)</td>
<td>0.5-5</td>
</tr>
<tr>
<td>3. Piston Pump (J2)</td>
<td>0.5-1</td>
</tr>
<tr>
<td>4. Control Valve (J1)</td>
<td>1-25</td>
</tr>
<tr>
<td>5. Servo Valve (J1)</td>
<td>1-4</td>
</tr>
</tbody>
</table>

Sizing a Filter
Damage Caused By Contamination

Surface Scoring & Wear

Fluid Degradation

Gel-Like / Varnish

Metal Shaving / Solid

Internally Generated
Ingression Contamination - Cause & Effect

**Cause**
- Improper Filtration
- Low Oil Level - Concentration of Contaminant
- Loose or Lost Breather Cap
- Leaking Fittings, Seals, Wipers, etc.
- Missing or Collapsed Inlet Strainer
- Poor Transferring, Delivering, and Dispensing Practices
- Clogged Filter - Filter in Bypass

**Effect**
- Accelerated Wear of Bearings, Thrust Plates, Filter Housing, etc.
- Bearing / Bushing Failure
- Reduced Pump Efficiency
- Reduced System Life
- Heat
- Internal Leaks
- Failed Pump

**Note From the Expert:**
*Change element when bypass is indicated. If no indicator is installed on the filter, consider installing one to remain on top of your fluid cleanliness.*
Cavitation Damage - Cause & Effect

**Cause**
- Inlet Restriction
- Clogged Inlet Strainer / Breather
- Inlet Strainer Too Small
- Inlet Line Too Long
- Inlet Line Bore Too Small
- Excessive Engine Speed
- Collapsed Inlet Hose
- Suction Head Too Great
- Oil Too Viscous (Cold Weather)

**Effect**
- Noise
- Heat
- Accelerated Wear Thrust Plates / Housing
- Internal Leaks
- Reduced Pump Efficiency
- Erratic Actuator Performance
- Failed Pump

**Note From the Expert:**
 Blocked suction strainers and air breathers are two leading causes of pump cavitation.
Aeration Damage - Cause & Effect

**Cause**
- Air Enters Oil
- Low Oil Level
- Whirlpool of Oil Above Strainer
- Loose Inlet Fittings
- Worn Pump Shaft Seal
- Worn Cylinder Rod Seal
- Foam Suspended in Oil due to Sloshing in the Reservoir

**Effect**
- Noise
- Heat
- Accelerated Wear Thrust Plates / Housing
- Internal Leaks
- Reduced Pump Efficiency
- Erratic Actuator Performance
- Failed Pump

**Note From the Expert:**

*A simple redesign of your system tank can give you increased de-aeration, and volume reduction.*
Pressure Damage - Cause & Effect

**Cause**
- Improper Relief Valve Setting
- Relief Valve Malfunctioned
- Slow Acting Relief Valve
- Absence of a Relief Valve
- Improper Size Elbow or Fitting Downstream of the Valve Affecting the Performance

**Effect**
- Accelerated Wear
- Cracked Housing
- Excessive Housing Cut-Out
- Reduced Efficiency
- Internal Leakage
- Bearing / Bushing Failure
- Thrust Plated Coined, Warped, or Cracked
- Broken Drive / Connecting Shaft

**Note From the Expert:**

*Continuously check pressure and flow to ensure proper system functioning.*
Heat Damage - Cause & Effect

**Cause**
- Low Oil Level
- Cavitation / Aeration / Water
- Contamination
- Inlet Restriction
- Relief Valve
- Incorrect Fluid
- Poor Size & Build of Reservoir
- Undersized Fittings, Hoses, Components, etc.

**Effect**
- Breakdown of Oil
- Loss of Lubricity
- Accelerated Wear
- Reduced Efficiency
- Leakage
- Varnish / Sludge
- Internal Seal Destruction
- Seizure

*Note From the Expert:*

*By optimizing your systems tank, this allows for better temperature control.*
How to Control Contamination

Maintain and Monitor Filtration

1. Check the condition of filter caps/breathers
2. Monitor dirt alarm and replace filter element as necessary
3. Take oil samples frequently and check for particulate or water contamination
4. Compare results with corporate guidelines for contamination levels (*reference pg. 14*)

Fluid Storage & Handling

1. Store fluid in clean, dry container
2. Do not mix old and new fluid
3. Pre-filter fluid before filling reservoir
4. Fill through fill cap strainer on reservoir

Parts Storage & Handling

1. Store parts in a clean area
2. Plug all port openings in components, manifolds, hose, and tube assemblies
3. Keep all hydraulic components plugged until flushed or installed in vehicle
How to Control Contamination - Continued

Parts Installation
1. Keep work area clean
2. Inspect parts for contamination before installing in a system
3. Make sure cylinder rods are not painted or have overspray

Flush Hydraulic System
1. Thoroughly clean all hydraulic components before assembly
2. Flush all hydraulic plumbing before final installation
3. After final assembly, flush total hydraulic system thoroughly before rolling out (roll-off cleanliness)

"...as much as 70% of all premature machine failures can be attributed to contamination"
-NORIA Corp.

