Vickers
Filtration Master Catalogue

EATON
Powering Business Worldwide
**Fluid Analysis**

Fluid Analysis 9

**Breathers**

BR110 Breather 13
- Filters out moisture and particles from incoming air

BR210 Breather 13
- Filters out particles from incoming air

MBR110 and MBR120 Breathers 13
- Filters out moisture and particles, ideal for mobile applications

**Return Line Filters**

HV3R Series Return Line 17
- Flows to: 280 L/min (75 USgpm)
- Pressures to: 50 bar (725 psi)
- Elements: V3R...series 18

**In-tank Filters**

HF4RT Series In Tank 21
- Flows to: 568 L/min (150 USgpm)
- Pressures to: 7 bar (100 psi)
- Elements: V405...series 22

**Suction Strainers**

OF3 Series Inlet Strainer 24
- Flows to 379 L/min (100 USgpm)

**Spin-on Filters**

OFRS 15 Series Spin-on 27
- Flows to: 60 L/min (15 USgpm)
- Pressures to: 7 bar (100 psi)
- Elements: V019...series 28

HS22 Series Twin Spin-on 30
- Flows to: 450 L/min (120 USgpm)
- Pressures to: 14 bar (200 psi)
- Elements: V021...series 31

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**Pressure Filters**

ECF Series Pressure 34
- Flows to: 19 L/min (5 USgpm)
- Pressures to: 207 bar (3,000 psi) 35

HF2P Series In Line and Subplate 36
- Flows to: 90 L/min (24 USgpm)
- Pressures to: 280 bar (4,000 psi)
- Elements: V304...series 37

MF2P Series Pressure 39
- Flows to: 113.5 L/min (30 USgpm)
- Pressures to: 275.5 bar (4,000 psi)
- Elements: V051...series 40

HF4P Series In Line and Subplate 42
- Flows to: 570 L/min (150 USgpm)
- Pressures to: 345 bar (5,000 psi)
- Elements: V405...series 43

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- Flows to: 454 L/min (120 USgpm)
- Pressures to: 420 bar (6,000 psi)
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Check out our full line of filtration products and accessories at www.eaton.com/filtration
Fluid Power is one of the most reliable and repeatable forms of power and motion control. When problems are encountered, 80% of the time they are related to inadequate contamination control practices. Eaton has more than a 75-year history of dedication to helping engineers develop, operate and maintain reliable, high quality power and motion control systems.

The systemic contamination control approach assures the user of the hydraulic system a cost effective approach to contamination control that allows the price of the filters and elements to be quickly recovered by the savings of improved performance, increased component life, increased oil life, increased uptime and fewer repairs.

The goal of systemic contamination control is always the same: to clean the fluid to the point that contamination is not a factor in the failure (catastrophic, intermittent, or degradation) of any component in the system during the desired useful life of that system.

The first step towards this goal is the setting of a target cleanliness level that takes into account the specific needs of the system.

Sources of Contamination
Eaton doc. 561, page 8

- Set a target Cleanliness Level
- Select filters and filter placements to achieve target
- Sample fluid and confirm achievement

Once the target has been set, the next step is to select and position filters in the system so that the target can be achieved in a cost effective manner.

After the machine is in operation, the last and ongoing step is to confirm that the target cleanliness level is being maintained. This is most often accomplished by sending a fluid sample to a particle counting laboratory that gives cleanliness code data to established standards. If the target is being met, the system only needs to have filters maintained and the fluid retested periodically. If the cleanliness target is not being achieved, corrective actions need to be taken. Sometimes a change in maintenance practices is needed, but at other times a shift to a finer grade of filter elements or additional filter housings may be needed.

There are four primary sources for solid contamination to enter a hydraulic fluid.

They are: contaminated new oil, built-in contamination, ingressed contamination and internally-generated contamination.
Contaminated New Oil

Although hydraulic and lubrication fluids are refined and blended under relatively clean conditions, the fluid travels through many hoses and pipes before it is stored in drums or in a bulk tank at the user’s facility. At this point, the fluid is no longer clean as the fluid lines it has traveled through have contributed metal and rubber particles, and the drums have added flakes of metal or scale. Storage tanks are a real problem because water condenses in them causing rust particles. Contamination from the atmosphere can also find its way into the tank unless satisfactory air breathers are fitted.

If the fluid is stored under reasonable conditions, the principal contaminants on delivery to the machine will also be metal, silica and fibers. With fluids from reputable suppliers, sampling has shown typical Cleanliness Levels of 17/16/14 or dirtier. Using a portable transfer cart fitted with a high efficiency filter, contamination should be removed from new fluids before the contamination enters and damages the components in the system.

Built-in Contamination

New machinery always contains a certain amount of built-in contamination. Care in system assembly and in new component flushing reduces this but never eliminates it. Typical built-in contaminants are burrs, chips, flash, dirt, dust, fiber, sand, moisture, pipe sealant, weld splatter, paint and flushing solution.

Ingressed Contamination

Contamination from the immediate surroundings can be ingressed into the fluid power or lubrication system. On large installations, such as those within steelworks or automotive plants, it is relatively easy to know the environmental conditions, though they vary considerably. For example, a coke oven system operates in conditions very different from a similar system in a cold mill. For mobile equipment, there is a very wide variation in environmental conditions by application, location and even by weather conditions (i.e. high winds).

The key is to severely limit the access that environmental contamination has to enter the hydraulic or lubrication system. There are four major ways dirt can enter a system: reservoir vent ports (breathers), power unit or system access plates, components left open during maintenance and cylinder seals.

Generated Contamination

The most dangerous contamination to a system is the contamination generated by the system itself. These particles are “work hardened” to a greater hardness than the surface from which they came, and are very aggressive in causing further wear in the system. In a system running on properly cleaned fluid very few particles are generated, although all components (especially pumps) create a small amount of particles during routine operation. In a system where these particles are not quickly captured the elevated contamination levels will cause the number of additional generated particles to increase at a highly accelerated rate! The best way to prevent contamination generation within a system is to start with a clean (fully flushed) system and keep the system fluid clean.
Filter Element Initial Efficiency

The international standard for rating the efficiency of a hydraulic or lubrication filter is the Multipass Filter Performance Beta Test (ISO 16889). The results of this test are reported as a ratio of number of particles greater than a designated size upstream of the test filter compared with the number of same size particles downstream of the test filter. These results are then expressed as a Beta ratio. Most Eaton™ filters are rated at Beta x(c)=1000. See individual filter “Features and Benefits” for more detail.

<table>
<thead>
<tr>
<th>Beta Ratios</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>50.00%</td>
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<tr>
<td>5</td>
<td>80.00%</td>
</tr>
<tr>
<td>10</td>
<td>90.00%</td>
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<tr>
<td>20</td>
<td>95.00%</td>
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<tr>
<td>75</td>
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<tr>
<td>100</td>
<td>99.00%</td>
</tr>
<tr>
<td>200</td>
<td>99.50%</td>
</tr>
<tr>
<td>1000</td>
<td>99.90%</td>
</tr>
<tr>
<td>5000</td>
<td>99.98%</td>
</tr>
</tbody>
</table>

Beta ratios and dirt capacity are only a guide to system cleanliness needs. Eaton filters are designed to maintain the targeted cleanliness level. Eaton filters are rated with the system cleanliness expected to be achieved with the use of that product. The assumptions behind these cleanliness ratings are: 1) the filter sees full system flow, 2) the filter is the primary filter in the system, and 3) air breathers along with recognized maintenance practices will limit dirt ingestion from the atmosphere.

A major problem in correlating multipass test claims to real world fluid cleanliness levels is that real systems operation greatly stresses the element. In active systems, flow rate changes (often several times a minute), pressure pulses (hundreds a minute), decompression shock waves, cold starts and other variables all work to degrade a filter’s performance. In multipass testing the element is subject to one gradual rise in differential pressure as the element loads!

Flow fatigue test protocol (ISO 3724) leaves many questions unanswered. Again the element is tested in laboratory conditions that cannot duplicate the interaction of the many forces working to stress and degrade the element. This laboratory test may fail to answer the question of how an aged element will perform during the latter part of its service life.

The best way to deal with this issue is to look at the construction and feel the element pleats. Are the pleats well supported? Do they flex under hand pressure? Any element that fails these simple tests will fail to maintain efficiency and integrity, and will not maintain the targeted cleanliness level.

Additionally, look at the pack construction. Steel wire mesh is very important in element construction. Wire keeps the pleats from flexing and gives the filter medium the support it needs to keep from failing due to fatigue. The downstream wire mesh also serves as a last chance protection in case of unexpectedly severe stress that causes element media rupture.

Filter Condition Indicators

After the filters are placed within the system, the next consideration is how the user is going to know when to change the element. The answer recommended in DIN 24550 standard is to have all filters fitted with a differential pressure indicator that gives an easy-to-read indication that the element needs to be changed. Eaton
indicators are designed to indicate at a pressure drop 20% below the bypass setting which equates to 95% of the element’s service life. This indication before bypass feature was incorporated to allow safe operation of the machine until the next shift change or convenient maintenance opportunity.

Element Service Life
As in any aspect of machine design or maintenance, cost of installation and operation are very important concerns. For filters, the length of time an element lasts in service and the initial cost of that element, combine to determine the economics of using that product.

The most important aspect of gaining long element service life is to minimize the ingestion! Reservoirs need to be fitted with vent filters (=3µm) that remove the dirt before it enters the system. Access port and doors need to be kept sealed so that dirt cannot be drawn into the system. Cylinder rods that extend into contamination laden environments should be shielded to minimize the dirt being drawn into the system.

The second important aspect to long element service life is to keep the cleanliness level of the fluid at or below target. Periods of machine operation with dirty fluid cause accelerated internal wear that loads a filter element. (It’s important the debris is caught as it saves the system, but it does cost the element part of its service life.) Always change an element on indication and always use genuine Eaton elements because of their consistent performance and superior strength under stress.

The third issue in long element service life is the “dirt capacity” of the element. This value is calculated as part of the multipass efficiency test. Because of the many differences between the test conditions and real system operation, different dirt capacity values do not correlate well to changes in element service life. Dirt capacity can only be used to compare elements under very specific laboratory situations, and as a result published dirt capacity values should be used as general information rather than specific comparable data.

Eaton elements are designed to give long life and reliable service in hydraulic or lubrication applications. This is achieved with our multi-layer construction. Each layer provides additional strength or capacity leading to overall superior performance. Some elements focus heavily on media structure only, which can give increased “dirt capacity” under laboratory conditions, but no increase in service life is experienced in real systems.

An often overlooked aspect of dirt capacity and service life is the effect of element area. When comparing an element of “x” area with an element of “2x” area, one would expect twice the life for the larger element. But, in real systems, the life extension is most often between 2.5 and 3.5 times as long. This is because the reduced flow density through a unit area of media allows for more effective contaminant capture. Larger elements are the most cost effective approach to contamination control from the perspective of operating costs.
Target Cleanliness
Using the Vickers Target Cleanliness Worksheet (#578), it is easy to determine the target ISO Cleanliness Level for a system. This target is based on the application’s components and system dynamics.

Placement and Media
Use the chart below to help select the appropriate filter placement and grade of media to achieve the target cleanliness level. For more detail, consult the Eaton Guide to Systemic Contamination Control, your Vickers representative, or the ANSI System Standards for Stationary Industrial Machinery.

Filter Placement
The chart below helps engineers select the grade of Vickers media and the filter placement(s) that will achieve the required target cleanliness. It assumes the system will experience “average” ingestion and that maintenance of the system will be consistent with current technology.

If in operation the system is running dirtier than expected, corrective actions should be initiated. Suggested corrective actions are:
- Check the indicator to see if the filters are on by-pass.
- Check the sources of ingestion and correct problems.
- Check that the filters are positioned properly to see maximum fluid flow.
- Consider using a finer Pak grade
- Add additional filters to the system.

Note: All systems need a sealed reservoir with vent port filtration.

CAUTION
Before servicing the element, the bleed plug in filter housing must be loosened to relieve pressure. This will minimize fluid overflow.

Housing
The selected housing should be rated within the required flow and pressures of the application.

Important: If the system fluid’s specific gravity (SG) is greater than 0.9 (for example, water glycol), the housing pressure drop (∆P) should be corrected for actual application.

Specific Gravity Corrections for Pressure Drops
The filter housing flow curves in this catalog can be adjusted using the following equation:

Adjusted ∆PHousing = ∆P Curve x Actual SG ÷ 0.9

Bypass Valve
Bypass valve selection is based upon system requirements. According to ANSI Standard 12.2.6, filter assemblies whose elements cannot withstand full system differential pressure without damage should be equipped with bypass valves. Generally, a higher bypass pressure setting will allow for longer element life. Some systems require filtration with no bypass, such as servo applications. Vickers H-Pak media is recommended for non-bypass systems.

Indicator
To meet ANSI Standard 12.2.5, filter assemblies should have a device to indicate when the filter requires servicing. Per ANSI Standard 12.2.6, the indicator should “trip” at approximately 80% of the bypass pressure setting. If using a non-bypass housing, an indicator selling of approximately 100 psid is recommended. Differential pressure indicators are rated 6,000 psi working, 3,500 psi fatigue.

Guide for Selecting Filters

<table>
<thead>
<tr>
<th>TARGET CLEANLINESS</th>
<th>RECOMMENDED FILTER PLACEMENT FOR HIGH INGESTION SYSTEMS WITH FIXED VOLUME PUMPS.</th>
<th>RECOMMENDED FILTER PLACEMENT FOR SYSTEMS WITH VARIABLE VOLUME PUMPS.</th>
<th>RECOMMENDED FILTER PLACEMENT FOR HIGH INGESTION SYSTEMS WITH VARIABLE VOLUME PUMPS.</th>
<th>Recirculating loop at 10% of system volume per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full flow pressure line or return line</td>
<td>Full flow pressure line or return line</td>
<td>Pressure line/ recirculating loop at 20% of system volume per minute</td>
<td>Pressure line plus return line plus recirculating loop</td>
<td>Recirculating loop at 20% of system volume per minute</td>
</tr>
<tr>
<td>14/12/10</td>
<td>-</td>
<td>03</td>
<td>03</td>
<td>-</td>
</tr>
<tr>
<td>15/13/11</td>
<td>-</td>
<td>03</td>
<td>03</td>
<td>-</td>
</tr>
<tr>
<td>16/14/12</td>
<td>03</td>
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<td>17/15/13</td>
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<td>16/14/10</td>
<td>05 or 10</td>
<td>10</td>
<td>10</td>
<td>05 or 10</td>
</tr>
</tbody>
</table>
Guide for Selecting Filters

Surge Control
Surge Control is used on systems where spikes and surges in the hydraulic system could prematurely trip the indicator. Surge controls slow the indicator response. If the indicator encounters a continuous high differential pressure, it will trip at the rated setting.

