

90 SERIES OPERATION AND MAINTENANCE MANUAL



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FILTER BASICS

The Forsta 90 Series are self-cleaning screen water filters. The major components include the Filter Housing (1), Fine Screen filter element (2), Particle Remover (3), Hydraulic Piston (8), and Backwash Valve (12).

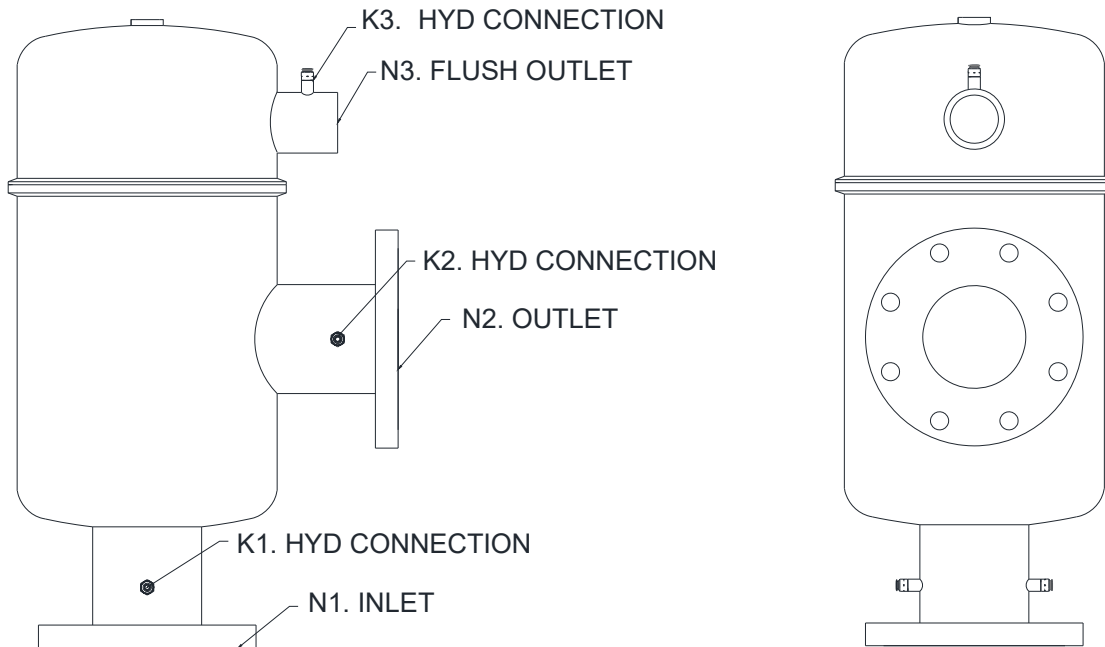


Figure 1: 90 Series Filter – General Layout

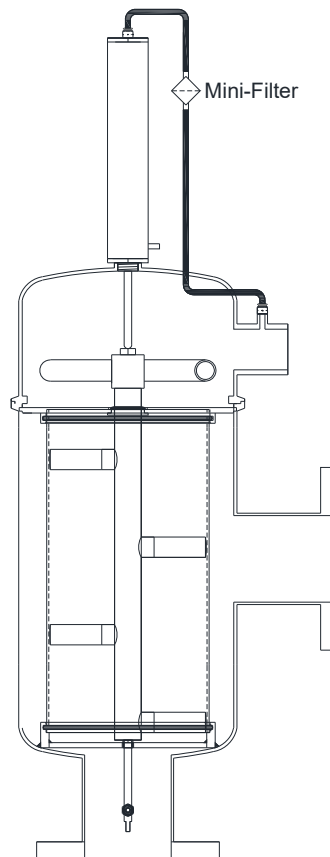


Figure 2: 90 Series Filter – Assembled View

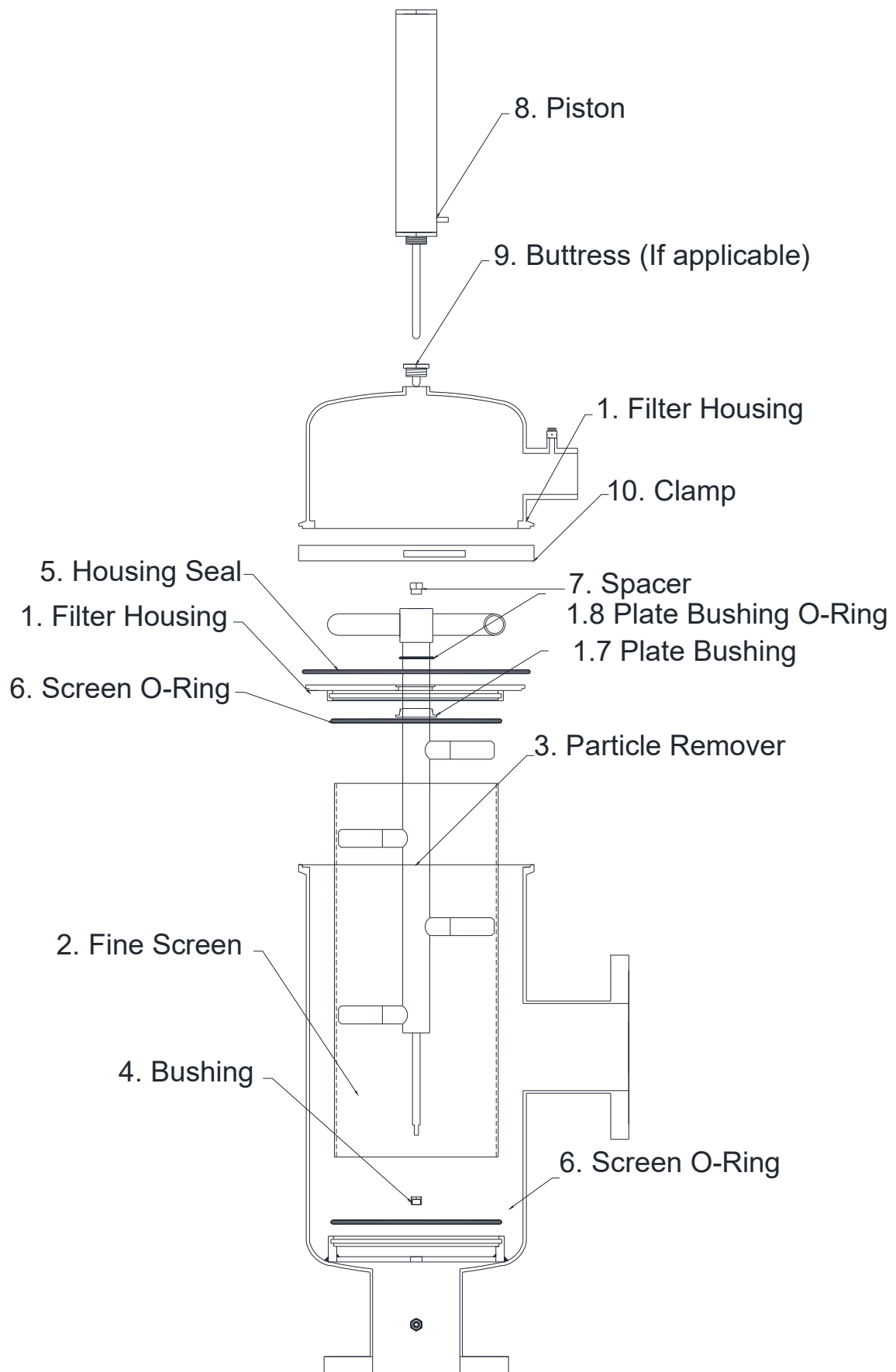
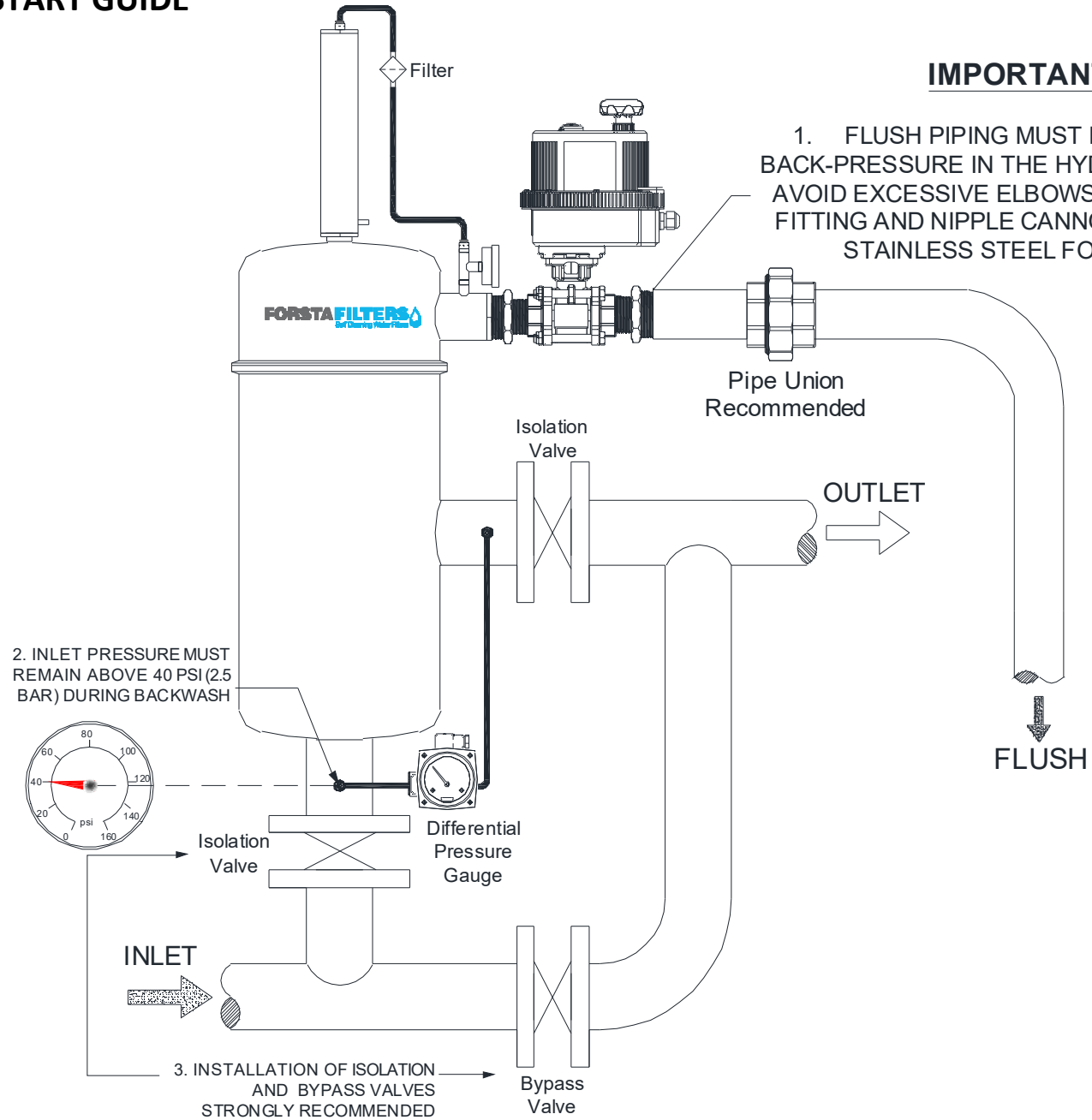


Figure 3: 90 Series Filter - Exploded View

QUICKSTART GUIDE



IMPORTANT NOTE:

1. FLUSH PIPING MUST BE OVERSIZED TO PREVENT BACK-PRESSURE IN THE HYDRAULIC MOTOR CHAMBER. AVOID EXCESSIVE ELBOWS AND ELEVATION GAIN. PIPE FITTING AND NIPPLE CANNOT BE PLASTIC, PREFERRED STAINLESS STEEL FOR MAX INTERNAL DIAMETER

Figure 4: 90 Series Filter – Quick Start Guide

INSTALLATION REQUIREMENTS

90 Series filters may be mounted directly on the inlet (N1) and outlet (N2) flanges, and positioned in any orientation. As shown below in figure 5, isolation valves should be installed at the inlet and outlet, and a bypass valve should be installed between the flanges. This will allow the filter to be taken offline without disruption to water flow.