Contamination Costs
- Downtime
- Additional Maintenance
- Replacement of Parts
- Environmental Fines and Cleanup
- Missed Pickup Hours
- Unhappy Customers
Schroeder's THF is an easy to use fluid analysis service that can be utilized as part of any predictive maintenance program.

Visit our product page: https://bit.ly/2Xb9nQn
Recommended Practices for Taking Oil Samples

**Sampling Procedure:**

1. Find a convenient opening above the fluid level in the reservoir through which the sampling tube can enter.

2. Determine the approximate distance (half the depth of the reservoir).

3. Place a reference mark on the sampling tube at a point corresponding to the length of the tubing needed to reach the halfway point from the opening through which the sampling tube will enter.

4. Use a lint-free cloth to clean all surfaces which could contribute contaminant to the fluid sample.

5. Operate the hydraulic circuits to help diffuse particulate contaminant as evenly as possible throughout the reservoir.

6. Insert the sampling tube into the reservoir to the reference mark immediately after the contaminant in the reservoir has been diffused.

   **NOTE:** It may be necessary to weigh the end of the tubing to help it to be positioned at the desired level.

7. Flush sampling tube with reservoir fluid equal to approximately five (5) times the internal volume of the sampling line. **Do not use flushing fluid or flushing bottle to obtain fluid sampling.**

8. Withdraw a fluid sample from the reservoir into a clean sample bottle.* Fill sample bottle to no more than 75% of the sample bottle volume.

9. Remove sample bottle and recap immediately.

   **NOTE:** Sample bottles are available for FREE from Schroeder Industries *(PLEASE NO WATER BOTTLES)*!

   **NOTE:** For accurate results, take sample immediately after vehicle or system has run for a fair amount of time.
Contamination Control in Hydraulic Hose Making

Making
Cutting hoses introduces contamination to the hydraulic system in the form of:

- Metal Particles From the Hose’s Wire Reinforcement
- Cutting Blade Itself
- Polymer Dust From the Hose’s Outer Cover and Inner Tube if Not Addressed Before Crimping and Installation

How to Clean a Hose
The most efficient and popular way to clean a hose prior to installing crimped ends is by blowing a foam cleaning projectile through the hose using a special attachment connected to compressed air.

Clamping
Hydraulic hose manufacturers estimate that 80% of hose failures are attributed to external, physical damage through pulling, kinking, crushing, or abrasion of the hose. Abrasion caused by hoses rubbing against each other or surrounding surfaces is the most common type of damage.

Note From the Expert:
A proper clamping solution can eliminate unnecessary damage to your hoses.
Common Poor Practices - Maintenance

Unprotected Parts Storage
- Caps
- Cylinders
- Unprotected Hoses

Dirty Parts
- Metal Contamination
- Dirty Cylinders

Open Containers
- Open Fluid Containers
- Open Part Containers

Open Fluid Containers
Common Poor Practices - Maintenance - Continued

Unprotected Hoses

Open Part Containers
Things to Consider - Fluid Handling

1. Condition-based hydraulic servicing. In order to maximize element and oil life, while saving money and reducing downtime, service your hydraulics when needed. Without using visual indicators, or oil analysis kits, how can you be sure your hydraulic system is performing as designed?

2. If you keep your hydraulic oil clean, cool, and dry, the need to change oil during a hydraulic service can be greatly reduced. In order to accomplish this, a comprehensive contamination control program must be implemented along with oil analysis.

3. Just because you bought "new" oil, it doesn't mean it's "clean" oil. Consider placing bulk filtration between your storage tank and fluid dispenser. Doing this provides protection for the entire fleet and ensures clean oil is being put into your vehicles.

4. Use a filter cart whenever a major hydraulic repair is completed. Not doing so will cause more damage in the future, guaranteed. Don’t dump the oil just because you changed a pump. A Schroeder filter cart can clean any contamination ingress during the pump change-out.
Contamination Control Tiers (1 of 3)
Tier 1 (Basic)

Basic contamination control begins with filtering contaminants while fluid is dispensed. The bulk filter assembly is plumbed between the storage tank and the dispensing nozzle. Dispensed fluid is filtered or it is returned to the storage tank, preventing contaminated oil from reaching the equipment.