Element
The Vickers element media grade should be selected to achieve the Target Cleanliness Level. The Vickers media construction should be chosen based upon system requirements such as flow characteristics, pressure surges and specific application conditions.

Important: If the system fluid’s specific gravity (SG) is greater than 0.9 (for example, water glycol), the element pressure drop ($\Delta P$) should be corrected.

H-Pak Construction
For systems where a bypass valve is undesirable, such as servo systems, the H-Pak media provides high collapse rated housing pressures. H-Pak media construction utilizes 304 stainless steel inner and outer mesh support along with heavier core tubes and media support to protect the system.

C-Pak Construction
C-Pak media uses five layer construction. C-Pak incorporates epoxy coated carbon steel as the two outer face layers to retain the inner media pak layers.

R-Pak Construction
The R-Pak spin-on filter elements are designed for low clean pressure drop and high efficiency. R-Pak incorporates a five layer media construction with outer layers of epoxy coated carbon steel wire to retain the inner media pak layers.

Viscosity Corrections for Pressure Drops
The element flow curves can be adjusted using the following equations:

\[
\text{Adjusted Clean } \Delta P_{\text{Element}} = \frac{\text{Actual viscosity in cP}}{29} \times \Delta P_{\text{Curve}}
\]

\[
\text{Actual viscosity in cSt/32} \times \text{Actual SG} \div 0.9 \times \Delta P_{\text{Curve}}
\]

\[
\text{Actual viscosity in SUS/150} \times \text{Actual SG} \div 0.9 \times \Delta P_{\text{Curve}}
\]

A good “rule of thumb”. To ensure satisfactory element life, the clean element pressure drop should generally be less than or equal to 40 percent of the indicator’s rated differential pressure:

\[
\Delta P_{\text{Element}} = 0.4 \times \Delta P_{\text{Indicator}}
\]

The best way to extend element service life is to minimize ingestion (vents, seals, cylinder rods) and maintain system cleanliness at or below the Target Cleanliness Level.
Fluid Analysis

Eaton Fluid Analysis Service

Eaton hydraulic components have a global reputation for quality, reliability and performance. That reputation is built on a tradition of customer service and we stand behind every one of our products.

Our Fluid Analysis Service follows that same tradition. We provide our customers with comprehensive fluid testing and diagnostic services, with detailed reports that are easy to understand.

To find out how the Eaton Fluid Analysis Service can help your operation, read on.

Then call us to get started.

A Name You Trust

Only one fluid analysis lab lets you put years of Eaton experience to work for you. So when the health of your hydraulic system is at stake, choose a partner with more than 75 years of experience. Contact your Eaton representative for more information on our Fluid Analysis Service.

Comprehensive Testing

The Eaton Fluid Analysis Service is certified to ISO 12025 and offers a full range of tests specifically designed for the analysis of hydraulic and lubrication system fluid. Our laboratory equipment and test procedures provide an exact analysis of your hydraulic or oil lubricated system, and our drawdown particle isolation procedure ensures accurate results.

Our testing procedures can include:

Photomicrography: We scan and photograph a filter patch using an optical microscope to find particle size and type. The scanning process verifies the automatic particle count to identify samples needing special preparation. This provides confirmation of automatic counter results, and helps us see what contaminants are in the fluid.

Viscosity (ASTM D445): We use this test to determine the viscosity of your oil. Without proper hydraulic fluid viscosity, your equipment will suffer. Incorrect viscosity leads to fluid breakdown, inefficient equipment operation, premature system failure and damage to other components.

Water (ASTM E203): We determine the water content in hydraulic fluid, which helps us predict quality and performance characteristics for the fluid and system components. Excess water reduces the viscosity of hydraulic fluid, which increases the likelihood of adverse chemical reactions and degrades equipment performance.

Drawdown Particle Isolation: Using this test, we determine the insoluble contaminants in hydraulic fluids, both insoluble particles and gel-like matter, organics and inorganics. Used in conjunction with photomicrography, the drawdown patch helps us identify the source and type of fluid contaminants.

Automatic Particle Count (ISO 11500): We use a high-intensity laser light source and a photo sensor to count the number and size of particles in the fluid sample and then define contaminants according to size distribution and quantities. Automatic particle counting is quick, repeatable and accurate. It provides reliable information we can use to check against ISO Standard 4406, which defines the relationship between particle counts and hydraulic fluid cleanliness. This lets us determine exactly what corrective actions, if any, are needed. The lab is also capable of testing to the new ISO 4406(1999) standard (4μ, 6μ, 14μ).

Spectrometric Analysis (ASTM D 5185): This shows us the concentration of oil-soluble elements and indicates the additives and trace metal content in the fluids. We use this technique to evaluate the condition of the additives in a fluid rather than its particulate contamination. Used in conjunction with automatic particle counting, it helps us accurately assess the cleanliness level of the fluid.

Energy Dispersive X-ray Fluorescence (ASTM E 1508): We perform Energy Dispersive X-ray Fluorescence (XRF) analysis on samples with extremely high concentrations of particulate contamination. By isolating chemical elements, we pinpoint contaminant types so we can establish their origins, and so you can take corrective action.

Critical Analysis

Fluid is the lifeblood of every hydraulic power system. To keep yours running efficiently and effectively, you need to know what’s in it. What you don’t know can hurt you.

The Eaton Fluid Analysis Service analyzes hydraulic fluid in much the same way a medical lab tests a blood sample. Just as a blood test helps a doctor diagnose health problems, a sample of hydraulic fluid can help us pinpoint sources of contamination and determine whether or not your system uses adequate filtration.

We can help you reduce catastrophic equipment failures, maintain optimum component performance, and identify any substandard maintenance practices. Your bottom-line benefit is increased productivity.

Clear Benefits

We offer testing designed to tell you the most about your hydraulic fluid. We use sophisticated computer programs and laboratory diagnostic equipment such as an Energy Dispersive X-ray Fluorescence and an inductively coupled plasma spectrophotometer.

After we use this advanced equipment to provide the most detailed possible analysis of your hydraulic fluid, we create reports that are always easy to read and understand. By taking the mystery out of fluid analysis, we provide a service that clearly explains the benefits of clean fluid.

EATON Vickers Filtration Catalog E-FIFI-MC002-E2 October 2020
**Fluid Test Results**

1. **VISCOSITY**
   - Time: Present Previous #1 Previous #2
   - Viscosity @ 100˚F (cSt (SUS))
     - Test 1: 45.0 (210) 45.5 (212) 45.8 (213)
   - Water % Weight
     - Test 1: 0.03% 0.03% 0.03%
   - pH
     - Test 1: 9.4 9.5 9.6
   - Note: pH is for water containing fluids only.
   - TAN mg KOH/gm
     - Test 1: 2.1 2.0 2.1
   - Note: TAN is for synthetic fluids only.

2. **Particle Count Summary**
   - Time: Present Previous #1 Previous #2
   - >2µ
     - Test 1: 65,120 4,100 418
   - >5µ
     - Test 1: 12,220 1,250 88
   - >10µ
     - Test 1: 5,800 700 39
   - >15µ
     - Test 1: 900 250 22
   - >25µ
     - Test 1: 125 60 4
   - >50µ
     - Test 1: 12.0 5.0 1.0
   - Cleanliness Code
     - Test 1: 23/21/17 19/17/15 16/14/12

**Fluid Analysis**

**Easy-to-Read Reports**

We present your fluid test results in a format that is easy to understand. Results typically include these items:

1. **Results Target:** A results target compares your actual fluid cleanliness results and your ideal cleanliness level. If you don’t have a target level yet, we can use your sample to help you determine what it should be.

2. **Trend Information:** We evaluate data from your previous two samples along with the results of your current sample. This provides a trend analysis of critical measurements, and shows changes in the fluid over time.

   **pH (ASTM E 70)** represents the strength of acidity in hydraulic fluid, and is usually measured for water-containing hydraulic fluids (water/glycols, invert emulsions). Typical values are 8.5–10.5.

   **Total Acid Number, or TAN (ASTM D 974),** is the amount of acid and acid-acting material constituents in hydraulic fluid. An increase in TAN indicates oxidation or acid contamination. Some hydraulic fluids exhibit higher acid numbers than others. Typical values are 0.1–3.0.

**KIT FEATURES**

- Super clean sample bottle
- Packaging for sending sample
- Numbered test sample data form
- Fluid analysis service

Also available is PN 894279, Vacuum Pump for extracting oil sample, and PN 932339, Ultra Clean Bottle.

*Items not in bold are non-standard and may have a longer lead time*
Fluid Analysis

3. Cleanliness Code Graph:
This graph uses the ISO 4406 standard for measuring and depicting the amount and size of particles per milliliter in hydraulic fluid, shown in a log-log2 graph that charts the amount of particles greater than certain micron sizes per milliliter of fluid.

Recommendations: This section of the report provides you with valuable information on the cleanliness of your hydraulic system, as well as tips on maintaining or improving its current condition.

Sample XRF Analysis Results
When a fluid sample shows high particulate contamination, we use Energy Dispersive X-ray Fluorescence (XRF) analysis to isolate and identify chemical elements. The results are shown in a graph like this.
Hydraulic reservoirs “breathe” air in and out as the oil level rises and falls. This circulating air contains particles and moisture that can cause corrosion, increase equipment wear and reduce fluid performance. In typical systems, the internal hydraulic fluid is warmer than the external environment. This difference in temperatures causes water vapor to form. Breathers protect your hydraulic system by filtering out damaging moisture and particles.

More than 25% of the samples sent to the Eaton Fluid Analysis Laboratory for analysis have significant water contamination. In an operating system, the H2O-gate Vent Breather creates a moisture barrier when there is a 5°F (2°C) difference between reservoir and ambient temperature and when there is a 10% per minute exchange of air volume above the fluid. The Mobile-gate breather is smaller in size but is also 1/4 the size and 1/2 the capacity of the H2O-gate. These temperature and air flow conditions are present in most hydraulic systems which employ a cylinder.

**Performs as a gate**
During the “inhalation” cycle, the proprietary media blocks the water vapor from entering the reservoir. During the “exhalation” cycle, the media allows the moisture in the reservoir air to exit. The moisture is carried off the media by the exiting air, restoring the media’s water barrier capacity and the moisture barrier mechanism is not affected by the amount of exposure to moisture. The reservoir air is maintained at a low relative humidity and more importantly, at a lower dew point temperature than the ambient temperature.

**Works even when the system is shut down.**
The H2O-gate and Mobile-gate Vent Breather retard the vapor equilibrium process and work to prevent condensation even after the system is shut and cooled down, such as overnight. As this chart illustrates, the dewpoint is slow to climb, even after the system temperature has dropped to the ambient temperature. Once the system has reached ambient temperature, condensation does not occur.

**Reduces humidity inside reservoir.**
The H2O-gate and Mobile-gate Vent Breathers lower and stabilize the relative humidity of air inside the reservoir, leading to a lower dewpoint (Tdewpoint < Tambient = NO CONDENSATION) at a rate and amount that will be dependent upon several conditions: the ambient conditions, the internal reservoir heat, amount and frequency of reservoir air flow through the vent and the temperature of the reservoir surfaces.

<table>
<thead>
<tr>
<th>BREATHER FEATURES</th>
<th>H2O-gate</th>
<th>Dirt-gate</th>
<th>Mobile-gate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Indicator</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Particle Control</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Water/Moisture Control</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Corrosion Resistant Housing</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>708 L/min (187 USgpm)</td>
<td>708 L/min (187 USgpm)</td>
<td>473 L/min (125 USgpm)</td>
</tr>
</tbody>
</table>

**Part Numbers:**
- NPT Mobile-gate MBR110
- Flange Mobile-gate MBR120
- H2O-gate BR110
- Dirt-gate BR210
Breathers

H2O-gate™ Reservoir Breather

Features/Benefits:
- Visual Mechanical Indicator: Actuates when particles have blocked the media, before the pump cavitates.
- Proprietary Media: Reduces dew point temperature to prevent condensation and is 99.7% efficient in blocking particles 3µ and larger.
- Reversible Flow Through Media: Allows for moisture to exit the reservoir.
- Media contains oil attractant layer to collect and return oil splashes.
- Easy Installation: Lightweight design can be hand tightened onto adapter.
- Durable Plastic Housing: Protects the media from external splashing.
- Superior breather filters both moisture and particles from air.
- Effective up to 121°C (250°F)
- Rated up to 25 SCFM

Part Numbers:
- H2O-gate BR110
- Bayonet Adapter 924710
- Screw-in Adapter P-077002

Dirt-gate™ Reservoir Breather

Features/Benefits:
- Visual Mechanical Indicator: Actuates when particles have blocked the media, before the pump cavitates.
- Easy Installation: Lightweight design can be hand tightened onto adapter.
- Durable Plastic Housing: Protects the media from external splashing.
- High Efficiency: (99% at 2 microns)
- Very Low Pressure Drop
- Filters out particles
- Effective up to 121°C (250°F)
- Rated up to 25 SCFM

Part Numbers:
- Dirt-gate BR210
- Bayonet Adapter 924710
- Screw-in Adapter P-077002

Note:
This breather does not filter moisture from air.

Mobile-gate™ Filler Breather Assemblies

Features/Benefits:
- Proprietary Media: Reduces dew point temperature to prevent condensation and is 99.7% efficient in blocking particles 10µ and larger.
- Water Barrier: Regenerates its water shedding capacity with each cycle.
- Reversible Flow Through Media: Allows for moisture to exit the reservoir.
- Easy Installation: Lightweight design can be hand tightened.
- Rugged metal housing is long lasting and ideal for mobile applications.
- Rated to 16.7 SCFM

Part Numbers:
- MBR110 5002486
- MBR120 5002487
Breathers

H2O-gate Specifications

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>FLOW</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>H1</th>
<th>H2</th>
<th>T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBR110</td>
<td>125</td>
<td>475</td>
<td>3.08</td>
<td>-</td>
<td>-</td>
<td>2.33</td>
<td>0.63</td>
<td>NPT 3/4</td>
</tr>
<tr>
<td>MBR120</td>
<td>125</td>
<td>475</td>
<td>3.08</td>
<td>1.88</td>
<td>-</td>
<td>2.50</td>
<td>3.50</td>
<td>-</td>
</tr>
<tr>
<td>MBR120 FLANGE</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.25</td>
<td>2.81</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Mobile-gate Specifications

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>FLOW</th>
<th>DIMENSIONS (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USgpm L/min</td>
<td>D1</td>
</tr>
<tr>
<td>MBR110</td>
<td>125</td>
<td>475</td>
</tr>
<tr>
<td>MBR120</td>
<td>125</td>
<td>475</td>
</tr>
<tr>
<td>MBR120 FLANGE</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Breathers
Adapters

Installation Dimensions

Threaded Pipe Adaptor

Bayonet Adaptor

Inches of water

0
0.2
0.7
1.0
1.2
1.7
2.0
2.2
2.7
3.0

 Mare of  water

10 20 30 40 50 60 70 80 90

Air Flow, SCFM

Fluid Displacement L/min (USgal)

283 (75)
850 (225)
1416 (375)
1982 (525)
2406 (675)

0.0025 (.036)
0.005 (.073)
0.0075 (.108)

ModeLS and part numbers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Vent Filters Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>924710</td>
<td>Bayonet, no check</td>
<td>BR110, BR210</td>
</tr>
<tr>
<td>P-077002</td>
<td>Threaded pipe</td>
<td>BR110, BR210</td>
</tr>
</tbody>
</table>

All Eaton Vent Filters are easily applied to reservoirs via Spin-On adapters.
Return Line Filters

General Data
Return line filters usually have spin-on type elements, cartridge elements in an in-line mounted housing, or cartridge elements within a housing that is mounted directly within the reservoir itself (sometimes referred to as an in-tank filter).