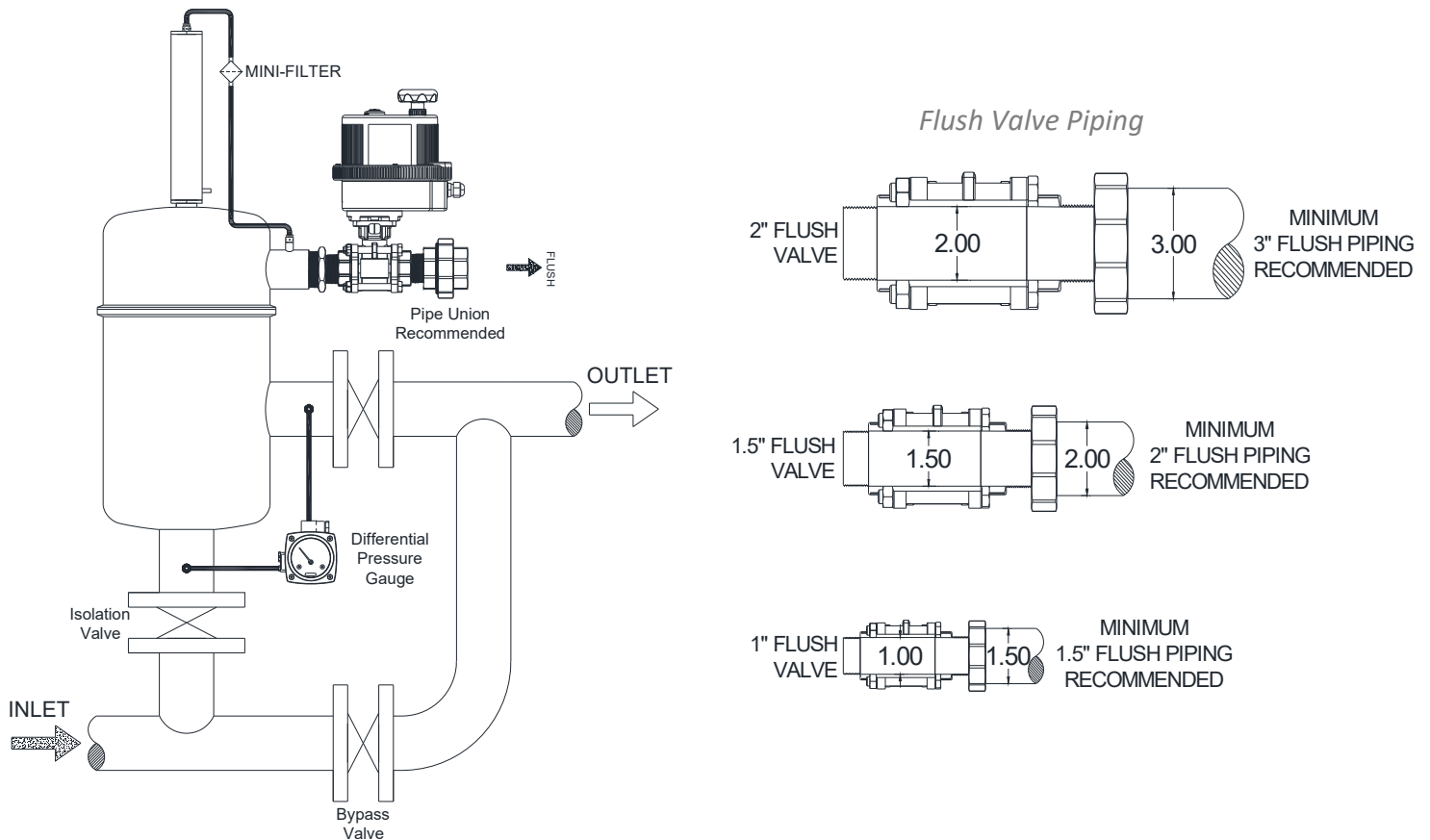


Figure 5: 90 Series Filter – Installment Layout

There should be adequate clearance around the filter to allow for easy maintenance access, including a minimum of 24" from the back (piston side). There must be enough room to remove the fine screen periodically.

Flush Line

The piping for the flush valve must have no backpressure. It is strongly recommended to use oversized piping to accommodate this requirement. For example, if the 90 Series filter uses a 1" valve, the recommended pipe is a minimum of 1.5" (see figure 5 above). **It is also recommended to add a union after the flush valve in order to service the filter.**

To minimize backpressure on the flush line, it is also important to avoid elevation gain in the flush line. Even small increases in elevation will reduce the filter's ability to perform an effective backwash cycle. If flush water must be transported to higher elevation, it is recommended to pipe the flush line to a storage tank first, and then pump it out to higher elevation. Additionally, minimize the use of elbows and shifts of direction to allow a smooth flow of water during backwash. For optimal performance, pipe fitting and nipple should be stainless steel to maximize internal diameter and reduce flow restriction.

Hydraulic Connection

Each flanged connection nozzle (N1) on the 90 Series filter has two $\frac{1}{4}$ " threaded couplings. One may be used to install a pressure gauge or other sensor equipment. The other $\frac{1}{4}$ " coupling will be used to connect hydraulic tubing from the differential pressure switch to the filter. The high-pressure line is fitted to the inlet, and low pressure fitted to the outlet.

Hydraulic Piston (if applicable)

The piston (8) is mounted on the domed end of the filter. $\frac{1}{4}$ " tubing must be installed from the fitting located on the back of the piston to the hydraulic connection (K3) on the flush outlet (N3). A mini-filter is installed on the hydraulic tubing to protect the piston.

FILTER PERFORMANCE

Normal Operation

During normal operation, dirty water enters through the inlet, flows down the center of the filter and is strained across the fine screen. As water passes from inside the screen to outside, suspended particles are trapped on the fine screen and continue to buildup, eventually creating a drop in pressure at the outlet of the filter. This drop in outlet pressure is monitored by the differential pressure gauge, which at seven PSID (pounds per square inch differential) sends a signal to the controller to initiate a backwash cycle.

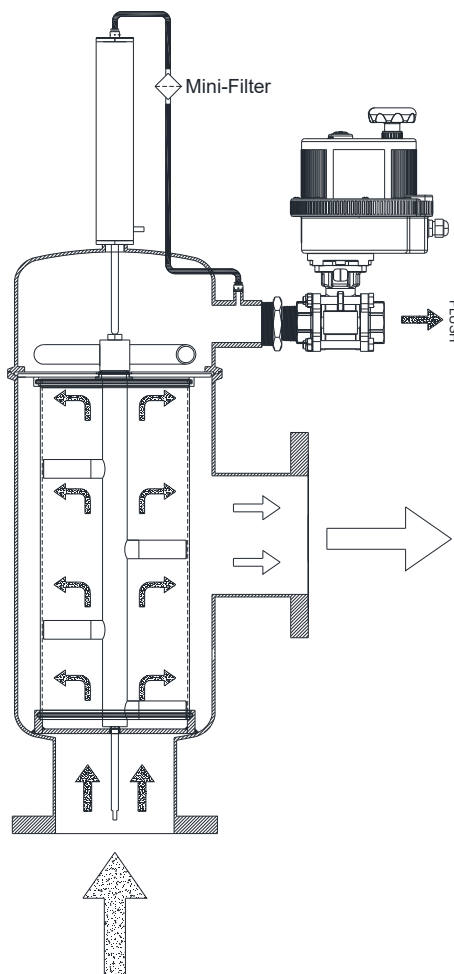


Figure 6: 90 Series Filter – Normal Operation

Backwash Cycle

The controller opens the flush valve, which causes a drop in pressure in the hydraulic motor chamber. This creates a low-pressure path inside the particle remover, which acts as a vacuum at the end of the suction nozzles, removing the built-up debris from the inside of the fine screen.