Recommended Components
- Bulk Filtration
- Desiccant Breather
- Quality Suction Strainer
- Quality Return Filter
- On-board Air Breather
Contamination Control Tiers (2 of 3)

Tier 2 (Intermediate)

In addition to the components in the basic solution, Tier 2 incorporates portable on-board cleaning that can extend the service life of the hydraulic fluid. The technician now has the ability to clean the hydraulic system after making any hydraulic repairs. As in the basic solution, proper maintenance practices, as well as a sampling program must be followed to ensure oil serviceability.

Recommended Components

- Bulk Filtration
- Desiccant Breather
- Quality Suction Strainer
- Quality Return Filter
- On-board Air Breather
- Portable Filtration
Contamination Control Tiers (3 of 3)
Tier 3 (Advanced)

The advanced solution uses all components in the lower tiers and incorporates a bulk storage pre-filter that prevents dirty oil from entering your tanks.

**Recommended Components**

- Bulk Filtration
- Desiccant Breather
- Quality Suction Strainer
- Quality Return Filter
- On-board Air Breather
- Advanced Portable Filtration
- Bulk Pre-Filter
Products

We will now dive in deeper to some of the products and solutions we offer here at Schroeder Industries.

All Schroeder products are tested and held to these standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 2941</td>
<td>Element Collapse (Burst)</td>
</tr>
<tr>
<td>ISO 2942</td>
<td>Fabrication Integrity</td>
</tr>
<tr>
<td>ISO 2943</td>
<td>Material Compatibility</td>
</tr>
<tr>
<td>ISO 3723</td>
<td>End Load</td>
</tr>
<tr>
<td>ISO 3724</td>
<td>Element Flow Fatigue</td>
</tr>
<tr>
<td>ISO 3968</td>
<td>Pressure Drop / Flow</td>
</tr>
<tr>
<td>ISO 4402: 1991</td>
<td>Calibration of automatic particle counters</td>
</tr>
<tr>
<td>ISO 4405: 1991</td>
<td>Determining particulate contamination of fluid by Gravimetric Method</td>
</tr>
<tr>
<td>ISO 4406: 1987</td>
<td>Methods of coding level of fluid contamination by solid particles</td>
</tr>
<tr>
<td>ISO 4406: 1999</td>
<td>Code for defining level of contamination of solid particles</td>
</tr>
<tr>
<td>ISO 4407: 1991</td>
<td>Determining fluid contamination by counting method using a microscope</td>
</tr>
<tr>
<td>ISO 11171: 1999</td>
<td>Calibration of liquid automatic particle counters</td>
</tr>
<tr>
<td>ISO 16889</td>
<td>Multi Pass Test</td>
</tr>
<tr>
<td>NAS 1638</td>
<td>Cleanliness requirements of parts used in hydraulic systems</td>
</tr>
<tr>
<td>NFPA/T-2.6.1</td>
<td>Burst Pressure Test</td>
</tr>
<tr>
<td>NFPA/T-2.6.1</td>
<td>Fatigue Testing</td>
</tr>
<tr>
<td>NFPA/T-3.10.17</td>
<td>Pressure / Life Rating of a Spin-On Filter</td>
</tr>
</tbody>
</table>
Bulk Filtration

**3K9 Single-Pass Filter Kit** -
- Provides entire shop single-pass filtration at the dispensing nozzle
- Mounted between bulk storage tank and fluid dispenser
- Used for hydraulic fluids
- Field proven to deliver fluid at 18/15/13 or better in a single-pass

**MCO Clean Oil Dispenser** -
- Provides guaranteed clean fluid at the dispensing nozzle
- Uses a bypass valve to divert fluid once the filter goes into bypass
- Prevents unfiltered fluid from reaching the fleet
- Used for hydraulic fluid
- Field proven to deliver fluid at 18/15/13 or better in a single-pass
**K9 Medium Pressure Filter** -

- Provides filtered fluid to dispensing applications
- Primarily used for engine oil and/or small bulk hydraulic fluid systems (*less than 250 gallon*)
- Comes with a 3 µm element

*NOTE: If using for engine oil, order and use the 27KZ25 (25 µm) element*

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**KL3 Return Line Filter** -

- Used as the bulk delivery pre-filter (3 µm)
- Prevents contamination from entering bulk storage from fluid vendor

*Replacement element part number is G3228*

*NOTE: Customer needs to source vendor delivery connection adapter*
Bulk Filtration - Continued

DBE-4 Desiccant Air Breather -

• Used on bulk storage tank
• Pleated air filter with 2 µm filtration rating
• Reusable base with check (intake) and bypass (outflow) valves
• Check valves prevent absorbents from being re-introduced into the system during downtime

Replacement cartridge: RDBE4   Replacement base: 1304256

ABF 3/10 Air Breather -

• Large surface areas offer high dirt holding capacity
• 3 µm / 40 SCFM
• Available with filter strainer, dipstick, indicator, and check/relief valve options

A-ABC-1 Air Breather Check Kit -

• The Air Breather Check (ABC) takes the guesswork out of when to change your air breather. The A-ABC-1 doesn’t care how dirty the air breather looks or how long it’s been installed, it only cares how well the breather is working.