Return line filters may also be equipped with fluid sampling devices to monitor the fluid cleanliness level. Secondary ports may also be incorporated to add make-up fluid and ensure that the fluid is transferred through a filter before entering the system.

Return line filters are:
• An integral part of an effective contamination control solution.
• Ideal for systems where the pump is the sensitive component.
• An economic means of achieving the target cleanliness level.
• Often placed before the fluid enters the reservoir in order to prevent debris and particles from recirculating through the system.
• A crucial component when cylinders are present in the system. Cylinders potentially contribute a large amount of contamination ingression and return line filters are ideal for this type of control solution.
• Sometimes the only filters necessary (combined with a breather) when seeing the entire system flow on a continuous basis.
• Only a part of an effective contamination control solution when the system employs variable displacement pumps. Filters in systems like this may be supplemented by pressure and/or off-line filters.

Applications
• Stroke boom delimbers
• Drilling platforms
• Die cast machines/injection molding
• Large machine tools
Return Line Filters
HV3R Series

Flows to 280 L/min (75 USgpm)
Pressures to 50 bar (725 psi)

Features and Benefits
- Beta Ratio: $\beta_{x(c)} = 1000$ to ISO 16889
- Designed to comply with ANSI specifications and ISO cleanliness standards
- Visual and electrical indicators with lamp options for system design flexibility
- Fully serviceable without tools
- Zero leak by-pass valve construction
- Wide range of element lengths for maximum design flexibility
- High efficiency replacement elements in standard configurations (C-Pak) to meet Target Cleanliness Levels
- High collapse elements available for non-bypass applications

HV3R Series
Filter and Element Model Code

Sample model code: HV3R1SC4RLB2C05

DESIGN SPECIFICATIONS

<table>
<thead>
<tr>
<th>Rated flow:</th>
<th>Length 1</th>
<th>Length 2</th>
<th>Length 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>160 L/min (42 USgpm)</td>
<td>240 L/min (63 USgpm)</td>
<td>280 L/min (74 USgpm)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluid compatibility:</th>
<th>Compatible with most petroleum oil, oil-in-water and water-in-oil fluids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Optional seals available for phosphate esters.</td>
</tr>
</tbody>
</table>

| Temp range: | -30°C to 121°C (-22°F to 250°F) |

<table>
<thead>
<tr>
<th>Pressure rating:</th>
<th>Operating</th>
<th>Fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 bar (725 psi)</td>
<td>50 bar (725 psi)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material:</th>
<th>Head</th>
<th>Bowl</th>
<th>Collar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aluminum</td>
<td>Carbon Steel</td>
<td>Carbon Steel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dry weight:</th>
<th>(Approximate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length 1</td>
<td>2.3 kg (5.1 lbs)</td>
</tr>
<tr>
<td>Length 2</td>
<td>2.5 kg (5.5 lbs)</td>
</tr>
<tr>
<td>Length 4</td>
<td>3.4 kg (7.5 lbs)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HV3R Series - HV3R</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Filter Series</td>
</tr>
<tr>
<td>2 Element Collapse Rating (C-Pak)</td>
</tr>
<tr>
<td>1 Low Collapse 17 bar (250 psi)</td>
</tr>
<tr>
<td>4 High Collapse 207 bar (3000 psi)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Port Options</th>
<th>BC</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G 1-1/2 to ISO 228</td>
<td>1.625 - 12UN SAE-20 str. Thd. (1-1/4&quot; tube)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Non-Bypass</td>
</tr>
<tr>
<td>3 Bypass set at 1.7 bar (25 psi)</td>
</tr>
<tr>
<td>4 Bypass set at 3 bar (43 psi)</td>
</tr>
<tr>
<td>6 Bypass set at 6 bar (87 psi)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicator Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>JN No Indicator (plug), No Connector</td>
</tr>
<tr>
<td>QB Electrical 1 bar (15 psi) Brad Harrison</td>
</tr>
<tr>
<td>QJ Electrical 1 bar (15 psi) Hirschmann w 24V light</td>
</tr>
<tr>
<td>QK Electrical 1 bar (15 psi) Hirschmann w 115V light</td>
</tr>
<tr>
<td>QL Electrical 1 bar (15 psi) Hirschmann w 230V light</td>
</tr>
<tr>
<td>QH Electrical 1 bar (15 psi) Hirschmann</td>
</tr>
<tr>
<td>LN Visual (30 psi) No Connector</td>
</tr>
<tr>
<td>RB Electrical 2 bar (30 psi) Brad Harrison</td>
</tr>
<tr>
<td>RJ Electrical 2 bar (30 psi) Hirschmann w 24 volt light</td>
</tr>
<tr>
<td>RK Electrical 2 bar (30 psi) Hirschmann w 115 volt light</td>
</tr>
<tr>
<td>RL Electrical 2 bar (30 psi) Hirschmann w 230 volt light</td>
</tr>
<tr>
<td>RH Electrical 2 bar (30 psi) Hirschmann</td>
</tr>
<tr>
<td>AN Visual (70 psi) No Connector</td>
</tr>
<tr>
<td>UB Electrical 4.9 bar (70 psi) Brad Harrison</td>
</tr>
<tr>
<td>UJ Electrical 4.9 bar (70 psi) Hirschmann w 24 volt light</td>
</tr>
<tr>
<td>UK Electrical 4.9 bar (70 psi) Hirschmann w 115 volt light</td>
</tr>
<tr>
<td>UL Electrical 4.9 bar (70 psi) Hirschmann w 230 volt light</td>
</tr>
<tr>
<td>UH Electrical 4.9 bar (70 psi) Hirschmann</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seal Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>B Buna-N</td>
</tr>
<tr>
<td>V Viton-A</td>
</tr>
<tr>
<td>Vilon is a registered trademark of E.I. DuPont</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assembly Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm (inch)</td>
</tr>
<tr>
<td>1 207 (8.15)</td>
</tr>
<tr>
<td>2 266 (10.47)</td>
</tr>
<tr>
<td>4 447 (17.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 17 bar (250 psi) Low Collapse</td>
</tr>
<tr>
<td>H 207 bar (3000 psi) High Collapse</td>
</tr>
<tr>
<td>X no element</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluid Cleanliness Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
</tr>
<tr>
<td>03</td>
</tr>
<tr>
<td>05</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>*20</td>
</tr>
<tr>
<td>XX</td>
</tr>
</tbody>
</table>
Return Line Filters
HV3R Series

V3R Element Model Code

Sample model code:
V3RB1C05

Housing Dimensions

mm (inch)

Mounting Holes
3/8 - 24 X 14 (0.56) deep with SC (SAE-20) port option
M10 with BC (G 1-1/4) port option

Indicator Plug

Label

1 5/8-12UNF in. or G 1 1/4 port
SAE-20 port
2 PL'S

Refer to Model Code

50.0 (1.97)
Clearance for Element Removal

Elements not in bold are non-standard and may have a longer lead time.

Flows to 280 L/min (75 USgpm)
Pressures to 50 bar (725 psi)
HV3R Filter Elements Flow Data

'K' factor - bar/lpm (psi/gpm)

<table>
<thead>
<tr>
<th>ELEMENT TYPE / SIZE</th>
<th>03</th>
<th>05</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>C -pak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.013 (0.717)</td>
<td>0.009 (0.479)</td>
<td>0.005 (0.252)</td>
<td>0.004 (0.193)</td>
</tr>
<tr>
<td>2</td>
<td>0.008 (0.450)</td>
<td>0.006 (0.332)</td>
<td>0.004 (0.196)</td>
<td>0.002 (0.127)</td>
</tr>
<tr>
<td>4</td>
<td>0.004 (0.220)</td>
<td>0.003 (0.170)</td>
<td>0.002 (0.092)</td>
<td>0.001 (0.071)</td>
</tr>
<tr>
<td>H -pak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.017 (0.919)</td>
<td>0.010 (0.569)</td>
<td>0.006 (0.321)</td>
<td>xxx</td>
</tr>
<tr>
<td>2</td>
<td>0.011 (0.578)</td>
<td>0.007 (0.374)</td>
<td>0.004 (0.214)</td>
<td>xxx</td>
</tr>
<tr>
<td>4</td>
<td>0.006 (0.312)</td>
<td>0.003 (0.184)</td>
<td>0.002 (0.097)</td>
<td>xxx</td>
</tr>
</tbody>
</table>

Note: For flow in gpm, use the values inside the brackets.
Note: The values for bar/lpm have been rounded to the third decimal.

Sample ΔP Calculation:

HV3R1SC4RLB2C05 - Filter assembly having '2' length filter element with micron rating code '05' at 100 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.) 0.8.

ΔP Assembly = ΔP Housing + ΔP Element

= Housing factor from graph x sp.gr.(actual)/0.9 + Flow Rate (Lpm) x Element 'K' factor (bar/lpm) x [actual cSt / 32] x [Sp.Gr(actual) / 0.9]

= 0.7 x 0.8/0.9 + 100 x 0.006 x 46/32 x 0.8/0.9

= 0.620 + 0.76

= 1.38 bar
In-tank Filters

General Data

In-tank filters are a special type of low pressure return line filters. In-tank filters are mounted directly to the reservoir tank top and have an accessible head that is located outside of the reservoir while the body of the housing is located inside the reservoir. The exposed cover allows the element to be easily replaced as needed.

The filter housing may be equipped with diffusers to ensure that the returning oil energy is gradually dissipated within the reservoir fluid to minimize the potential for aerating or foaming of the oil. In addition, the diffuser helps direct the fluid outward against the walls of the reservoir to aid in the heat transfer capability of the reservoir.

Applications

- Forestry harvesting equipment such as delimbers and feller bunchers
- Injection molding or blow molding equipment
- Offshore drilling platform power units
- Machine tools
- Die cast machines

Applications
In-tank Filters
HF4RT Series

Flows to 454 L/min (120 USgpm)
Pressures to 7 bar (100 psi)

Features and Benefits
- Beta Ratio: $\beta_{x(c)} = 1000$ to ISO 16889
- Designed to comply with ANSI specifications and ISO cleanliness standards.
- Conforms to HF4 specifications
- Gauge and electrical switch options available to monitor element loading
- In-tank configuration minimizes space requirements and potential system leakage points
- Optional secondary port allows filtration of a second return line without additional fittings or filtered fill port
- High efficiency replacement elements in standard configurations (C-Pak) to meet Target Cleanliness Levels.

Optional extend tube allows smaller filtration unit to be used where needed

HF4RT Series
Filter and Element Model Code

Sample model code: HF4RT1SD313XXBC05

Design Specifications

| Rated flow: | Length 3 | 189 L/min (50 USgpm) |
| Length 6 | 379 L/min (100 USgpm) |
| Length 7 | 454 L/min (120 USgpm) |

Fluid compatibility: Compatible with most petroleum oil, oil-in-water and water-in-oil fluids
Optionals seals available for phosphate esters.

Temp range: -30°C to 121°C (-22°F to 250°F)

Pressure rating:
- Fatigue 7 bar (100 psi)
- Operating 7 bar (100 psi)

Material:
- Head Aluminum
- Cover Aluminum
- Bowl Carbon Steel

Dry weight:
- Length 3: 4.5 kg. (10.0 lbs.)
- Length 6: 6.6 kg. (14.5 lbs.)
- Length 7: 8.4 kg. (18.6 lbs.)

HF4RT 1 1 1 1 1 1 1 1 1 1

Filter Series - HF4RT

Element Collapse Rating
1 - 10 bar (150 psi) Low Collapse

Port Options
- BC - G1/4" to ISO 228
- ME - 1-1/4" - SAE 4 bolt Flange Code 61 (M12 x 1.75)
- SD - 1.875 - 12 UN SAE-24 str. Thd. (1/2" tube)
- FE - 1-1/4" - SAE 4 bolt Flange Code 61 (UNC)

Valve Options
3 - Bypass set at 1.7 bar (25 psi) cracking pressure
4 - Bypass set at 3 bar (43 psi) cracking pressure

Indicator Options*
XX - No indicator
GA - Gauge 0-4 bar (0-60psi)
GB - Gauge 0-10 bar (0-160psi)
MB - Electrical, 15 PSI
RB - Electrical, 30 PSI
MH - Electrical, 15 PSI
RH - Electrical, 30 PSI

Secondary Port
- BC - G1/4" to ISO 228 use with BC Inlet Port
- SD - 1.875 - 12 UN SAE-24 str. Thd. (1/2" tube) use with SD Inlet Port

Assembly Length
- mm (inch)
3 - 378 (14.9)
6 - 584 (23)
7 - 787 (31)

Seal Material
B - Buna-N
V - Viton-A

Element Construction
- Standard Construction

Fluid Cleanliness Rating
Target fluid

<table>
<thead>
<tr>
<th>Code</th>
<th>cleanliness level</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>16/14/12 or better</td>
</tr>
<tr>
<td>05</td>
<td>18/16/14 or better</td>
</tr>
<tr>
<td>10</td>
<td>20/18/15 or better</td>
</tr>
<tr>
<td>20</td>
<td>22/19/16 or better</td>
</tr>
<tr>
<td>XX</td>
<td>no element</td>
</tr>
</tbody>
</table>

* For indicator options, refer to Static Indicators on page 150.
In-tank Filters
HF4RT Series

V405 Element Model Code

Sample model code: V4051B3C05

Filter Element
V405 - For use with HF4RT

Element Collapse Rating
1 - 10 bar (150 psi)
Low Collapse

Seal Material
B - Buna-N
V - Viton-A

Element Length
mm (inch)
3 - 229 (9)
6 - 457 (18)
7 - 686 (27)

Element Construction
C - C-Pak (code 03, 05, 10, 20)

Fluid Cleanliness Rating
Target fluid
Code cleanliness level
03 16/14/12 or better
05 18/16/14 or better
10 20/18/15 or better
20 22/19/16 or better

Housing Dimensions

mm (inch)

Refer to Model Code

Outlet port
1/2" Hose
1 1/2" NPT
1 1/2" NPT

Reservoir Opening

Inlet Flange

SAE-4 bolt flange code 61

V405 1 C

3 1" **

† Filter Element
‡ Element Collapse Rating
§ Seal Material

† 1 Filter Element
V405 - For use with HF4RT

‡ 2 Element Collapse Rating
1 - 10 bar (150 psi)
Low Collapse

§ 3 Seal Material
B - Buna-N
V - Viton-A

Flow Data

Housing/Bypass Valve Flow Data

Pressure drop - bar
Pressure drop - psid
Flow Rate - L/min
Flow Rate - USgpm

In-tank Filters
HF4RT Series
Flows to 280 L/min (75 USgpm)
Pressures to 50 bar (725 psi)

HF4RT Filter Elements Flow Data

Note: For flow in gpm, use the values inside the brackets.
Note: The values for bar/lpm have been rounded to the third decimal.