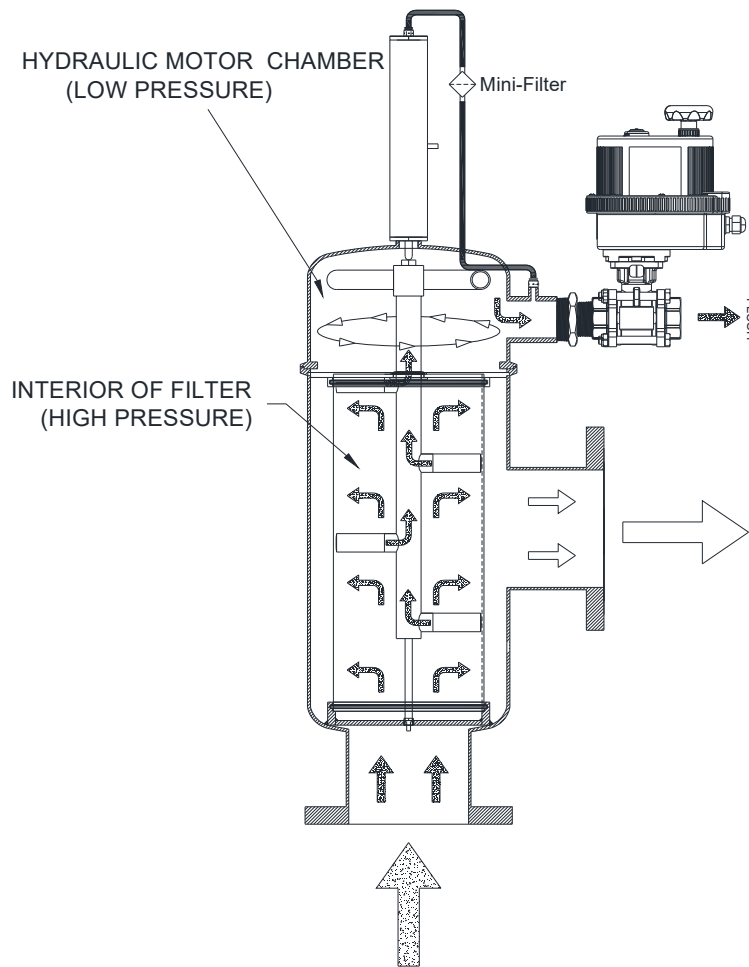


Figure 7: 90 Series Filter – Backwash Cycle

Water flows through the suction nozzles, down the interior of the particle remover, and out the hydraulic motor. The motor rotates the particle remover, enabling each suction nozzle to cover a radial strip of screen. And the pressure difference between the interior of the filter and the hydraulic motor chamber drives the particle remover toward the hydraulic piston.

The piston depressurizes during the backwash cycle, and expels the volume of water from its chamber. This acts as a timer, gradually allowing the particle remover to drive the piston rod into the piston, assuring that the suction nozzles cover the entire surface of the fine screen. When the piston reaches the end of its stroke, the backwash cycle is complete, and the flush valve closes. Pressure inside the hydraulic motor chamber normalizes with the rest of the filter, and the piston pushes the particle remover back to its original position.

After the piston and particle remover move back to their original positions, the filter returns to normal operation. During the entire backwash cycle, the main flow through the filter is never disrupted.

FLOW & PRESSURE REQUIREMENTS

Forsta 90 Series filters have a minimum pressure requirement of 40 PSI. This includes any pressure loss incurred during the backwash cycle. Therefore, the pump performance is a crucial component in determining whether the filter will perform correctly.

Pump manufacturers will provide the performance data in the form of a pump curve. This is a graph that plots pressure vs. flow rate. A pump is considered adequate for an application if it can maintain a minimum of 40 PSI while pumping the normal system flow AND the additional flow required during backwash. The additional flow depends on the filter model and what valve is used.

<u>Valve Size</u>	<u>Additional Flow Rate Required</u>
1"	40-60 gpm
1.5"	110 gpm
2"	220 gpm

Figure 8: 90 Series Filter – Valve Flow Rates

MAINTENANCE & SPARE PARTS

Startup

When pumping water through the Forsta 90 Series for the first time or after it has been empty, it is important to follow a correct sequence of valve actuation in order to prevent damage to the filter components.

With both isolation valves closed and the bypass valve open, the correct sequence is:

1. Slowly open the inlet isolation valve letting water flow into the filter. If installed, bleed out the air through a valve on the top of the filter body. Let the entire filter fill with water before moving to the next step.
2. Close the bypass valve.
3. Open the outlet isolation valve.

If it is not an option to close the bypass valve momentarily before opening the outlet valve, then both may be actuated simultaneously.

Shutdown

To remove the filter from operation, reverse the steps used for startup.

1. Close the outlet valve.
2. Open the bypass valve
3. Close the inlet valve, and slowly open the drain valve on the bottom of the filter housing. There will be residual pressure in the tank still, so use caution when draining.

If it is not an option to close the outlet valve momentarily before opening the bypass, then both may be actuated simultaneously.

Periodic Maintenance

Every six months, or whenever pumps or water flow is shutdown, it is recommended to open and inspect the filter components. Access to the internal components can be gained by removing the clamp and top section of the filter body. Simply remove the top, lift the particle remover and plate out of the filter housing and separate into two components. Inspect both for wear.

Remove the piston from the back plate and drain the water from the piston chamber. Verify that the piston rod is moving smoothly in and out, and inspect the piston tip for wear.

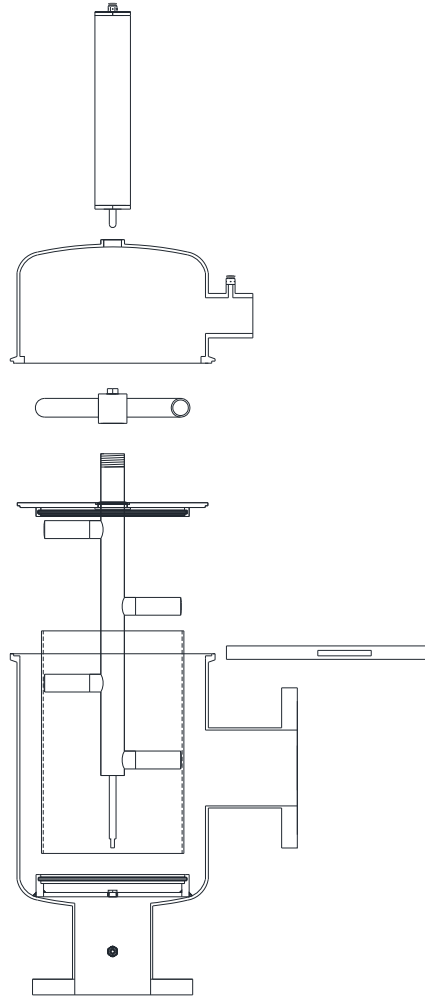


Figure 9: 90 Series Filter - Inspection

Remove the screen and particle remover, using the front cover for access. Both should be extracted in one piece. Separate the two items and inspect both for damage. The screen mesh and bushing should be inspected for wear. Also inspect the particle remover rod and suction nozzles for wear. If rod bushing needs to be replaced, apply Loctite Threadlocker to the bushing threads before installing the new one.

When taking care of the filter, also perform the same periodic maintenance on the piston itself. A step-by-step description of disassembling the piston for maintenance and replacement of parts is displayed on page 12 of the manual.