NOTE: See Catalog (L-4329) for optional mounting kit

PABR7 Air Breather -

• 3 µm / 35 SCFM
• Durable synthetic Nylon 6 housing
• Replacement Phenolic resin impregnated filter element
• Integrated anti-splash insert

Replacement element: R-PAB7-3
**Bulk Filtration - Continued**

**Y2, D5 Visual Indicator -**

- Visual indicators provide an economical way to know, at a glance, when a filter element needs to be replaced. With the dial indicator, the pointer will reach the red section just before bypassing occurs.

*NOTE: The Y2 is a variable, tri-color gauge, whereas the D5 is a visual pop-up.*

**SKB-1 Suction Strainer -**

- Unique protection, for pumps of all sizes, from ferrous particles. Some of which have the potential of destroying pumps in a single-pass.

**GS-5U Gauge Kit -**

- Protects vehicles against over pressurization. The 150 psi gauge can not be damaged when a 2500 psi system is being checked. This design feature eliminates the need to know the pressure before testing.

- Compact and portable; The GS-5U is 6½" in diameter. The GS-5U fits easily into the average tool box for instant availability.
Bulk Filtration - Continued

**MFD Mobile Filtration System -**
- Dual filter cart with 5 µm or 3 µm elements
- 7 gpm pump

*Suggested part numbers:*
- MFD127Z05Z01B07 (P/N 7616339)
- 27KZ5 (5 µm element)
- 27KZ1 (1 µm element)

**MFS Mobile Filtration System -**
- Single filter cart with 1 µm element
- 7 gpm pump

*Suggested part numbers:*
- MFS127Z05Z01B07 (P/N 7616445)
- 27KZ1 (1 µm element)
How to Clean Hydraulic Systems using a Filter Cart

1. Place wands into hydraulic reservoir. Ensure the suction wand is lower than the return or on the opposite side of the return wand.

2. Run cart for 10-12 minutes to clean the reservoir.

3. Turn on hydraulic pump and starting with the largest bore cylinder, cycle the function three (3) times.

4. Turn off pump and clean reservoir following procedure in Step 2.

5. Repeat Step 3 for the remaining hydraulic functions. Turn off pump between each function in order to clean the reservoir.

6. After all functions have been run, top off reservoir and clean the tank one last time. (Skip cleaning reservoir if bulk filtration unit is installed on the hydraulic dispenser).

NOTES:

1. As a best practice and for ease of use, install quick disconnects (QD’s) on each truck being serviced by the filter cart. QD’s also assist in preventing re-introduced contamination and assist in maintaining a closed hydraulic system.

2. Some tank designs prevent cycling of the hydraulic system because the wands must be inserted into the tank with the return filter removed. In this case, run the filter cart for 25 minutes to maximize cleanliness of the reservoir in a single step.

3. Know your ISO count. Consider upgrading the cart with the HY-TRAX® Retrofit System Assembly (pg. 50).
Our filter housings are continuously tested using the latest ISO and NFPA test procedures in our Fluid Care Center (FCC). Extensive testing is conducted to verify rated fatigue and burst pressures and to ensure compatibility with various mineral-based fluids.

**Product offerings include:**

- High Pressure Filters (1,500-6,500 psi)
- Medium Pressure Filters (500-1,500 psi)
- Stainless Steel (up to 1,500 psi)
- Low Pressure Filters (up to 500 psi)
- Suction Filters
- Manifold Cartridge Kits & Filters
- Custom Solutions
### Model Code: ART85Z5SS43Y2

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td><strong>Flow Rating</strong></td>
<td>225 gpm (840 L/min) for 150 SUS (32 cSt) fluids</td>
</tr>
<tr>
<td><strong>Max. Op. Pressure</strong></td>
<td>145 psi (10 bar)</td>
</tr>
<tr>
<td><strong>Min. Yield Pressure</strong></td>
<td>353 psi (37 bar), per NFPA T2.6.1</td>
</tr>
<tr>
<td><strong>Rated Fatigue Pressure</strong></td>
<td>145 psi (10 bar), per NFPA T2.6.1</td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
<td>-20°F to 225°F (-29°C to 107°C)</td>
</tr>
<tr>
<td><strong>Porting Head &amp; Cap</strong></td>
<td>Aluminum</td>
</tr>
<tr>
<td><strong>Element Case</strong></td>
<td>Plastic</td>
</tr>
<tr>
<td><strong>Element Change Clearance</strong></td>
<td>16.39&quot; (340 mm)</td>
</tr>
<tr>
<td><strong>ΔP</strong></td>
<td>See H&amp;L Catalog (L-2520)</td>
</tr>
<tr>
<td><strong>Porting</strong></td>
<td>2½&quot; SAE 4-bolt flange Code 61, Dual, Dual SAE-32</td>
</tr>
</tbody>
</table>