'KM' factor - bar/lpm (psi/gpm)

ELEMENT TYPE / SIZE MICRON RATING

03 05 10 20
C - pak 3 0.003 (0.168) 0.003 (0.140) 0.001 (0.078) 0.001 (0.044)
6 0.001 (0.080) 0.001 (0.066) 0.001 (0.037) 0.001 (0.021)
7 0.001 (0.051) 0.001 (0.043) 0.001 (0.024) 0.001 (0.013)
22
In-tank Filters
HF4RT Series
Flow Data

Flows to 280 L/min (75 USgpm)
Pressures to 50 bar (725 psi)

Flow versus pressure drop:
150 SUS (32 cSt) oil with specific gravity of ≤0.9

HF4RT Filter Elements Flow Data

'K' factor - bar/lpm (psi/gpm)

<table>
<thead>
<tr>
<th>ELEMENT TYPE / SIZE</th>
<th>03</th>
<th>05</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-pak 3</td>
<td>0.003 (0.168)</td>
<td>0.003 (0.140)</td>
<td>0.001 (0.078)</td>
<td>0.001 (0.044)</td>
</tr>
<tr>
<td>6</td>
<td>0.001 (0.080)</td>
<td>0.001 (0.066)</td>
<td>0.001 (0.037)</td>
<td>0.001 (0.021)</td>
</tr>
<tr>
<td>7</td>
<td>0.001 (0.051)</td>
<td>0.001 (0.043)</td>
<td>0.001 (0.024)</td>
<td>0.001 (0.013)</td>
</tr>
</tbody>
</table>

Note: For flow in gpm, use the values inside the brackets.
Note: The values for bar/lpm have been rounded to the third decimal.

Housing/Bypass Valve Flow Data

Housing

Bypass Valve

Sample ΔP Calculation:

HF4RT1SD3XX3XXBC05 - Filter assembly having '3' length filter element with micron rating code '05' at 200 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.): 0.8.

\[
\Delta P_{\text{Assembly}} = \Delta P_{\text{Housing}} + \Delta P_{\text{Element}}
\]

\[
= \text{Housing factor from graph \times sp.gr.(actual)/0.9} + \text{Flow Rate (Lpm) \times Element 'K' factor (bar/lpm) \times [actual cSt / 32 \times \text{Sp.Gr.(actual) / 0.9]}}
\]

\[
= 0.15 \times 0.8/0.9 + 200 \times 0.003 \times 46/32 \times 0.8/0.9
\]

\[
= 0.130 + 0.76
\]

\[
= 0.89 \text{ bar}
\]
OF3 Series Inlet Strainers

Flows to 379 L/min (100 USgpm)

Features and Benefits
- Stainless steel elements have 149 micron (100 mesh) screen to protect hydraulic pumps from solid contaminants.
- Available flow rates to 379 L/min (100 USgpm). Higher rates can be achieved by using multiple strainers.
- Bypass valve available to prevent system shutdown.
- Element media is pleated for long life.
- Elements can be cleaned and reused.

General Data
These Vickers inlet strainers protect hydraulic pumps and control systems from solid contaminants. They should be used as immersion suction strainers on pump inlet lines.

Bypass Valve
An available integral relief valve parallels the element and is preset to open at a 3 psi pressure drop across the element. Element bypassing can be achieved by excess flow rates, high fluid viscosity, dirt-loaded elements, or a combination of these.

Element Selection
The size and number of elements selected should be based on the maximum flow ratings listed on this page. The ratings are conservative, and a change in fluid viscosity should not significantly affect capacity.

Cleaning
The strainer elements should be cleaned periodically. Remove the elements from the reservoir, wash thoroughly in a suitable solvent, and blow dry with air from inside to outside.

Design Specifications

<table>
<thead>
<tr>
<th>Model Code</th>
<th>OF3 12 3RV 10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Series</td>
<td>OF3 - Inlet strainers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Size (NPTF)</td>
<td>08 - 1&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 - 1 1/4&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 - 1 1/2&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 - 2&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 - 2 1/2&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 - 3&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bypass Valve</td>
<td>3RV - 3 psi differential opening pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank</td>
<td>Omit if not required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design number</td>
<td>Subject to change. Dimensions remain the same for designs 10 through 19.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Rated flow: | OF3-08 38 L/min (10 USgpm) |
| OF3-10 76 L/min (20 USgpm) |
| OF3-12 114 L/min (30 USgpm) |
| OF3-16 189 L/min (50 USgpm) |
| OF3-20 284 L/min (75 USgpm) |
| OF3-24 379 L/min (100 USgpm) |

Fluid compatibility:
These strainers are compatible with all commonly used hydraulic fluids, including phosphate esters and water based fluids.

Temp range: -40°C to +107°C (-40°F to +225°F)

Filtration: Unit is supplied with 149 micron (100 mesh) wire cloth element.

Material:
- Head: Nylon
- Element: Pleated stainless steel

Dry weight: (Approximate)
- OF3-08: 0.3 kg (0.7 lbs)
- OF3-10: 0.4 kg (1.0 lbs)
- OF3-12: 0.6 kg (1.4 lbs)
- OF3-16: 0.8 kg (1.8 lbs)
- OF3-20: 1.0 kg (2.3 lbs)
- OF3-24: 1.4 kg (3.0 lbs)
## Installation Dimensions

### Inlet Strainer

<table>
<thead>
<tr>
<th>Model Series</th>
<th>Minimum Screen Area cm² (in²)</th>
<th>A (NPTF pipe thread)</th>
<th>B</th>
<th>C ± 3.2 (± 0.125)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OF3-08</td>
<td>710 (110)</td>
<td>1&quot;</td>
<td>67.8 (2.67)</td>
<td>135.9 (5.35)</td>
</tr>
<tr>
<td>OF3-10</td>
<td>1032 (160)</td>
<td>1 1/4&quot;</td>
<td>88.1 (3.47)</td>
<td>174.0 (6.85)</td>
</tr>
<tr>
<td>OF3-12</td>
<td>2194 (340)</td>
<td>1 1/2&quot;</td>
<td>101.6 (4.00)</td>
<td>250.2 (9.85)</td>
</tr>
<tr>
<td>OF3-16</td>
<td>2194 (340)</td>
<td>2&quot;</td>
<td>101.6 (4.00)</td>
<td>250.2 (9.85)</td>
</tr>
<tr>
<td>OF3-20</td>
<td>2581 (400)</td>
<td>2 1/2&quot;</td>
<td>131.3 (5.17)</td>
<td>256.5 (10.10)</td>
</tr>
<tr>
<td>OF3-24</td>
<td>3226 (500)</td>
<td>3&quot;</td>
<td>131.3 (5.17)</td>
<td>299.2 (11.78)</td>
</tr>
</tbody>
</table>

### Typical Installations

Access opening should be provided so strainers can be removed for cleaning without draining fluid from tank.
Spin-on Filters

General Data
Spin-on filters typically consist of a head mounted directly in-line with the return piping and a canister containing an element which screws onto a threaded post. The canister seals to the head to prevent leakage.

These are an effective and economical choice of filter where the return line pressure is low and there are no large flow surges with the return line. They are also easily installed without specialty equipment or tooling.

Applications
- Agricultural equipment - tractors, spreaders, harvesters
- Metal forming presses
- Strapping systems
- Brush Chippers
- Turf maintenance equipment
- Small power units
**Spin-on Filters**

**OFRS15**

**Features and Benefits**
- Simple spin-on element design for easy maintenance
- Bypass valves prevent excessive pressure drop and accidental element collapse
- Two available ports for use as gauge and/or diagnostic ports

**DESIGN SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated flow</td>
<td>57 L/min (15 USgpm)</td>
</tr>
<tr>
<td>Fluid compatibility</td>
<td>Compatible with most most petroleum oil, water glycol, oil-in-water and water-in-oil fluids.</td>
</tr>
<tr>
<td>Temp range</td>
<td>-40°C to +107°C (-40°F to +225°F)</td>
</tr>
<tr>
<td>Pressure rating Operating</td>
<td>7 bar (100 psi)</td>
</tr>
<tr>
<td>Material Head</td>
<td>Die cast aluminum</td>
</tr>
<tr>
<td>Bowl</td>
<td>Carbon steel</td>
</tr>
<tr>
<td>Dry weight</td>
<td>1.0 kg (2.2 lbs.)</td>
</tr>
</tbody>
</table>

**OFRS15 Series**

**Filter and Element Model Code**

**Sample model code:** OFRS15S2R03PBE1010

---

**Filter Series - OFRS**

1. **Flow Rating**
   - 15 - 15 USgpm (57 L/min)

2. **Port Type**
   - B - G1 to ISO 228
   - P - 1in NPT
   - S - 1.312-12 UN SAE-16 straight thd.

3. **Assembly Length**
   - mm (inch)
   - 1 - 194.6 (7.7)
   - 2 - 250.4 (9.9)
   - X - no element

4. **Fluid Cleanliness Rating**
   - Code
     - R03 - 16/14/12
     - R05 - 16/14/12
     - R10 - 20/18/15
     - XXX - no element

5. **Pressure Gauge Option**
   - P - Pressure gauge 0-8 bar (0-120 psi); p/n 736129
   - C - Color Coded Pressure Gauge (For use with 1.7 bar (25 psi) bypass only); p/n P-232965-01
   - X - No Gauge

6. **Outlet Gauge Port Location (1/8" NPT)**
   - E - Location E
   - X - No Gauge

7. **Bypass Valve**
   - 10 - Bypass valve set at 0.6 bar (10 psi)
   - 25 - Bypass valve set at 1.7 bar (25 psi)

8. **Design Number**
   - 10 - Standard Design

---

**Inlet Gauge Port Location (1/8" NPT)**

- B - Location B
- X - No Gauge
Spin-on Filters
OFRS15

Flows to 57 L/min (15 USgpm)
Pressures to 7 bar (100 psi)

V019 Element Model Code

Sample model code:
V0191B2R03

<table>
<thead>
<tr>
<th>Series Designation</th>
<th>V019 - Filter element for use with OFRS15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element Collapse Rating</td>
<td></td>
</tr>
<tr>
<td>1 - 10 bar (150 psi)</td>
<td></td>
</tr>
<tr>
<td>Seal Material</td>
<td></td>
</tr>
<tr>
<td>B - Buna-N</td>
<td></td>
</tr>
</tbody>
</table>

<p>| Fluid Cleanliness Rating |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Target fluid cleanliness level</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>16/14/12</td>
</tr>
<tr>
<td>05</td>
<td>18/16/14</td>
</tr>
<tr>
<td>10</td>
<td>20/18/15</td>
</tr>
</tbody>
</table>

Housing Dimensions

mm (inch)

- Pressure gauge connection
- 2 holes for mounting Mounting screw torque
- 27.2 (1.07)
- 13.5 (0.53)
- 9,53/9.78R (0.375/0.385R) Typ.
- .375-16 UNC-2B thd. 19.1 (0.75) min. full thd.
- 26.9 (1.06)
- 26.9 (1.06)
- 23.9 (0.94)
- 47.8 (1.88)
- 11.2 (0.44)
- 11.2 (0.44)
- 7.87R (0.31R)
- 3,05R (0.12R) Typ.
- Pressure gauge connection
- 1/8” NPTF pipe thd.
- 2 locations (see Model Code)
- B Pressure gauge connection
- 49.3 (1.94)
- 98.8 (3.89)
- Optional pressure gauge
- Approx. 55.9 (2.20)
- Inlet port
- Outlet port
- 24.4 (0.96)
- 24.4 (0.96)
- Long (length 2) 250,4 (9.86)
- Long (length 2) 226,1 (8.9)
- Std. (length 1) 194,6 (7.66)
- Std. (length 1) 170,2 (6.70)
- 12.7 (0.50)
- Clearance required for removal of cartridge
- 97.5 Max. (3.84)
- Hex. - both ends
- 44,4 (1.75)
- 28
Spin-on Filters

OFRS15

Flow Data

Element Flow Data

---

**OFRS 15 Element Length 1**

<table>
<thead>
<tr>
<th>Flow Rate - USgpm</th>
<th>Pressure drop - bar</th>
<th>Pressure drop - psid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.1</td>
<td>0.01</td>
</tr>
<tr>
<td>20</td>
<td>0.2</td>
<td>0.02</td>
</tr>
<tr>
<td>30</td>
<td>0.3</td>
<td>0.03</td>
</tr>
<tr>
<td>40</td>
<td>0.4</td>
<td>0.04</td>
</tr>
<tr>
<td>50</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>60</td>
<td>0.6</td>
<td>0.06</td>
</tr>
</tbody>
</table>

**OFRS 15 Element Length 2**

<table>
<thead>
<tr>
<th>Flow Rate - USgpm</th>
<th>Pressure drop - bar</th>
<th>Pressure drop - psid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.1</td>
<td>0.01</td>
</tr>
<tr>
<td>20</td>
<td>0.2</td>
<td>0.02</td>
</tr>
<tr>
<td>30</td>
<td>0.3</td>
<td>0.03</td>
</tr>
<tr>
<td>40</td>
<td>0.4</td>
<td>0.04</td>
</tr>
<tr>
<td>50</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>60</td>
<td>0.6</td>
<td>0.06</td>
</tr>
</tbody>
</table>

**Flow versus pressure drop:**

150 SUS (32 cSt) oil with specific gravity of ≤0.9

**Housing/Bypass Valve Flow Data**

**Sample ΔP Calculation:**

OFRS15S2R03PBE1010 - Filter assembly having ‘2’ length spinon filter element with micron rating code ‘03’ at 50 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.)0.8.