Particle Remover

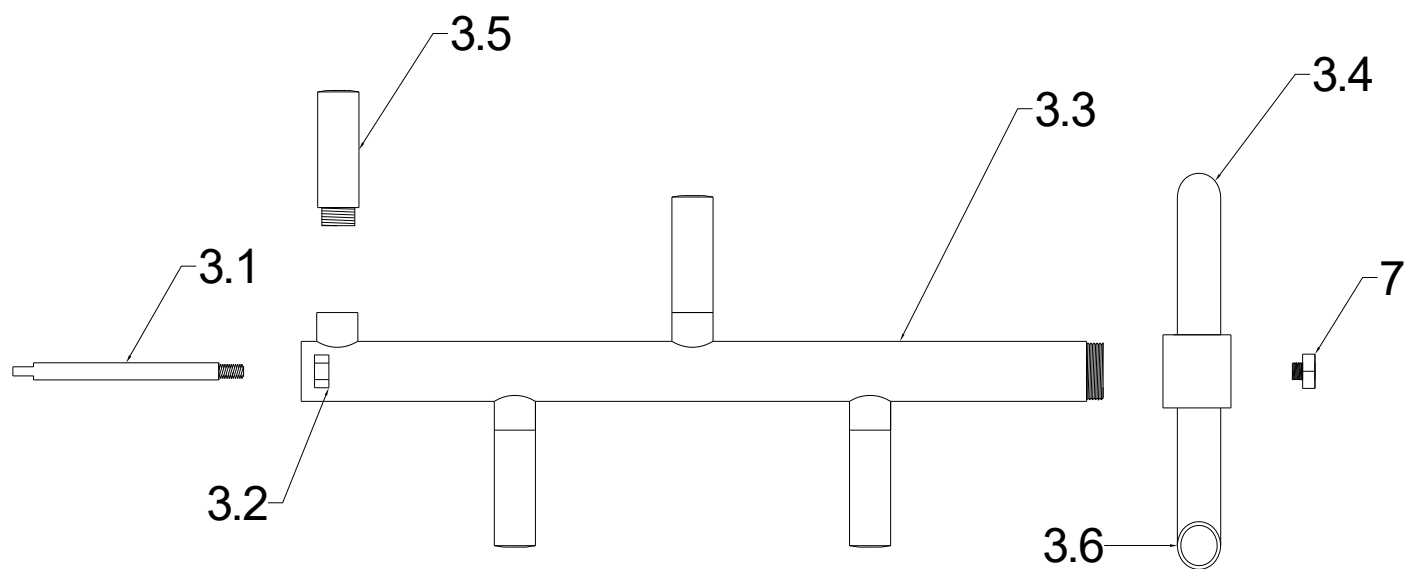


Figure 10: 90 Series Filter – Particle Remover

Part Name	Part No.
Particle Remover Rod	3.1
Counter Nut	3.2
Particle Remover Casing	3.3
Hydraulic Motor	3.4
Suction Nozzle	3.5
Hydraulic Motor Insert	3.6
Stainless Steel Hex Spacer	7

Figure 10-1: 90 Series Filter – Particle Remover Parts List

Spare Parts

Spare parts for your Forsta Self cleaning filter are listed below. We offer packages for 2-year, and 5-year increments.

Spare parts for maintenance for **two** years include:

Part Number	Description	Qty
1.7-90/180C/LP180C-UHMWPE	Plate Bushing	1
1.8-90/180C/LP180C-UHMWPE	Plate Bushing O-Ring	1
16-1/4	Mini Filter	1
17-Fitting/Tubing	Fitting & Tubing	1
18-D/P-HK	Pressure Differential Switch	1
3.5-90/180C	Suction Nozzles	3-5
4-90/180C/LP180C-VHL	Stainless Steel Bushing	1
5-90/180C/LP180C	Housing Seal	1
6-90/180C/LP180C	Screen O-Ring	2
7-90/180C-316L-VES	Spacer	1
8K-90/180C	Piston Repair Kit	1
10-90/180C/LP180C	Stainless Steel Clamp	1

Spare parts for maintenance for **five** years include:

Part Number	Description	Qty
1.7-90/180C/LP180C-UHMWPE	Plate Bushing	2
1.8-90/180C/LP180C-UHMWPE	Plate Bushing O-Ring	2
2-90	Fine Screen	1
3-90	Particle Remover	1
3.1-90	Particle Remover Rod	1
3.5-90	Suction Nozzles	3-5
4-90/180C/LP180C-VHL	Bushing	2
5-90/180C/LP180C	Cover Seal	2
6-90/180C/LP180C	Screen O-Rings	4
7-90/180C-316L-VES	Stainless Steel Hex Spacer	2
8-90-316L	Hydraulic Piston	1
8.10-90-316L	Piston Rod	2
8K-90	Piston Repair Kit	2
12-EBV-24VAC-BN	Valve	1
16-1/4	Mini-Filter	2
18-D/P-HK	Differential Pressure Gauge	2
17-Fitting/Tubing	Fitting & Tubing	2