### Model Code: MRT18LZ10S24S24D5

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow Rating</strong></td>
<td>up to 150 gpm (570 L/min) for 150 SUS (32 cSt) fluids</td>
</tr>
<tr>
<td><strong>Max. Op. Pressure</strong></td>
<td>900 psi (6 bar)</td>
</tr>
<tr>
<td><strong>Min. Yield Pressure</strong></td>
<td>2700 psi (186 bar)</td>
</tr>
<tr>
<td><strong>Rated Fatigue Pressure</strong></td>
<td>750 psi (52 bar), per NFPA T2.6.1-2005</td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
<td>-20°F to 225°F (-29°C to 107°C)</td>
</tr>
<tr>
<td><strong>Porting Head &amp; Cap</strong></td>
<td>Cast Aluminum (Anodized)</td>
</tr>
<tr>
<td><strong>Element Case</strong></td>
<td>Steel</td>
</tr>
<tr>
<td><strong>Element Change Clearance</strong></td>
<td>17.0&quot; (432 mm)</td>
</tr>
<tr>
<td><strong>ΔP</strong></td>
<td>See H&amp;L Catalog (L-2520)</td>
</tr>
<tr>
<td><strong>Porting</strong></td>
<td>1.5&quot; - SAE straight thread</td>
</tr>
</tbody>
</table>
**Model Code: LRT18LZ10S24S24NY2**

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow Rating</strong></td>
<td>Up to 150 gpm (570 L/min) for 150 SUS (32 cSt) fluids</td>
</tr>
<tr>
<td><strong>Max. Op. Pressure</strong></td>
<td>100 psi (7 bar)</td>
</tr>
<tr>
<td><strong>Min. Yield Pressure</strong></td>
<td>400 psi (28 bar)</td>
</tr>
<tr>
<td><strong>Rated Fatigue Pressure</strong></td>
<td>90 psi (6 bar), per NFPA T2.6.1-2005</td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
<td>-20°F to 225°F (-29°C to 107°C)</td>
</tr>
<tr>
<td><strong>Porting Head &amp; Cap</strong></td>
<td>Die Cast Aluminum</td>
</tr>
<tr>
<td><strong>Element Case</strong></td>
<td>Steel</td>
</tr>
<tr>
<td><strong>Element Change Clearance</strong></td>
<td>17.0&quot; (432 mm)</td>
</tr>
<tr>
<td><strong>ΔP</strong></td>
<td>See H&amp;L Catalog (L-2520)</td>
</tr>
</tbody>
</table>

**Model Code: TNK25**

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. Return Flow</strong></td>
<td>75 gpm (284 L/min)</td>
</tr>
<tr>
<td><strong>Tank Volume</strong></td>
<td>25 gal (100L)</td>
</tr>
<tr>
<td><strong>Tank Materials</strong></td>
<td>High Density Polyethylene (HDPE) Polypropylene (Polypro)</td>
</tr>
<tr>
<td><strong>Temperature Range</strong></td>
<td>High Density Polyethylene (HDPE) -20°F to 180°F (-29°C to 105°C) Polypropylene (Polypro) -32°F to 240°F (0°C to 116°C)</td>
</tr>
<tr>
<td><strong>Return Line Filter</strong></td>
<td>TNK25: RT &amp; GRT</td>
</tr>
<tr>
<td><strong>Element Change Clearance</strong></td>
<td>TNK25: 12&quot; (305 mm)</td>
</tr>
<tr>
<td><strong>ΔP</strong></td>
<td>See H&amp;L Catalog (L-2520)</td>
</tr>
</tbody>
</table>
Our full range of fuel filtration products have revolutionized fuel cleanliness, and serve a diverse range of markets and industries. The designs of our products are a result of many hours of field testing, laboratory research, over 73 years of experience, and partnerships with fuel industry and filtration experts.