$$\Delta P \text{ Assembly} = \Delta P \text{ Housing} + \Delta P \text{ Element}$$

$$\Delta P \text{ Housing} = \text{Housing } \Delta P \text{ from graph } \times \text{ sp.gr.(actual)/0.9}$$

$$\Delta P \text{ Element} = \text{Element } \Delta P \text{ valve from from graph(bar/lpm)} \times \{ \text{actual cSt / 32} \} \times \{ \text{Sp.Gr(actual) / 0.9} \}$$

$$= 0.4 \times 0.8/0.9 + 0.08 \times 46/32 \times 0.8/0.9$$

$$= 0.350 + 0.1$$

$$= 0.45 \text{ bar}$$
Spin-on Filters
HS22 Series

Features and Benefits
- Designed to comply with ANSI specifications and ISO cleanliness standards
- Dual flow path design maximizes flow capability and service life
- Spin-on element makes servicing fast and easy
- High efficiency replacement elements in standard configurations (R-Pak) to meet Target Cleanliness Levels

DESIGN SPECIFICATIONS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated flow</td>
<td>Length 1: 227 L/min (60 USgpm)</td>
</tr>
<tr>
<td></td>
<td>Length 2: 454 L/min (120 USgpm)</td>
</tr>
<tr>
<td>Fluid compatibility</td>
<td>Compatible with most petroleum oil, water glycol, oil-in-water and water-in-oil fluids</td>
</tr>
<tr>
<td>Temp range</td>
<td>-32°C to +107°C (-25°F to +225°F)</td>
</tr>
<tr>
<td>Pressure rating</td>
<td>Operating: 14 bar (200 psi)</td>
</tr>
<tr>
<td>Material</td>
<td>Head: Aluminum</td>
</tr>
<tr>
<td>Dry weight</td>
<td>Length 1: 7.3 kg (16 lbs)</td>
</tr>
<tr>
<td></td>
<td>Length 2: 8.6 kg (19 lbs)</td>
</tr>
</tbody>
</table>

HS22 Series
Filter and Element Model Code

Sample model code: HS221SD32NB2R05

Filter Series - HS22
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10

Element Collapse Rating
1 - 150 psi Low Pressure

Port options
BD - G1-1/4 to ISO 228
ME - 1-1/2" SAE 4 bolt Flange Code 61 (M12 x 1.75)
SD - 1.875 - 12 UN sae-24 str. Thd (1-1/2" tube)
FE - 1-1/2" SAE 4 bolt Flange Code 61 (UNC)

Valve options
3 - Bypass set at 1.7 bar (25 psi) cracking pressure
4 - Bypass set at 3 bar (50 psi) cracking pressure

Indicator options
1 - No indicator
2 - 13.7 bar (200 psi) gauge
4 - 4 bar (60 psi) gauge

Receptacle
N - None

Seal material
B - Buna-N

Assembly Length
mm (inch)
1 - 253 (10)
2 - 355 (14)
X - No Element

Element Construction
R - R-Pak (code 3, 5,10, 20)
W - Water Removal (10, length 2 only)
X - No Element

Fluid cleanliness rating
Target fluid cleanliness level
03 - 16/14/12 or better
05 - 18/16/14 or better
10 - 20/18/15 or better
20 - 22/19/16 or better
XX - No Element
Spin-on Filters
HS22 Series

Flows to 450 L/min (120 USgpm)
Pressures to 14 bar (200 psi)

V021 Element Model Code

Sample model code: V0211B1R03

Housing Dimensions

mm (inch)

Filter Element
V021 - Filter element for use with HS22 and OFRS-60 series filters (R-Pak construction only)

Element Collapse Rating
1 - 10 bar (150 psi) Low Pressure

Seal Material
B - Buna-N

Canister Length
mm (inch)
1 - 184 (7)
2 - 286 (11)

Element Construction
R - R-Pak (code 3, 5, 10, 20)
W - Water Removal (Code 10, length 2 only)

Fluid Cleanliness Rating

<table>
<thead>
<tr>
<th>Code</th>
<th>Target fluid cleanliness level</th>
<th>Element construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>16/14/12 R-Pak</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>18/16/14 R-Pak</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>20/18/15 R-Pak or water removal</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>22/19/16 R-Pak</td>
<td></td>
</tr>
</tbody>
</table>

V021 1 B**

Flows to 450 L/min (120 USgpm)
Pressures to 14 bar (200 psi)
Spin-on Filters
HS22 Series
Flow Data

Element Flow Data

HS22 R-Pak Element Length 1

HS22 R-Pak Element Length 2

Housing/Bypass Valve Flow Data

Housing

Bypass Valve

Sample ΔP Calculation:

HS221SD32NB2RO5 - Filter assembly having ‘2’ length filter element with micron rating code ‘05’ at 250 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.)0.8.

<table>
<thead>
<tr>
<th>ΔP Assembly</th>
<th>=</th>
<th>ΔP Housing</th>
<th>+</th>
<th>ΔP Element</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>=</td>
<td>Housing ΔP from graph x sp.gr.(actual)/0.9</td>
<td>+</td>
<td>Element ΔP valve from from graph(bar/lpm) x [ actual cSt / 32 ] x [Sp.Gr(actual) / 0.9]</td>
</tr>
<tr>
<td></td>
<td>=</td>
<td>0.3 x 0.8/0.9</td>
<td>+</td>
<td>0.37 x 46/32 x 0.8/0.9</td>
</tr>
<tr>
<td></td>
<td>=</td>
<td>0.260</td>
<td>+</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>=</td>
<td>0.73 bar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Flows to 450 L/min (120 USgpm)
Pressures to 14 bar (200 psi)

Flow versus pressure drop:
150 SUS (32 cSt) oil with specific gravity of ≤0.9

Pressure Filters

General Data

Pressure filters are used to protect downstream components from contamination levels beyond the recommended cleanliness target. Because they are typically sized for the output of the pump, pressure filters tend to be smaller than return line filters when cylinders are present. In systems using accumulators, pressure filters must be sized according to the large effective flow rates present during parts of the duty cycle.

In some applications, pressure filters are used as isolation filters to protect specific components such as proportional or servo valves. Typically these filters are non-bypass and employ elements that are capable of withstanding full system differential pressure without collapsing. While these filters are sized to handle only a specific components’ required flow, the use of high collapse elements result in a higher cost than elements used in housings with bypass valves. Most isolation filters are direct-mounted beneath the valve which can save space as well as reduce plumbing costs.

Applications

- Paper Mills
- Steel Mills
- Injection molding machines
- Motion bases
- Sawmill equipment
- Flight simulators
- Test and simulation equipment
- Entertainment stage equipment
- Hydrostatic drives
- Power generation turbine control systems
Pressure Filters

General Data
Pressure filters are used to protect downstream components from contamination levels beyond the recommended cleanliness target. Because they are typically sized for the output of the pump, pressure filters tend to be smaller than return line filters when cylinders are present. In systems using accumulators, pressure filters must be sized according to the large effective flow rates present during parts of the duty cycle.

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Applications
- Paper Mills
- Steel Mills
- Injection molding machines
- Motion bases
- Sawmill equipment
- Flight simulators
- Test and simulation equipment
- Entertainment stage equipment
- Hydrostatic drives
- Power generation turbine control systems
**Features and Benefits**

- Integrated throwaway element which is screwed into the manifold port for last chance filtration

---

**DESIGN SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated flow:</strong></td>
<td>19 L/min (5 USgpm)</td>
</tr>
<tr>
<td><strong>Fluid compatibility:</strong></td>
<td>Compatible with all petroleum-/oil-based and synthetic fluids. Not rated for use with fluoro-rubber or ethylene propylene seals.</td>
</tr>
<tr>
<td><strong>Temp range:</strong></td>
<td>-30°C to +121°C (-22°F to 250°F)</td>
</tr>
<tr>
<td><strong>Pressure rating:</strong></td>
<td>Operating 200 bar (3000 psi)</td>
</tr>
<tr>
<td><strong>Cavity:</strong></td>
<td>BC20-S3</td>
</tr>
<tr>
<td><strong>Material:</strong></td>
<td>Head Aluminum</td>
</tr>
<tr>
<td>****</td>
<td>Bowl Aluminum</td>
</tr>
<tr>
<td><strong>Dry weight:</strong></td>
<td>(Approximate) 0.11 kg (0.25 lbs)</td>
</tr>
</tbody>
</table>

---

**ECF Series**

**Filter and Element Model Code**

Sample model code: ECF1SB1J3CV025

---

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECF</td>
<td>Filter Series - ECF</td>
</tr>
<tr>
<td>1</td>
<td>Element Collapse Rating</td>
</tr>
<tr>
<td>1</td>
<td>17 bar (250 psi) low collapse</td>
</tr>
<tr>
<td>SB</td>
<td>Port Options</td>
</tr>
<tr>
<td>1.312-12 UN SAE-16 straight thread</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Valve Options</td>
</tr>
<tr>
<td>1</td>
<td>Non-Bypass (Screw directly into cavity)</td>
</tr>
<tr>
<td>J</td>
<td>Indicator Options</td>
</tr>
<tr>
<td>1</td>
<td>No indicator</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Assembly Length</td>
</tr>
<tr>
<td>80.2</td>
<td>mm (inch)</td>
</tr>
<tr>
<td>30</td>
<td>3.16</td>
</tr>
<tr>
<td>C</td>
<td>Element Construction</td>
</tr>
<tr>
<td>S</td>
<td>Standard construction</td>
</tr>
<tr>
<td>M</td>
<td>Wire screen</td>
</tr>
<tr>
<td>V</td>
<td>Seal Material</td>
</tr>
<tr>
<td>V</td>
<td>Viton-A</td>
</tr>
<tr>
<td>015</td>
<td>Fluid Cleanliness</td>
</tr>
<tr>
<td>20/18/15</td>
<td>Fluid Cleanliness</td>
</tr>
<tr>
<td>025</td>
<td>Wirescreen</td>
</tr>
<tr>
<td>100</td>
<td>Wirescreen</td>
</tr>
</tbody>
</table>
**Pressure Filters**

**ECF Series**

**Features and Benefits**

- Integrated throwaway element which is screwed into the manifold port for last chance filtration.

**DESIGN SPECIFICATIONS**

- **Rated flow:** 19 L/min (5 USgpm)
- **Fluid compatibility:** Compatible with all petroleum-/oil-based and synthetic fluids. *Not rated for use with fluoro-rubber or ethylene propylene seals.*
- **Temp range:** -30°C to +121°C (-22°F to 250°F)
- **Pressure rating:** Operating 200 bar (3000 psi)
- **Cavity:** BC20-S3
- **Material:**
  - Head Aluminum
  - Bowl Aluminum
- **Dry weight:** (Approximate) 0.11 kg (0.25 lbs)

**Filter Series - ECF**

**Element Collapse Rating**

- 1 - 17 bar (250 psi) low collapse

**Port Options**

- SB - 1.312-12 UN SAE-16 straight thread

**Valve Options**

- 1 - Non-Bypass (Screw directly into cavity)

**Indicator Options**

- J - No indicator

**Assembly Length**

- mm (inch)
  - 380.2 (3.16)

**Element Construction**

- C - Standard construction
- M - Wire screen

**Seal Material**

- V - Viton-A

**Fluid Cleanliness**

**Fluid**

<table>
<thead>
<tr>
<th>Code</th>
<th>Rating</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>015</td>
<td>20/18</td>
<td>C-Pak</td>
</tr>
<tr>
<td>025</td>
<td>Wirescreen</td>
<td>Wirescreen</td>
</tr>
</tbody>
</table>

**Housing/Element Flow Data**

**Flow versus pressure drop:**

150 SUS (32 cSt) oil with specific gravity of ≤0.9

**ECF15**

<table>
<thead>
<tr>
<th>Flow Rate - L/min</th>
<th>Pressure drop - psi</th>
<th>Flow Rate - USgpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>1.25</td>
<td></td>
</tr>
</tbody>
</table>

**ECF 25/150**

<table>
<thead>
<tr>
<th>Flow Rate - L/min</th>
<th>Pressure drop - psi</th>
<th>Flow Rate - USgpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>1.25</td>
<td></td>
</tr>
</tbody>
</table>
Features and Benefits

- Beta Ratio: \( \beta_{x(c)} = 1000 \) to ISO 16889
- Designed to comply with ANSI specifications and ISO cleanliness standards
- Visual, electrical, and electrical indicators with lamp options for system design flexibility
- Conforms to HF2 automotive specifications
- Compact design for use with servo and proportional valves
- Manifold mounting option for system flexibility
- High efficiency replacement elements in standard configurations (C-Pak) to meet Target Cleanliness Levels
- High collapse elements available for non-bypass applications

DESIGN SPECIFICATIONS

<table>
<thead>
<tr>
<th>Rated flow:</th>
<th>Length 1</th>
<th>Length 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45 L/min (12 USgpm)</td>
<td>91 L/min (24 USgpm)</td>
</tr>
</tbody>
</table>

Fluid compatibility: Compatible with most petroleum oil, water glycol, oil-in-water and water-in-oil fluids. Optional seals available for phosphate esters.