Figure 11: 90 Series Filter – 2- and 5-Year Parts Maintenance

Hydraulic Piston

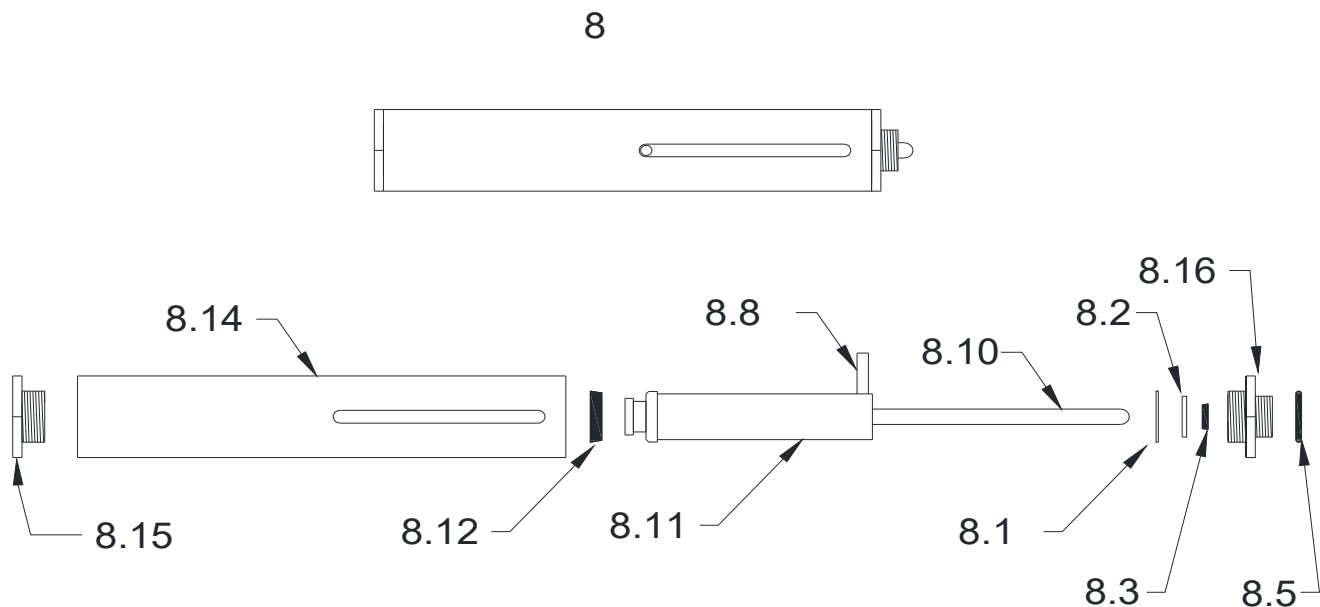
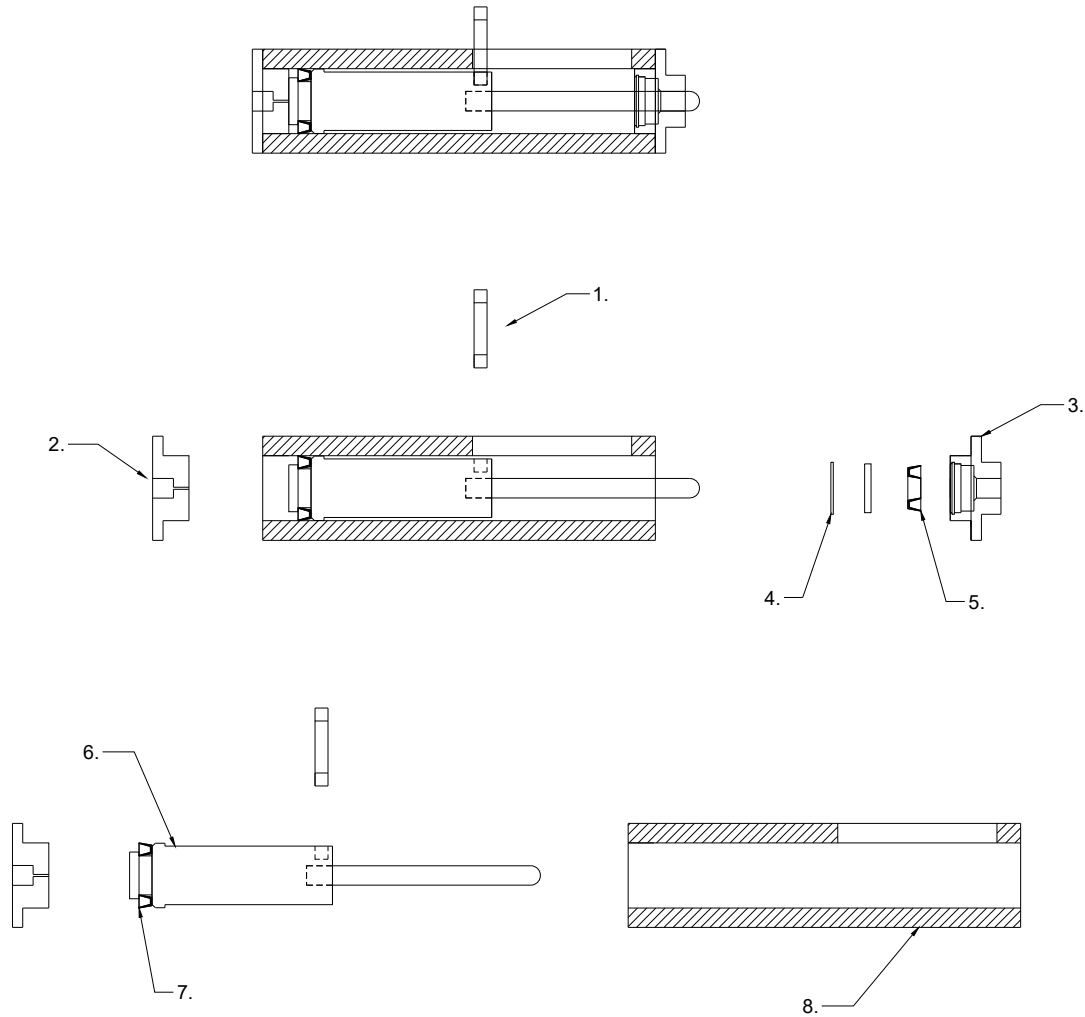


Figure 12: 90 Series Filter – Hydraulic Piston

Part Name	Part No.
Hydraulic Piston Assembly	8
Snap Ring	8.1
Head Ring	8.2
Shaft U-Cup	8.3
Head O-Ring	8.5
Piston Pin	8.8
Piston Shaft	8.10
U-Cup Holder	8.11
Casing U-Cup	8.12
Casing	8.14
Casing Cap	8.15
Piston Head	8.16

Figure 12-1: 90 Series Filter – Part List – Hydraulic Piston

Piston Seal Replacement Guide



To replace the seals in a 90 series piston:

1. Unscrew piston pin (8.8)
2. Unscrew piston casing cap (8.15)
3. Unscrew piston head (8.16)
4. Use retaining ring pliers to remove snap ring (8.1) and head ring (8.2)
5. Replace shaft U-cup (8.3)
6. Remove U-cup holder (8.11)
7. Replace casing U-cup (8.12)
8. Clean casing (8.14) and lubricate using Molykote 111 or silicone grease

Figure 13: 90 Series Filter – Piston Seal Replacement

Troubleshooting Guide

1. Pressure
 - a. Record the pressure reading at inlet connection K1. If the pressure is below 40 psi, this is your problem.
 - i. Solution - Increase system pressure by:
 1. Choking the outlet of the filter
 2. Ramping up the pump
 3. Replacing pressure gauge if defective
2. Backwash Pressure
 - a. Record the pressure reading at inlet connection K1 during a backwash (flush valve open). If pressure is below 40 psi, this is your problem.
 - i. Solution - Increase system pressure by:
 1. Choking the outlet of the filter
 2. Ramping up the pump
 3. Replacing pressure gauge if defective
3. Flush Port
 - a. Record the pressure reading at the flush outlet connection K3 during backwash. If no pressure gauge is installed on K3, add a tee ("T") connection to install gauge. If the pressure does not show 0 psi during a backwash, this is your problem.
 - i. Solution
 1. Re-pipe the flush line to prevent back-pressure. Remove elbows, elevation gain, and oversize the pipe
 2. Flush directly into a nearby tank
 3. Increase flush valve size (1" to 1.5", 1.5" to 2")
4. Mini-filter
 - a. Inspect mini-filter located on the piston tubing line. If the mini-filter is clogged, this is your problem.
 - i. Solution
 1. Wash the mini-filter
5. Hydraulic Piston
 - a. Inspect the hydraulic piston. Verify that the rod can smoothly move back and forth, and that the pin moves the entire length of the slot. If pin does not move smoothly this is your problem.
 - i. Solution
 1. Open the hex cap and inspect the rubber seals for wear. They may need replacing
 2. Check that the hex cap has a small hole through it to allow water to flow out of the piston. If this orifice is obstructed, remove debris
6. Particle Remover
 - a. Inspect the internal components for smooth operation. If particle remover is jammed, this is your problem.
 - i. Solution
 1. Bypass the filter and relieve pressure. Open the clamp and remove the top section of the filter. The particle remover should rotate freely inside the center of the plate
 2. Remove the plate and inspect the particle remover. The rod should be inserted into the bushing near the inlet of the filter. There should be clearance between the suction nozzles and the screen
 3. Check for any severe damage or wear on any of the components