Product offerings include:

- Fuel Condition Monitoring Equipment
- Biodiesel Treatment & Polishing
- On-Board, Mobile Diesel Filtration
- ASME Filtration Vessels
- Diesel Particulate & Coalescing Solutions
- Custom Solutions
- CNG Filtration Technology
Diesel Engine Problems From Poor Quality Diesel/Biodiesel Fuel

- Bacterial Growth
- Clogged Fuel Injections
- Seal Failures
- Oil Degradation/Leakage
- Damaged Fuel Pump
- Blocked Fuel Filter

Unseen particles can still cause damage
**Model Code: GHPF11GGZ3VS24D5R**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Rating</td>
<td>Up to 100 gpm (380 L/min)</td>
</tr>
<tr>
<td>Max. Op. Pressure</td>
<td>150 psi (10.3 bar)</td>
</tr>
<tr>
<td>Min. Yield Pressure</td>
<td>2600 psi (179 bar)</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>-20°F to 225°F (-29°C to 107°C)</td>
</tr>
<tr>
<td>Bypass Setting</td>
<td>Cracking: 40 psi (2.8 bar)</td>
</tr>
<tr>
<td>Porting Head</td>
<td>Cast Aluminum, Anodized</td>
</tr>
<tr>
<td>Element Case</td>
<td>Aluminum, Anodized</td>
</tr>
<tr>
<td>Element Change Clearance</td>
<td>2.0&quot; (51 mm)</td>
</tr>
<tr>
<td>Porting</td>
<td>SAE-24</td>
</tr>
</tbody>
</table>

**Model Code: GHCFCG5VS24D5R**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Rating</td>
<td>Up to 25 gpm (95 L/min)</td>
</tr>
<tr>
<td>Max. Op. Pressure</td>
<td>150 psi (10.3 bar)</td>
</tr>
<tr>
<td>Min. Yield Pressure</td>
<td>1189 psi (82 bar)</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>32°F to 225°F (0°C to 107°C)</td>
</tr>
<tr>
<td>Bypass Setting</td>
<td>Cracking: 40 psi (2.8 bar)</td>
</tr>
<tr>
<td>Porting Head</td>
<td>Cast Aluminum, Anodized</td>
</tr>
<tr>
<td>Element Case</td>
<td>Aluminum, Anodized</td>
</tr>
<tr>
<td>Sump</td>
<td>Cast Aluminum, Anodized</td>
</tr>
<tr>
<td>Element Change Clearance</td>
<td>4.5&quot; (114 mm)</td>
</tr>
<tr>
<td>Porting</td>
<td>SAE-24</td>
</tr>
</tbody>
</table>
**Model Code: BDFP11GGZ3CG5VD514**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow Rating:</strong></td>
<td>Up to 14 gpm (53 L/min)</td>
</tr>
<tr>
<td><strong>Max. Op. Pressure:</strong></td>
<td>See GHPF &amp; GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Min. Yield Pressure:</strong></td>
<td>See GHPF &amp; GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Operating Temp.:</strong></td>
<td>32°F to 104°F (0°C to 40°C)</td>
</tr>
<tr>
<td><strong>Bypass Setting:</strong></td>
<td>Cracking: 40 psi (2.8 bar)</td>
</tr>
<tr>
<td><strong>Porting Head:</strong></td>
<td>See GHPF &amp; GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Element Case:</strong></td>
<td>See GHPF &amp; GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Sump:</strong></td>
<td>See GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Element Change Clearance:</strong></td>
<td>4.50” (114 mm)</td>
</tr>
<tr>
<td><strong>Porting:</strong></td>
<td>-16 SAE (J1926)</td>
</tr>
</tbody>
</table>

**Model Code: BDFC11GGZ3CG5VD525**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow Rating:</strong></td>
<td>Up to 25 gpm (95 L/min) for ULSD15 &amp; biodiesel blends</td>
</tr>
<tr>
<td><strong>Operating Temp.:</strong></td>
<td>32°F to 104°F (0°C to 40°C)</td>
</tr>
<tr>
<td><strong>Bypass Setting:</strong></td>
<td>40 psi (2.8 bar)</td>
</tr>
<tr>
<td><strong>Porting Head:</strong></td>
<td>See GHPF &amp; GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Element Case:</strong></td>
<td>See GHPF &amp; GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Sump:</strong></td>
<td>See GHCF Specs (pg. 35)</td>
</tr>
<tr>
<td><strong>Element Change Clearance:</strong></td>
<td>4.50” (114 mm) (Elements included)</td>
</tr>
</tbody>
</table>
**Model Code: BDC39QPMLZ3VAVM**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow Rating:</strong></td>
<td>Up to 25 gpm (95 L/min) for ULSD15 &amp; biodiesel blends</td>
</tr>
<tr>
<td><strong>Temperature Range:</strong></td>
<td>32°F to 165°F (0°C to 74°C) Standard</td>
</tr>
<tr>
<td><strong>Bypass Setting:</strong></td>
<td>Particulate: 15 psi (1.03 bar)</td>
</tr>
<tr>
<td></td>
<td>Coalescing: 25 psi (1.7 bar)</td>
</tr>
<tr>
<td><strong>Porting Base:</strong></td>
<td>Anodized Aluminum</td>
</tr>
<tr>
<td><strong>Cap:</strong></td>
<td>Plated Steel</td>
</tr>
<tr>
<td><strong>Bag Housing:</strong></td>
<td>304 Stainless Steel</td>
</tr>
<tr>
<td><strong>Filter Housings:</strong></td>
<td>Particulate: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard)</td>
</tr>
<tr>
<td></td>
<td>Coalescing: Epoxy Paint w/ High-phos Electroless Nickel Plating (Standard)</td>
</tr>
<tr>
<td><strong>Element Change Clearance:</strong></td>
<td>33.8” (858 mm)</td>
</tr>
</tbody>
</table>