Temp range: -26°C to +121°C (-15°F to +250°F)

Pressure rating:
- Operating: 280 bar (4000 psi)
- Fatigue: 280 bar (4000 psi)

Material:
- Head: Ductile iron
- Bowl: Carbon Steel

Dry weight:
- Length 1: 4.6 kg (10.1 lbs)
- Length 2: 5.9 kg (13.1 lbs)

HF2P Series
Filter and Element Model Code

Sample model code:
HF2P1SA4LN2B05

Flow to 90 L/min (24 USgpm)
Pressures to 280 bar (4,000 psi)
Pressure Filters

HF2P Series

Flows to 90 L/min (24 USgpm)
Pressures to 280 bar (4,000 psi)

V304 Element Model Code

Sample model code:

V3041B1C05

V304

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>Filter Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>V304 - For use with HF2P series filters</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Element Collapse Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 17 bar (250 psi) (C-Pak only)</td>
<td></td>
</tr>
<tr>
<td>5 - 207 bar (3000 psi) (H-Pak only)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Seal Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>B - Buna-N</td>
<td></td>
</tr>
<tr>
<td>V - Viton-A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>Element Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 101 (4)</td>
<td></td>
</tr>
<tr>
<td>2 - 203 (8)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5</th>
<th>Element Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>C - C-Pak (code 03, 05, 10, 20)</td>
<td></td>
</tr>
<tr>
<td>H - H-Pak (code 03, 05, 10)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6</th>
<th>Fluid Cleanliness Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Fluid cleanliness level</td>
</tr>
<tr>
<td>03</td>
<td>16/14/12 or better</td>
</tr>
<tr>
<td>05</td>
<td>18/16/14 or better</td>
</tr>
<tr>
<td>10</td>
<td>20/18/15 or better</td>
</tr>
<tr>
<td>20</td>
<td>22/19/16 or better</td>
</tr>
</tbody>
</table>

Housing Dimensions

mm (inch)

Subplate Mounting

<table>
<thead>
<tr>
<th>1</th>
<th>Outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø25.4 (1.00)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Inlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø17.5 (0.69)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Indicator Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø8.6 (0.34) thru 4PL's</td>
<td></td>
</tr>
</tbody>
</table>

5/16-18UNC x 4.25 long grade 8 bolts for 0.5 engagement are recommended (4 req’d). Torque 9-12lb-ft (12-16Nm)

Refer to Model Code

<table>
<thead>
<tr>
<th>1</th>
<th>Inlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø6.75 (0.27)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Outlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø76.2 (3.00)</td>
<td></td>
</tr>
</tbody>
</table>

Clearance for Element Removal

75 (2.96)
**Pressure Filters**  
**HF2P Series**  
**Flow Data**

**HF2P Filter Elements Flow Data**

'K' factor - bar/lpm (psi/gpm)

<table>
<thead>
<tr>
<th>ELEMENT TYPE / SIZE</th>
<th>03</th>
<th>05</th>
<th>10</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>C - pak</td>
<td>0.037 (2.046)</td>
<td>0.032 (1.735)</td>
<td>0.017 (0.924)</td>
<td>0.010 (0.531)</td>
</tr>
<tr>
<td>H - pak</td>
<td>0.044 (2.396)</td>
<td>0.031 (1.688)</td>
<td>0.019 (1.026)</td>
<td>xxx</td>
</tr>
</tbody>
</table>

Note: For flow in gpm, use the values inside the brackets.  
Note: The values for bar/lpm have been rounded to the third decimal.

**Housing/Bypass Valve Flow Data**

**Sample ΔP Calculation:**  
HF2P1SA4LN25C05 - Filter assembly having '2' length filter element with micron rating code '05' at 50 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.)0.8.

\[
\Delta P_{Assembly} = \Delta P_{Housing} + \Delta P_{Element}
\]

\[
\Delta P_{Housing} = \text{Housing factor from graph} \times \text{sp.gr.(actual)/0.9}
\]

\[
\begin{align*}
\Delta P_{Element} &= \text{Flow Rate (Lpm) x Element 'K' factor} \\
&\quad \times [\text{actual cSt / 32}] \\
&\quad \times [\text{Sp.Gr(actual) / 0.9}]
\end{align*}
\]

\[
\begin{align*}
\Delta P_{Housing} &= 0.26 \times 0.8/0.9 \\
\Delta P_{Element} &= 50 \times 0.016 \times 46/32 \times 0.8/0.9 \\
\end{align*}
\]

\[
\Delta P_{Assembly} = 0.220 + 1.01 = 1.23 \text{ bar}
\]

---

Note: For flow in gpm, use the values inside the brackets.  
Note: The values for bar/lpm have been rounded to the third decimal.
Features and Benefits

- Beta Ratio: $\beta x(c) = 1000$ to ISO 16889
- Designed to comply with ANSI specifications and ISO cleanliness standards
- Visual, electrical, and electrical indicators with lamp options for system design flexibility
- High efficiency replacement elements in standard configurations (C-Pak) to meet Target Cleanliness Levels
- Poppet type leak by-pass valve construction

Design Specifications

| Rated flow:          | Length 5                  | 68 L/min (18 USgpm) |
|                     | Length 7                  | 113.5 L/min (30 USgpm) |
| Fluid compatibility:| Compatible with most petroleum oil, oil-in-water and water-in-oil fluids. Optional seals available for phosphate esters. |
| Temp range:         | -26°C to +121°C (-15°F to +250°F) |
| Pressure rating:     | Operating Fatigue         | 276 bar (4000 psi) 276 bar (4000 psi) |
| Material:           | Head Bowl                 | Ductile iron Steel |
| Dry weight:         | (Approximate)             | Length 5 Length 7   |
|                     |                           | 3.9 kg (8.3 lbs) 4.5 kg (9.9 lbs) |

MF2P Series Filter Assembly Model Code

Sample model code:
MF2P1SA5ANB5C05

Filter Series - MF2P

Element Collapse Rating
1 - 17 bar (250 psi) Low Collapse

Port Options
SA - 1.062 - 12UN SAE-12 (3/4” tube)

Valve Options
5 - Bypass set at 100 psi (7 bar) cracking pressure

Indicator Options
AN - Visual 4.9 bar (70 psi), No Connector
JN - No Indicator (plug), No Connector
UB - Electrical 4.9 bar (70 psi), Brad Harrison
UJ - Electrical 4.9 bar (70 psi), Hirschmann w 24 volt light
UK - Electrical 4.9 bar (70 psi), Hirschmann w 115 volt light
UL - Electrical 4.9 bar (70 psi), Hirschmann w 230 volt light
UH - Electrical 4.9 bar (70 psi), Hirschmann

Seal Material
B - Buna-N
V - Viton-A

Assembly Length
mm (inch)
5 - 210 (8.27)
7 - 263 (10.36)

Element Construction
C - 250 psi Low Collapse
X - no element

Fluid Cleanliness Rating
Code Target fluid cleanliness level
03 16/14/12 or better
05 18/16/14 or better
10 20/18/15 or better
20 22/19/16 or better
XX no element
# Pressure Filters

## MF2P Series

Flows to 113.5 L/min (30 USgpm)
Pressures to 275.5 bar (4,000 psi)

## Housing Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>mm (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INLET</td>
<td>40 (1.57)</td>
</tr>
<tr>
<td>SW 27</td>
<td>45 (1.37)</td>
</tr>
<tr>
<td>Outlet</td>
<td>55 (2.17)</td>
</tr>
<tr>
<td>R9</td>
<td>55 (2.17)</td>
</tr>
<tr>
<td>Length 5</td>
<td>204 (8.03)</td>
</tr>
<tr>
<td>Length 7</td>
<td>257 (10.12)</td>
</tr>
<tr>
<td>Clogging Indicator Port</td>
<td>35 (1.38)</td>
</tr>
<tr>
<td>ø 41</td>
<td>1.61</td>
</tr>
<tr>
<td>ø 76.2</td>
<td>3.00 (3.39)</td>
</tr>
</tbody>
</table>

## V0512 Element Model Codes

Sample model code: V0512B5C05

<table>
<thead>
<tr>
<th>Code</th>
<th>Filter Element</th>
<th>Seal Material</th>
<th>Element Length</th>
<th>Element Construction</th>
<th>Fluid Cleanliness Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>V0512</td>
<td>For use with MF2P series housings</td>
<td>B - Buna-N</td>
<td>5 - 117 (5), 7 - 169 (7)</td>
<td>C - C-Pak (code 03, 05, 10, 20)</td>
<td>Code Target fluid cleanliness level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Target fluid cleanliness level</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>16/14/12 or better</td>
</tr>
<tr>
<td>05</td>
<td>18/16/14 or better</td>
</tr>
<tr>
<td>10</td>
<td>20/18/15 or better</td>
</tr>
<tr>
<td>20</td>
<td>22/19/16 or better</td>
</tr>
</tbody>
</table>

## Pressure Filters MF2P Series

Flow Data

<table>
<thead>
<tr>
<th>Pressure Drop - psid</th>
<th>Flow Rate - USgpm</th>
<th>Flow Rate - L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,0</td>
<td>0,0</td>
<td>0,0</td>
</tr>
<tr>
<td>0,2</td>
<td>0,4</td>
<td>0,4</td>
</tr>
<tr>
<td>0,5</td>
<td>0,6</td>
<td>0,6</td>
</tr>
<tr>
<td>1,0</td>
<td>5,0</td>
<td>15,0</td>
</tr>
<tr>
<td>2,0</td>
<td>10,0</td>
<td>20,0</td>
</tr>
<tr>
<td>3,0</td>
<td>15,0</td>
<td>25,0</td>
</tr>
<tr>
<td>4,0</td>
<td>20,0</td>
<td>30,0</td>
</tr>
<tr>
<td>5,0</td>
<td>25,0</td>
<td>35,0</td>
</tr>
<tr>
<td>6,0</td>
<td>30,0</td>
<td>40,0</td>
</tr>
<tr>
<td>7,0</td>
<td>35,0</td>
<td>45,0</td>
</tr>
<tr>
<td>8,0</td>
<td>40,0</td>
<td>50,0</td>
</tr>
<tr>
<td>9,0</td>
<td>45,0</td>
<td>55,0</td>
</tr>
<tr>
<td>10,0</td>
<td>50,0</td>
<td>60,0</td>
</tr>
<tr>
<td>11,0</td>
<td>55,0</td>
<td>65,0</td>
</tr>
<tr>
<td>12,0</td>
<td>60,0</td>
<td>70,0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure Drop - bar</th>
<th>Flow Rate - USgpm</th>
<th>Flow Rate - L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,0</td>
<td>0,0</td>
<td>0,0</td>
</tr>
<tr>
<td>0,2</td>
<td>0,4</td>
<td>0,4</td>
</tr>
<tr>
<td>0,5</td>
<td>0,6</td>
<td>0,6</td>
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<tr>
<td>1,0</td>
<td>5,0</td>
<td>15,0</td>
</tr>
<tr>
<td>2,0</td>
<td>10,0</td>
<td>20,0</td>
</tr>
<tr>
<td>3,0</td>
<td>15,0</td>
<td>25,0</td>
</tr>
<tr>
<td>4,0</td>
<td>20,0</td>
<td>30,0</td>
</tr>
<tr>
<td>5,0</td>
<td>25,0</td>
<td>35,0</td>
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<tr>
<td>6,0</td>
<td>30,0</td>
<td>40,0</td>
</tr>
<tr>
<td>7,0</td>
<td>35,0</td>
<td>45,0</td>
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<tr>
<td>8,0</td>
<td>40,0</td>
<td>50,0</td>
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<tr>
<td>9,0</td>
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<td>55,0</td>
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<tr>
<td>10,0</td>
<td>50,0</td>
<td>60,0</td>
</tr>
<tr>
<td>11,0</td>
<td>55,0</td>
<td>65,0</td>
</tr>
<tr>
<td>12,0</td>
<td>60,0</td>
<td>70,0</td>
</tr>
</tbody>
</table>

Sample ∆P Calculation:

\[ \Delta P_{Assembly} = \Delta P_{Housing} + \Delta P_{Element} = Housing \text{ factor from graph} + \text{Flow Rate (Lpm)} \times \text{Element 'K' factor} \times \text{sp.gr. (actual)} / 0.9 \times \left( \frac{\text{actual cSt}}{32} \right) \times \left( \frac{\text{Sp.Gr.(actual)}}{0.9} \right) \]

\[ \Delta P_{Assembly} = 0.3 \times \frac{0.8}{0.9} + 50 \times 0.011 \times \frac{46}{32} \times \frac{0.8}{0.9} \]

\[ \Delta P_{Assembly} = 0.260 + 0.69 \]

\[ \Delta P_{Assembly} = 0.95 \text{ bar} \]
Pressure Filters
MF2P Series
Flow Data

Flows to 113.5 L/min (30 USgpm)
Pressures to 275.5 bar (4,000 psi)

Flow versus pressure drop:
150 SUS (32 cSt) oil with specific gravity of ≤ 0.9

MF2P Filter Elements Flow Data

'K' factor - bar/lpm (psi/gpm)

<table>
<thead>
<tr>
<th>ELEMENT TYPE / SIZE</th>
<th>03</th>
<th>05</th>
<th>10</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>C - pak</td>
<td>5</td>
<td>0.014 (0.750)</td>
<td>0.011 (0.602)</td>
<td>0.008 (0.443)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>0.009 (0.509)</td>
<td>0.008 (0.411)</td>
<td>0.005 (0.290)</td>
</tr>
</tbody>
</table>

Note: For flow in gpm, use the values inside the brackets.
Note: The values for bar/lpm have been rounded to the third decimal.

Housing/Bypass Valve Flow Data

Housing

Bypass

Sample ΔP Calculation:

MF2P1SA5UNB5C05 - Filter assembly having '5' length filter element with micron rating code '05' at 50 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.)0.8.

ΔP Assembly = ΔP Housing + ΔP Element

= Housing factor from graph x sp.gr.(actual)/0.9 + Flow Rate (Lpm) x Element 'K' factor (bar/lpm) x [ actual cSt / 32 ] x [Sp.Gr(actual) / 0.9]

= 0.3 x 0.8/0.9 + 50 x 0.011 x 46/32 x 0.8/0.9

= 0.260 + 0.69

= 0.95 bar
Features and Benefits

- Beta Ratio: $\beta_{x(c)} = 1000$ to ISO 16889
- Designed to comply with ANSI specifications and ISO cleanliness standards
- Visual and electrical indicators with lamp options for system design flexibility
- Conforms to HF4 specifications
- Fatigue rated to 5000 psi for maximum reliability in rugged applications
- Top loading design to ease maintenance and minimize spillage
- Multiple filter element lengths for design flexibility
- High efficiency replacement elements in standard configurations (C-Pak) to meet Target Cleanliness Levels
- High collapse elements available for non-bypass applications

Series Filter and Element Model Code

Sample model code: HF4P1SD4LNB6C06

DESIGN SPECIFICATIONS

Rated flow:
- Length 3: 189 L/min (50 USgpm)
- Length 6: 379 L/min (100 USgpm)
- Length 7: 568 L/min (150 USgpm)

Fluid compatibility: Compatible with most petroleum oil, water glycol, oil-in-water and water-in-oil fluids. Optional seals available for phosphate esters.