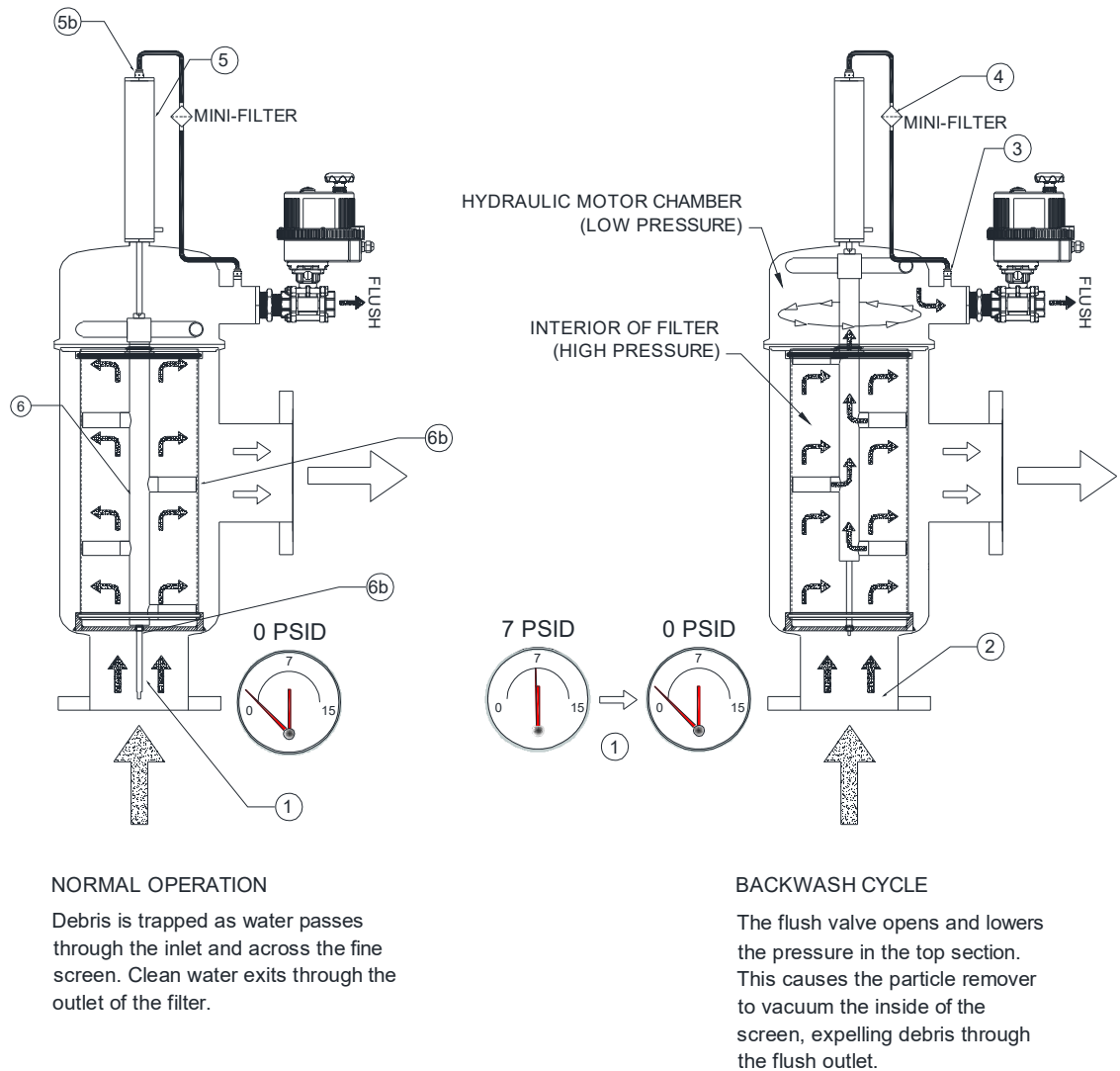
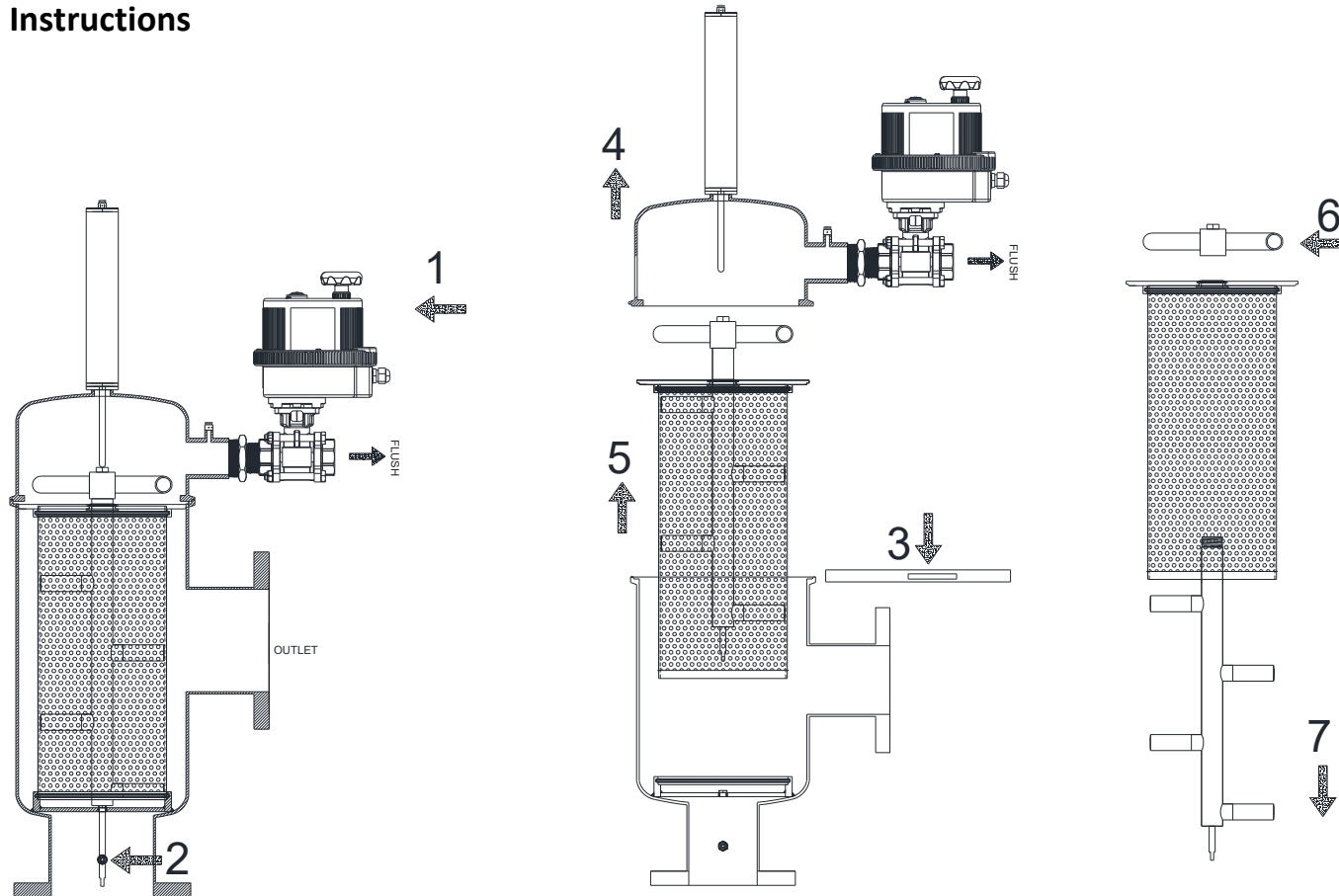