**Model Code: HDP-KF1-340-BC1, 600-BC1, & 600-HT1**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow Rating:</strong></td>
<td>Up to 160 gph (600 lph)</td>
</tr>
<tr>
<td><strong>Max. Op. Pressure:</strong></td>
<td>14.5 psia (&lt;1 bar) suction side application</td>
</tr>
<tr>
<td><strong>Temperature Range:</strong></td>
<td>BC1: -40°F to 194°F (-40°C to 90°C)</td>
</tr>
<tr>
<td></td>
<td>HT1: -4°F to 194°F (-20°C to 90°C)</td>
</tr>
<tr>
<td><strong>Nominal Voltage:</strong></td>
<td>24V DC (12V DC is optional for heater or water sensor)</td>
</tr>
<tr>
<td><strong>Water Separation Eff.:</strong></td>
<td>&gt;95% to ISO CD 16332</td>
</tr>
<tr>
<td><strong>Porting Thread:</strong></td>
<td>340-BC1: M22 x 1.5</td>
</tr>
<tr>
<td></td>
<td>600-BC1: M27 x 2.0</td>
</tr>
<tr>
<td></td>
<td>600-HT1: G¾&quot; (BSPP)</td>
</tr>
<tr>
<td><strong>Options:</strong></td>
<td>Fuel pre-heater, and water sensor</td>
</tr>
</tbody>
</table>
Our fluid conditioning and diagnostic monitoring tools are known for their diversity, capability and precision. As applications become more sophisticated and widespread, the need for highly efficient fluid conditioning, as well as condition monitoring is increasing.

**Product offerings include:**

- De-Watering, De-Gassing & Dehydration Units
- Asset Management Filtration Carts
- Mobile & Stationary Filtration Systems
- EasyTest & Fluid Analysis
- HTB | Hydraulic Test Benches
- TestMate® & HY-TRAX® Series
- Custom Solutions
### Model Code: MFD-BC-1-09-H10-H05
- **Flow Rating:** 7 gpm (26.5 L/min) max
- **Maximum Viscosity:** 1000 SUS (216 cSt)
- **Fluid Temperature Range:** 25°F to 150°F (-4°C to 65°C)
- **Bypass Setting:** Cracking 30 psi (2 bar) x 2
- **Element Technology:** Staged 10 and 5 µm elements installed

### Model Code: MFD-1-27-GXX-B-14
- **Flow Rating:** 14 gpm (53.0 L/min) max
- **Maximum Viscosity:** 1000 SUS (216 cSt)
- **Fluid Temperature Range:** 25°F to 150°F (-4°C to 65°C)
- **Bypass Setting:** Cracking 25 psi (1.7 bar)
- **Element Technology:** Element not installed. Order desired micron elements as a separate line item.

### Model Code: AMFS-1-18-G05-G03
- **Flow Rating:** 5 gpm (19 L/min)
- **Viscosity:** 60-100 SUS (10-216 cSt)
- **Fluid Temperature Range:** 25°F to 150°F (-4°C to 65°C)
- **Bypass Setting:** Cracking: 30 psi (2 bar) x 2
A Retrofit Assembly enabling filtration systems to display and transmit ISO particle counts in real-time