Temp range: -26°C to +121°C (-15°F to +250°F)

Pressure rating:
- Operating: 345 bar (5000 psi)
- Fatigue: 345 bar (5000 psi)

Material:
- Head: Ductile Iron
- Bowl: Carbon Steel
- Lid: Ductile Iron

Dry weight:
- Length 3: 28.8 kg (63.4 lbs)
- Length 6: 38.7 kg (85.3 lbs)
- Length 7: 51.5 kg (113.6 lbs)

**Series**

- Filter Series - HF4P

**Element Collapse Rating**

1 - 10 bar (150 psi) Low Collapse
4 - 207 bar (3000 psi) High Collapse

**Port options**

- BD: G1½ to ISO 228
- ME: 1/½ SAE 4 bolt Flange Code 61 (M12 x 1.75)
- MR: 1/½ SAE 4 bolt Flange Code 62 (M16 x 2.0)
- SD: 1.875 - 12 UN SAE-24 str. Thd. (1/½" tube)
- FE: 1/½ SAE 4 bolt Flange Code 61 (UNC)
- FR: 1/½ SAE 4 bolt Flange Code 62 (UNC)
- WS: Subplate mounting

**Valve options**

1 - Non-Bypass
4 - Bypass set at 2.9 bar (43 psi) cracking pressure
6 - Bypass set at 6 bar (90 psi) cracking pressure

**Indicator options**

- AN: Visual 4.9 bar (70 psi), No Connector
- LN: Visual 2 bar (30 psi), No Connector
- JN: No Indicator (plug), No Connector
- RB: Electrical 2 bar (30 psi), Brad Harrison
- RJ: Electrical 2 bar (30 psi), Hirschmann w/24 volt light
- RK: Electrical 2 bar (30 psi), Hirschmann w/115 volt light
- RL: Electrical 2 bar (30 psi), Hirschmann w/230 volt light
- RH: Electrical 2 bar (30 psi), Hirschmann
- TB: Electrical 7.9 bar (115 psi), Brad Harrison
- TJ: Electrical 7.9 bar (115 psi), Hirschmann w/24 volt light
- TK: Electrical 7.9 bar (115 psi), Hirschmann w/115 volt light
- TL: Electrical 7.9 bar (115 psi), Hirschmann w/230 volt light
- TH: Electrical 7.9 bar (115 psi), Hirschmann
- UB: Electrical 4.9 bar (70 psi), Brad Harrison
- UJ: Electrical 4.9 bar (70 psi), Hirschmann w/24 volt light
- UK: Electrical 4.9 bar (70 psi), Hirschmann w/115 volt light
- UL: Electrical 4.9 bar (70 psi), Hirschmann w/230 volt light
- UH: Electrical 4.9 bar (70 psi), Hirschmann w/115 volt light

**Seal material**

- B: Buna-N
- V: Viton-A

**Assembly Length**

- mm (inch): 3 - 447 (17.6), 6 - 685.3 (27), 7 - 923.5 (36.4)

**Element construction**

- C: 10 bar (150 psi) Low Collapse
- H: 207 bar (3000 psi) High Collapse
- X: No element

**Fluid cleanliness rating**

- Target fluid cleanliness level:
  - Code 03: 16/14/12 or better
  - Code 05: 18/16/14 or better
  - Code 10: 20/18/15 or better
  - Code 20*: 22/19/16 or better
  - Code XX: No element

* C-Pak only
V405 Element model code
(Meets HF4 Standard)

Sample model code:
V4051B3C03

Housing Dimensions
mm (inch)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>25.4</td>
</tr>
<tr>
<td>B</td>
<td>73</td>
</tr>
<tr>
<td>A</td>
<td>146.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>640</td>
</tr>
<tr>
<td>B</td>
<td>315</td>
</tr>
<tr>
<td>A</td>
<td>610</td>
</tr>
</tbody>
</table>

Element Length
mm (inch)

<table>
<thead>
<tr>
<th>Code</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>229</td>
</tr>
<tr>
<td>05</td>
<td>457</td>
</tr>
<tr>
<td>10</td>
<td>686</td>
</tr>
</tbody>
</table>

Fluid Cleanliness Rating

<table>
<thead>
<tr>
<th>Code</th>
<th>Code cleanliness level</th>
</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>16/14/12</td>
</tr>
<tr>
<td>05</td>
<td>18/16/14</td>
</tr>
<tr>
<td>10</td>
<td>20/18/15</td>
</tr>
<tr>
<td>20</td>
<td>22/19/16</td>
</tr>
</tbody>
</table>

Seals

- B: Buna-N
- V: Viton-A

Element Collapse Rating

- 1: 10 bar (150 psi)
- 4: 206.9 bar (3000 psi)

High Collapse

NOTE: Use 1 only with bypass valve or monitored delta P indicator.

Element Construction

- C: C-Pak (code 03, 05, 10, 20)
- H: H-Pak (code 03, 05, 10)

Filter Element - V405

Refer to Model Code

Inlet & Outlet = 31.8 (1.25)
0-ring = 2 x 1.139

Inflow to 570 L/min (150 USgpm)
Pressures to 345 bar (5,000 psi)

Pressure Filters
HF4P Series
**Pressure Filters**

**HF4P Series**

**Flow Data**

Flows to 570 L/min (150 USgpm)
Pressures to 345 bar (5,000 psi)

**Flow versus pressure drop:**
150 SUS (32 cSt) oil with specific gravity of ≤0.9

---

### HF4P Filter Elements Flow Data

‘K’ factor - bar/lpm (psi/gpm)

<table>
<thead>
<tr>
<th>ELEMENT TYPE / SIZE</th>
<th>03</th>
<th>05</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>C -pak</td>
<td>0.003 (0.168)</td>
<td>0.003 (0.140)</td>
<td>0.001 (0.078)</td>
<td>0.001 (0.044)</td>
</tr>
<tr>
<td>6</td>
<td>0.001 (0.080)</td>
<td>0.001 (0.066)</td>
<td>0.001 (0.037)</td>
<td>0.001 (0.021)</td>
</tr>
<tr>
<td>7</td>
<td>0.001 (0.051)</td>
<td>0.001 (0.043)</td>
<td>0.001 (0.024)</td>
<td>0.001 (0.013)</td>
</tr>
<tr>
<td>H -pak</td>
<td>0.004 (0.206)</td>
<td>0.003 (0.145)</td>
<td>0.002 (0.088)</td>
<td>xxx</td>
</tr>
<tr>
<td>6</td>
<td>0.002 (0.096)</td>
<td>0.001 (0.068)</td>
<td>0.001 (0.041)</td>
<td>xxx</td>
</tr>
<tr>
<td>7</td>
<td>0.001 (0.062)</td>
<td>0.001 (0.044)</td>
<td>0.001 (0.026)</td>
<td>xxx</td>
</tr>
</tbody>
</table>

Note: For flow in gpm, use the values inside the brackets.
Note: The values for bar/lpm have been rounded to the third decimal.

---

### Housing/Bypass Valve Flow Data

#### Housing

**Bypass Valve**

**Flow Data**

Note: For flow in gpm, use the values inside the brackets.

---

### Sample ΔP Calculation:

HF4P1SD4LN8C05 - Filter assembly having ‘6’ length filter element with micron rating code ‘05’ at 200 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.)0.8.

ΔP Assembly = ΔP Housing + ΔP Element

$$\Delta P = \text{Housing factor from graph x sp.gr.} / \text{0.9} + \text{Flow Rate (Lpm) x Element 'K' factor (bar/lpm) x [actual cSt / 32] x [Sp.Gr(actual) / 0.9]}$$

$$= 0.26 \times 0.8 / 0.9 + 200 \times 0.001 \times 46 / 32 \times 0.8 / 0.9$$

$$= 0.220 + 0.25$$

$$= 0.47 \text{ bar}$$
Pressure Filters

HF3P Series

Features and Benefits
- Beta Ratio: $\beta_{4(c)} = 1000$ to ISO 16889
- Designed to comply with ANSI specifications and ISO cleanliness standards
- Visual, electrical, and lamp options for system design flexibility
- Conforms to HF3 automotive specifications
- Fatigue rated to 6000 psi for maximum reliability in the most rugged applications
- Reverse flow valve option for hydrostatic transmission applications
- Multiple filter element lengths for design flexibility
- High efficiency replacement elements in standard configurations (C-Pak) to meet Target Cleanliness Levels
- High collapse elements available for non-bypass applications

HF3P Series
Filter and Element Model Code

Sample model code: HF3P1SB4LNB2C05

Reverse Flow Non-bypass (Valve Option 8)

Reverse Flow Bypass (Valve Option 9)

Flow rates:
- Flows to 454 L/min (120 USgpm)
- Pressures to 410 bar (6,000 psi)

DESIGN SPECIFICATIONS

<table>
<thead>
<tr>
<th>Rated flow:</th>
<th>Length 1</th>
<th>106 L/min (28 USgpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length 2</td>
<td>208 L/min (55 USgpm)</td>
</tr>
<tr>
<td></td>
<td>Length 4</td>
<td>344 L/min (91 USgpm)</td>
</tr>
<tr>
<td></td>
<td>Length 5</td>
<td>454 L/min (120 USgpm)</td>
</tr>
</tbody>
</table>

Fluid compatibility: Compatible with most petroleum oil, water glycol, oil-in-water and water-in-oil fluids. Optional seals available for phosphate esters.

Temp range: -26°C to +121°C (-15°F to +250°F)

Pressure rating:
- Operating Pressure: 410 bar (6000 psi)
- Fatigue Pressure: 410 bar (6000 psi)

Material:
- Head: Ductile iron
- Bowl: Carbon Steel

Dry weight:
- Length 1: 20.3 kg (44.8lbs)
- Length 2: 22.5 kg (49.5lbs)
- Length 4: 28.5 kg (62.9lbs)
- Length 5: 43.4 kg (95.7lbs)

Design flexibility

Valve Options
1 - Non-Bypass
4 - Bypass set at 2.9 bar (43 psi) cracking pressure
6 - Bypass set at 6 bar (90 psi) cracking pressure
8 - Reverse Flow Valve Non-Bypass
9 - Reverse Flow Valve 2.9 bar (43 psi) Bypass

* Reverse flow bypass available with BD, MU, SD and FU ports only.

Indicator Options
- AN - Visual 4.9 bar (70 psi), No Connector
- JN - No Indicator (plug), No Connector
- KN - Visual 1 bar (15 psi), No Connector
- LN - Visual 2 bar (30 psi), No Connector
- ON - Visual 7.9 bar (115 psi), No Connector
- RB - Electrical 2 bar (30 psi), Brad Harrison
- RH - Electrical 2 bar (30 psi), Hirschmann
- RJ - Electrical 2 bar (30 psi), Hirschmann
- RK - Electrical 2 bar (30 psi), Hirschmann
- RL - Electrical 2 bar (30 psi), Hirschmann
- TB - Electrical 7.9 bar (115 psi), Brad Harrison
- TH - Electrical 7.9 bar (115 psi), Hirschmann
- TJ - Electrical 7.9 bar (115 psi), Hirschmann
- TK - Electrical 7.9 bar (115 psi), Hirschmann
- TL - Electrical 7.9 bar (115 psi), Hirschmann
- UB - Electrical 4.9 bar (70 psi), Brad Harrison
- UH - Electrical 4.9 bar (70 psi), Hirschmann
- UJ - Electrical 4.9 bar (70 psi), Hirschmann
- UK - Electrical 4.9 bar (70 psi), Hirschmann
- UL - Electrical 4.9 bar (70 psi), Hirschmann

Seal Material
B - Buna-N
V - Viton-A

Assembly Length
- mm (inch): 1 - 230 (9.1), 2 - 293 (11.5), 4 - 414 (16.3), 5 - 569 (22.4)

Element Construction
- C - 17 bar (250 psi)
- Low Collapse
- H - 207 bar (3000 psi)
- High Collapse
- X - no element

Fluid Cleanliness Rating
- Target fluid cleanliness level
- Code cleanliness level
- 03 - 16/14 or better
- 05 - 18/16/14 or better
- 10 - 20/18/15 or better
- 20 - 22/19/16 or better (C-Pak only)
- XX - no element

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Pressure Filters
HF3P Series

V602 Element Model Code

Sample model code: V6021B1C03

Housing Dimensions

1/2-20UNF-2B in. X 17 (0.67) deep 4 Places

Refer to Model Code

Drain Plug G 1/2

95 (3.74) Clearance required for element removal

Outlet Porting

1 1/2” or 2” SAE flange code 61, inch or metric

1 1/2” or 2” SAE flange code 62, inch or metric

Indicator Plug

SAE-16, 24, G1 OR G1 1/2

16” Housing

ø152 (5.98)

427 Clearance required for element removal

Housing/Bypass Valve Flow Data

Flow Rate - USgpm

Pressure drop - bar

Pressure drop - psid

Flow Rate - L/min

Bypass Valve

Flow Rate - USgpm

Pressure drop - bar

Pressure drop - psid

Flow Rate - L/min
**Pressure Filters**  
HF3P Series  
**Flow Data**

**Flows to** 454 L/min (120 USgpm)  
**Pressures to** 420 bar (6,000 psi)

**Flow versus pressure drop:**  
150 SUS (32 cSt) oil with specific gravity of \( \leq 0.9 \)

---

**Element Flow Data**

**HF3P Filter Elements**

'K' factor - bar/lpm (psi/gpm)

<table>
<thead>
<tr>
<th>ELEMENT TYPE / SIZE</th>
<th>03</th>
<th>05</th>
<th>10</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>C -pak 1</td>
<td>0.011 (0.589)</td>
<td>0.009 (0.499)</td>
<td>0.005 (0.266)</td>
<td>0.003 (0.153)</td>
</tr>
<tr>
<td>C -pak 2</td>
<td>0.005 (0.288)</td>
<td>0.004 (0.241)</td>
<td>0.002 (0.135)</td>
<td>0.001 (0.076)</td>
</tr>
<tr>
<td>C -pak 4</td>
<td>0.003 (0.175)</td>
<td>0.003 (0.146)</td>
<td>0.001 (0.082)</td>
<td>0.001 (0.046)</td>
</tr>
<tr>
<td>C -pak 5</td>
<td>0.002 (0.132)</td>
<td>0.002 (0.110)</td>
<td>0.001 (0.061)</td>
<td>0.001 (0.034)</td>
</tr>
<tr>
<td>H -pak 1</td>
<td>0.017 (0.936)</td>
<td>0.012 (0.659)</td>
<td>0.007 (0.401)</td>
<td>xxx</td>
</tr>
<tr>
<td>H -pak 2</td>
<td>0.008 (0.455)</td>
<td>0.006 (0.320)</td>
<td>0.004 (0.195)</td>
<td>xxx</td>
</tr>
<tr>
<td>H -pak 4</td>
<td>0.005 (0.273)</td>
<td>0.004 (0.192)</td>
<td>0.002 (0.117)</td>
<td>xxx</td>
</tr>
<tr>
<td>H -pak 5</td>
<td>0.004 (0.206)</td>
<td>0.003 (0.145)</td>
<td>0.002 (0.088)</td>
<td>xxx</td>
</tr>
</tbody>
</table>

Note: For flow in gpm, use the values inside the brackets.  
Note: The values for bar/lpm have been rounded to the third decimal.

---

**Sample ΔP Calculation**:

HF3P1SB4LN2C05 - Filter assembly having ‘2’ length filter element with micron rating code ‘05’ at 100 L/min flow rate using a hydraulic fluid at 46 cSt viscosity & specific gravity (sp.gr.):0.8.