<table>
<thead>
<tr>
<th><strong>FCU 1310: Model Code: FCU-1310-4-U-AS-1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self- Diagnosis:</strong></td>
</tr>
<tr>
<td><strong>Measured Value:</strong></td>
</tr>
<tr>
<td><strong>Measuring Range:</strong></td>
</tr>
<tr>
<td><strong>Accuracy:</strong></td>
</tr>
<tr>
<td><strong>Seal Material:</strong></td>
</tr>
<tr>
<td><strong>Ambient Temp. Range:</strong></td>
</tr>
<tr>
<td><strong>Storage Temp. Range:</strong></td>
</tr>
<tr>
<td><strong>IP Class:</strong></td>
</tr>
<tr>
<td><strong>Operating Pressure:</strong></td>
</tr>
<tr>
<td><strong>Operating Pressure w/ Adapter for Pressure Lines</strong></td>
</tr>
<tr>
<td><strong>Pressure Max.</strong></td>
</tr>
<tr>
<td><strong>Maximum Suction Ht.</strong></td>
</tr>
<tr>
<td><strong>Permissible Viscosity Range:</strong></td>
</tr>
<tr>
<td><strong>Fluid Temperature Range:</strong></td>
</tr>
<tr>
<td><strong>Power Supply Voltage:</strong></td>
</tr>
<tr>
<td><strong>Max. Power / Current Consumption:</strong></td>
</tr>
<tr>
<td><strong>Interface:</strong></td>
</tr>
<tr>
<td><strong>Weight:</strong></td>
</tr>
</tbody>
</table>
## HMG4000 Diagnostic Unit: Model Code: HMG 4000-000-US

### Analog Input

<table>
<thead>
<tr>
<th>Input signals</th>
<th>HSI analogue sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 channels M12x1Ultra-Lock flange sockets (5 pole) channel A to Channel H</td>
<td>HSI SMART sensor</td>
</tr>
<tr>
<td>Voltage signals: i.e. 0.5 .. 4.5 V, 0 .. etc. (input ranges for 0 .. 50 V, 0 .. 10 V, 0 .. 4.5 V, -10 .. 10 V)</td>
<td>Current signals, i.e. 4 .. 20mA, 0 .. 20mA (input range 0 .. 20 mA) 1 x PT 100 / PT 1000 (on Channel H)</td>
</tr>
<tr>
<td>Accuracy dependence of the input range</td>
<td>≤ ± 0.1% FS at HSI, voltage, current</td>
</tr>
<tr>
<td></td>
<td>≤ ± 1% FS at PT 100 / PT 1000</td>
</tr>
</tbody>
</table>

### Digital Inputs

<table>
<thead>
<tr>
<th>Input signals</th>
<th>Digital status (high/low)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 channels via M12x1 Ultra-Lock flange socket (5 pole) Channel I, J</td>
<td>Frequency (0.01 to 30,000 Hz)</td>
</tr>
<tr>
<td></td>
<td>PWM duty cycle</td>
</tr>
<tr>
<td></td>
<td>Durations (i.e. Period length)</td>
</tr>
<tr>
<td>Level</td>
<td>Switching threshold / switch-back threshold: 2 V/1 V Max input voltage: 50 V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>≤ ± 0.1%</td>
</tr>
</tbody>
</table>

### CAN

<table>
<thead>
<tr>
<th>Input signals</th>
<th>HCSI sensors, CAN, J1939, CANopen PDO, CANopen SDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 channels M12x1 Ultra-Lock flange socket (5 pole) channel K1 to K28</td>
<td>Baud rate 10 kbit/s to 1 Mbit/s</td>
</tr>
<tr>
<td>Accuracy</td>
<td>≤ ± 0.1%</td>
</tr>
</tbody>
</table>

### Calculated channels

| Quantity | 4 channels via virtual port L (channel L1 to channel L4) |
Our exceptional elements are tested to ensure fabrication integrity in the manufacturing process. They are also tested for efficiency and dirt holding capacity in a multi-pass test stand, equipped with inline particle capabilities, which are calibrated to ISO standards and exceed industry requirements.

Product offerings include:

♦ Synthetic Media (Z-Media®)
♦ Patented Grommet & Bushing (GeoSeal®)
♦ Unique Contaminant Holding (DirtCatcher®)
♦ Anti-Stat Pleat Media (ASP®)
♦ Cellulose Media (E-Media)
♦ Water-Absorbent (W-Media)
♦ Private Label Branding
♦ BestFit® Online Cross-Overs
Z-Media®

The special class of micro-glass and other fibers used in Z-Media® are manufactured with utmost precision, to specific thicknesses and densities, and bonded with select resins to create material with extra fine passages.

- **Downstream Stainless Steel wire mesh**
- **Downstream Scrim Layer**
- **Main Filter Layer**
  - Pre-filter Layer*
- **Upstream Scrim Layer**
- **Upstream Epoxy Coated Wire Mesh**
- **Branded Plastic Outer wrap**

**Stainless Steel Wire Mesh downstream**
No threat of epoxy coating migrating downstream and contaminating the system

**High cost-effective media area**
Less restriction, lower pressure drop, lower hydraulic load

**Multilayer media support**
Provides protection and support to media layers

**Multilayer filter media**
Provides strength and high dirt holding capacity

**Wire Mesh upstream and downstream**
Better pleat stability

* Where applicable
48,000 SKU's or 1,200 of Upgrade Replacement Series Currently Available

Visit our online converter: http://schroederindustries.info/CrossReference.aspx