<table>
<thead>
<tr>
<th>ΔP Assembly</th>
<th>=</th>
<th>ΔP Housing +</th>
<th>ΔP Element</th>
</tr>
</thead>
</table>
| = | Housing factor from graph  
\( \times \text{sp.gr.}(\text{actual})/0.9 \) | + | Flow Rate (Lpm) \( \times \) Element ‘K’ factor  
\( \times \frac{\text{actual cSt}}{32} \) \( \times \frac{\text{Sp.Gr}(\text{actual})}{0.9} \) |
| = | 0.12 \( \times \) 0.8/0.9 | + | 100 \( \times \) 0.001 \( \times \) 46/32 \( \times \) 0.8/0.9 |
| = | 0.100 | + | 0.127 |

\[= 0.22 \text{ bar}\]
**DESIGN SPECIFICATIONS**

**Material:**
- PV/PE Series: Aluminum
- PHV/PHE Series: Stainless Steel

**Fluid compatibility:** Compatible with most petroleum oil, oil-in-water and water-in-oil fluids. Optional seals available for phosphate esters.

**Installation Torque:**
- PV/PE Series: 33 Nm (24 lbs-ft)
- PHV/PHE Series: 100 Nm (74 lbs-ft)

**Temp range:** -26°C to +120°C (-15°F to +250°F)

**Switch Rating (all models):**
- 3A@24VDC
- 5A@250VAC

**Dry weight (Approximate):**
- PV: 55g (0.1lbs)
- PHV: 110g (0.2lbs)
- PE: 150g (0.3lbs)
- PHE: 250g (0.6lbs)

**Pressure rating:**
- PV/PE Series: 210 bar (3000PSI)
- PHV/PHE Series: 420 bar (6000PSI)

**Indicator Model Code**

<table>
<thead>
<tr>
<th>Indicator type and pressure rating</th>
<th>PV</th>
<th>PE</th>
<th>PHV</th>
<th>PHE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>visual 210 bar (3000psi)</td>
<td>visual 420 bar (6000psi)</td>
<td>electrical 210 bar (3000psi)</td>
<td>electrical 420 bar (6000psi)</td>
</tr>
</tbody>
</table>

**Pressure setting**
- 1B: 1 bar (15psid)
- 2B: 2 bar (30psid)
- 5B: 5 bar (75psid)
- 8B: 8 bar (115psid)

**Seal material**
- V: Viton-A

**Connector**
- B: Brad Harrison 5 Pin
- H: Hirschmann
- N: None (use with PV indicators)

**Light option**
- L24: 24 Volt Lamp
- L115: 115 Volt Lamp
- L230: 230 Volt Lamp

**INDICATOR OPTIONS (3000 PSI - USE WITH FILTER MODELS HV6R, HV3R)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
<th>Filter Assembly Code Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>POPUP VISUAL 15 psi</td>
<td>PV 1B VN AN KN</td>
<td></td>
</tr>
<tr>
<td>POPUP VISUAL 30 psi</td>
<td>PV 2B VN LN</td>
<td></td>
</tr>
<tr>
<td>POPUP VISUAL 70 psi</td>
<td>PV 5B VN AN</td>
<td></td>
</tr>
<tr>
<td>BRAD HARRISON 5 PIN ELECTRICAL 15 psi</td>
<td>PE 1B V B QB</td>
<td></td>
</tr>
<tr>
<td>BRAD HARRISON 5 PIN ELECTRICAL 30 psi</td>
<td>PE 2B V B RB</td>
<td></td>
</tr>
<tr>
<td>BRAD HARRISON 5 PIN ELECTRICAL 70 psi</td>
<td>PE 5B V B UB</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN ELECTRICAL 15 psi</td>
<td>PE 1B V H QH</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN ELECTRICAL 30 psi</td>
<td>PE 2B V H RH</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN ELECTRICAL 70 psi</td>
<td>PE 5B V H UH</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 15 psi - L24</td>
<td>PE 1B V H L24 QJ</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 30 psi - L24</td>
<td>PE 2B V H L24 RJ</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 70 psi - L24</td>
<td>PE 5B V H L24 UJ</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 15 psi - L115</td>
<td>PE 1B V H L115 QK</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 30 psi - L115</td>
<td>PE 2B V H L115 RK</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 70 psi - L115</td>
<td>PE 5B V H L115 UK</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 15 psi - L230</td>
<td>PE 1B V H L230 QL</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 30 psi - L230</td>
<td>PE 2B V H L230 RL</td>
<td></td>
</tr>
<tr>
<td>HIRSCHMANN VISUAL ELECTRICAL 70 psi - L230</td>
<td>PE 5B V H L230 UL</td>
<td></td>
</tr>
</tbody>
</table>
## Accessories
### Differential Indicators

**INDICATOR OPTIONS (6,000 PSI - USE WITH FILTER MODELS HF2P, HF3P, HF3PS, HF4, MF2P)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
<th>Filter Assembly Code Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Popup Visual 30psi</td>
<td>PHV 2B VN</td>
<td>LN</td>
</tr>
<tr>
<td>Popup Visual 70 Psi</td>
<td>PHV 5B VN</td>
<td>AN</td>
</tr>
<tr>
<td>Popup Visual 115 Psi</td>
<td>PHV 8B VN</td>
<td>ON</td>
</tr>
<tr>
<td>Brad Harrison 5 Pin Electrical 30 Psi</td>
<td>PHE 2B V B</td>
<td>RB</td>
</tr>
<tr>
<td>Brad Harrison 5 Pin Electrical 70 Psi</td>
<td>PHE 5B V B</td>
<td>UB</td>
</tr>
<tr>
<td>Brad Harrison 5 Pin Electrical 115 Psi</td>
<td>PHE 8B V B</td>
<td>TB</td>
</tr>
<tr>
<td>Hirschmann Electrical 30 Psi</td>
<td>PHE 2B V H</td>
<td>RH</td>
</tr>
<tr>
<td>Hirschmann Electrical 70 Psi</td>
<td>PHE 5B V H</td>
<td>UH</td>
</tr>
<tr>
<td>Hirschmann Electrical 115 Psi</td>
<td>PHE 8B V H</td>
<td>TH</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 30 Psi - L24</td>
<td>PHE 2B V H L24</td>
<td>RJ</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 70 Psi - L24</td>
<td>PHE 5B V H L24</td>
<td>UJ</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 115 Psi - L24</td>
<td>PHE 8B V H L24</td>
<td>TJ</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 30 Psi - L115</td>
<td>PHE 2B V H L115</td>
<td>RK</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 70 Psi - L115</td>
<td>PHE 5B V H L115</td>
<td>UK</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 115 Psi - L115</td>
<td>PHE 8B V H L115</td>
<td>TK</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 30 Psi - L230</td>
<td>PHE 2B V H L230</td>
<td>RL</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 70 Psi - L230</td>
<td>PHE 5B V H L230</td>
<td>UL</td>
</tr>
<tr>
<td>Hirschmann Visual Electrical 115 Psi - L230</td>
<td>PHE 8B V H L230</td>
<td>TL</td>
</tr>
<tr>
<td>Indicator Plug</td>
<td>3040056</td>
<td>—</td>
</tr>
</tbody>
</table>

### Differential Indicator Dimensional Schematics

#### PE * B V B

**PHE * B V B**

![Schematic](image1)

#### PV * B VN

![Schematic](image2)

#### PE * B V H

**PHE * B V H**

![Schematic](image3)

#### PE * B V H L**

**PHE * B V H L**

![Schematic](image4)
## Accessories
### Static Indicators

<table>
<thead>
<tr>
<th>Indicator Model Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLV 1B V N N</td>
<td>Visual, 15 PSI, No connector</td>
</tr>
<tr>
<td>PLE 1B V H N</td>
<td>Electrical, 15 PSI, Hirschmann</td>
</tr>
<tr>
<td>PLE 1B V B N</td>
<td>Electrical, 15 PSI, Brad Harrison</td>
</tr>
<tr>
<td>PLE 1B V H L24</td>
<td>Electrical, 15 PSI, Hirschmann with 24 Volt light</td>
</tr>
<tr>
<td>PLE 1B V H L115</td>
<td>Electrical, 15 PSI, Hirschmann with 115 Volt light</td>
</tr>
<tr>
<td>PLE 1B V H L230</td>
<td>Electrical, 15 PSI, Hirschmann with 230 Volt light</td>
</tr>
<tr>
<td>PLV 2B V N N</td>
<td>Visual, 30 PSI, No connector</td>
</tr>
<tr>
<td>PLE 2B V H N</td>
<td>Electrical, 30 PSI, Hirschmann</td>
</tr>
<tr>
<td>PLE 2B V B N</td>
<td>Electrical, 30 PSI, Brad Harrison</td>
</tr>
<tr>
<td>PLE 2B V H L24</td>
<td>Electrical, 30 PSI, Hirschmann with 24 Volt light</td>
</tr>
<tr>
<td>PLE 2B V H L115</td>
<td>Electrical, 30 PSI, Hirschmann with 115 Volt light</td>
</tr>
<tr>
<td>PLE 2B V H L230</td>
<td>Electrical, 30 PSI, Hirschmann with 230 Volt light</td>
</tr>
<tr>
<td>PLV 5B V N N</td>
<td>Visual, 70 PSI, No connector</td>
</tr>
<tr>
<td>PLE 5B V H N</td>
<td>Electrical, 70 PSI, Hirschmann</td>
</tr>
<tr>
<td>PLE 5B V B N</td>
<td>Electrical, 70 PSI, Brad Harrison</td>
</tr>
<tr>
<td>PLE 5B V H L24</td>
<td>Electrical, 70 PSI, Hirschmann with 24 Volt light</td>
</tr>
<tr>
<td>PLE 5B V H L115</td>
<td>Electrical, 70 PSI, Hirschmann with 115 Volt light</td>
</tr>
</tbody>
</table>

### Indicator Model Code

- **Indicator type and pressure rating**
  - PLV - Visual
  - PLE - Electrical
  - SLV - Visual
  - SLE - Electrical

- **Pressure setting**
  - 1B - 1 bar (15psid)
  - 2B - 2 bar (30psid)
  - 5B - 5 bar (75psid)
  - 1.4B - 1.4 bar (20psid)

- **Seal Material**
  - V - Viton-A

- **Connector**
  - B - Brad Harrison 5 Pin
  - N - Hirschmann
  - H - None

- **Light Options**
  - L24 - 24 Volt Lamp
  - L115 - 115 Volt Lamp
  - L230 - 230 Volt Lamp
  - N - None
### Accessories

#### Electrical Pressure Switch

**Hirschmann Connector**

![Pressure Switch Diagram]

<table>
<thead>
<tr>
<th>HOUSING</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRT</td>
<td>3039708 Electrical Switch 30 psi Hirschmann Connector</td>
</tr>
</tbody>
</table>

#### Gauge

**0-10 Bar Gauge**

![Gauge Diagram]

<table>
<thead>
<tr>
<th>HOUSING</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRT</td>
<td>3039703 Gauge 0 - 10 Bar</td>
</tr>
</tbody>
</table>

**Note:** Gauges indicate pressure in both bar and psi
**Accessories**

**Indicator Switch**

**Schematic Wiring Diagram**

Note: The female connector is to be furnished by the customer.

Note: When fitting indicator, torque to 41-47 Nm.

**ELECTRICAL**

**Switch:** SPDT

**Rating:**
- 7 amps, resistive
- 4 amps, inductive
- 2 amps, lamp load @28 VDC, 115 VAC 60 Hz & 220 VAC 50 Hz or 60 Hz

**Hirschmann (DIN 43650 Type AM) Receptacle**

**Brad Harrison (41512) Receptacle**

**Electrical Pressure Switch**

<table>
<thead>
<tr>
<th>HOUSING</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF4RT</td>
<td>3039705</td>
<td>Electrical Switch 15 psi Brad Harrison Connector</td>
</tr>
<tr>
<td></td>
<td>3039707</td>
<td>Electrical Switch 15 psi Hirschmann Connector</td>
</tr>
<tr>
<td>HF4RT</td>
<td>3039706</td>
<td>Electrical Switch 30 psi Brad Harrison Connector</td>
</tr>
<tr>
<td></td>
<td>3039708</td>
<td>Electrical Switch 30 psi Hirschmann Connector</td>
</tr>
</tbody>
</table>

**Hirshmann Connector**

**Brad Harrison Connector**
Accessories

Gauge

<table>
<thead>
<tr>
<th>HOUSING</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF4RT</td>
<td>3039703 Gauge 0-160 psi (use with 43 psi Bypass Valve)</td>
</tr>
<tr>
<td></td>
<td>3039704 Gauge 0-60 psi (use with 25 psi Bypass Valve)</td>
</tr>
</tbody>
</table>

Note: Gauges indicate pressure in both bar and psi

Mounting Bracket

**HV6R Housing**

mm (inch)

Order part number 3039702
## Accessories

### Gauge

**Seal Kits**

**Note**
Seal kits include all soft goods to fully service a unit.

<table>
<thead>
<tr>
<th>SERIES</th>
<th>SEAL TYPE</th>
<th>SEAL KIT PART #</th>
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</thead>
<tbody>
<tr>
<td>HV6R</td>
<td>Buna-N</td>
<td>3039688</td>
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<tr>
<td></td>
<td>Viton-A</td>
<td>3039689</td>
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<tr>
<td>HV3R</td>
<td>Buna-N</td>
<td>3039690</td>
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<tr>
<td></td>
<td>Viton-A</td>
<td>3039691</td>
</tr>
<tr>
<td>HF4RT</td>
<td>Buna-N</td>
<td>3039692</td>
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<tr>
<td></td>
<td>Viton-A</td>
<td>3039693</td>
</tr>
<tr>
<td>HF2P</td>
<td>Buna-N</td>
<td>3039694</td>
</tr>
<tr>
<td></td>
<td>Viton-A</td>
<td>3039695</td>
</tr>
<tr>
<td>HF3P</td>
<td>Buna-N</td>
<td>3039696</td>
</tr>
<tr>
<td></td>
<td>Viton-A</td>
<td>3039697</td>
</tr>
<tr>
<td>HF3PS</td>
<td>Buna-N</td>
<td>3039698</td>
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<tr>
<td></td>
<td>Viton-A</td>
<td>3039699</td>
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<tr>
<td>HF4P</td>
<td>Buna-N</td>
<td>3039700</td>
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<tr>
<td></td>
<td>Viton-A</td>
<td>3039701</td>
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<tr>
<td>OFR60/120</td>
<td>Buna-N</td>
<td>590021 (Bowl seal only)</td>
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<td>Viton-A</td>
<td>591761 (Bowl seal only)</td>
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<td>OFR15/30</td>
<td>Buna-N</td>
<td>226214</td>
</tr>
<tr>
<td></td>
<td>Viton-A</td>
<td>262422</td>
</tr>
</tbody>
</table>

* Viton is a registered trademark of E.I. Dupont
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