Figure 14: 90 Series Filter - Troubleshooting

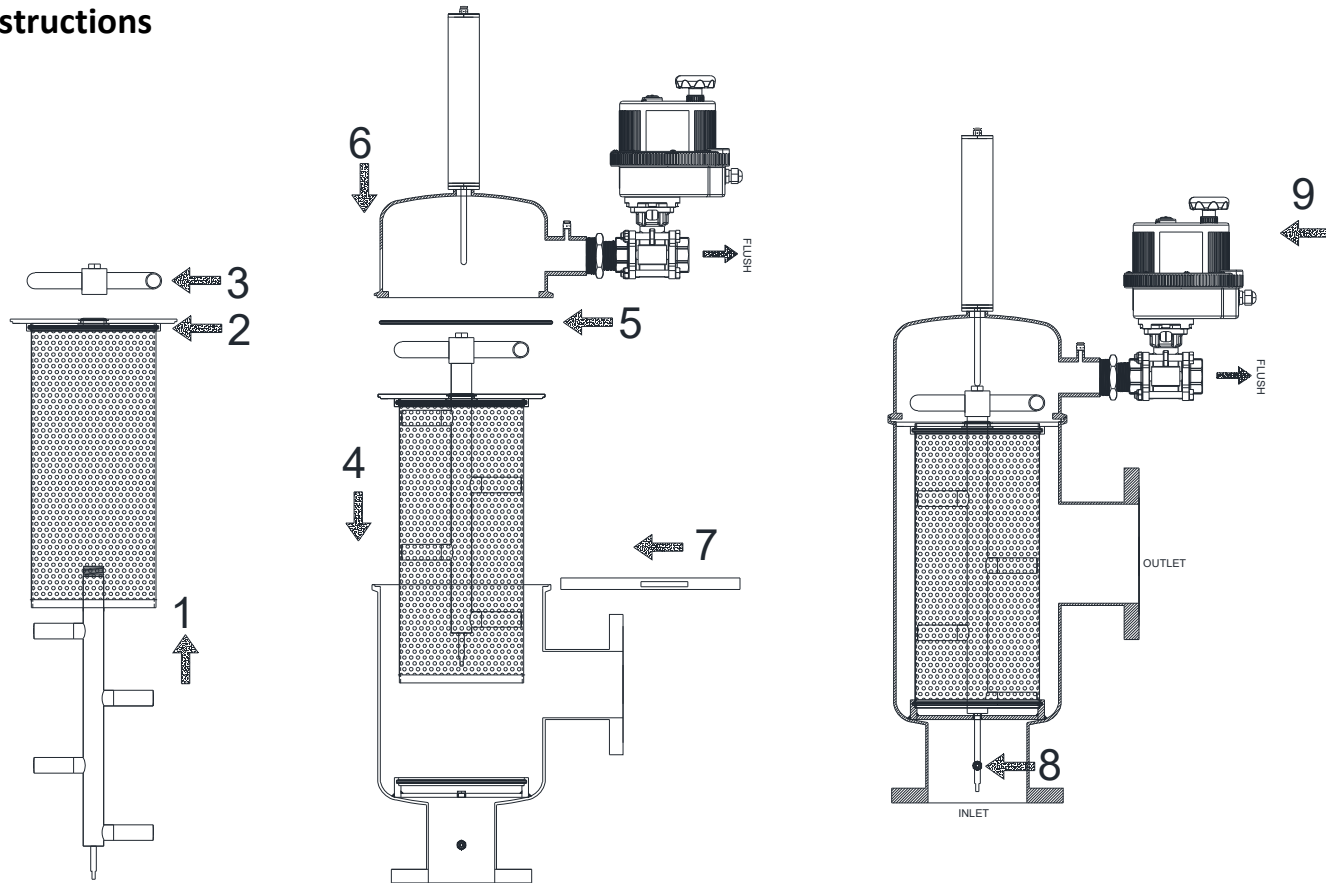
Screen Removal Instructions



1. Relieve pressure in the filter body by first running a backwash cycle. Monitor the pressure gauge on the flush outlet and stop once zero PSI is reached.
2. Drain the filter body by removing the fittings on the inlet pipe.
3. Remove the clamp holding the top section and filter body together.
4. Remove the entire system of top section, piston, and flush valve all together.
5. Remove the particle remover and fine screen system all together.
6. Remove the hydraulic motor sprinkler. (Please note the sprinkler has a left-handed thread)
7. Separate the particle remover and fine screen while examining any contamination or damage to the components.

Figure 15: 90 Series Filter – Screen Removal

Screen Installation Instructions



1. Insert the particle remover into the screen guiding the particle remover through the bushing.
2. Lubricate the screen O-rings with NSF 61 approved silicone grease before installation.
3. Install the sprinkler for the hydraulic motor.
4. Place the fine screen and particle remover system into the filter body.
5. Lubricate cover seal O-ring with the same NSF 61 approved silicone grease and place in the groove between plate and filter body.
6. Place top section with the piston and valve onto the filter body to close the filter.
7. Place the clamp around and secure the top section to the filter body.
8. Install the fitting in the hydraulic connection that was taken out to drain the filter body.
9. Run the systems backwash cycle and ensure there are no leaks before returning to normal function.

Figure 16: 90 Series Filter – Screen Installation

90 Series Filters Wiring

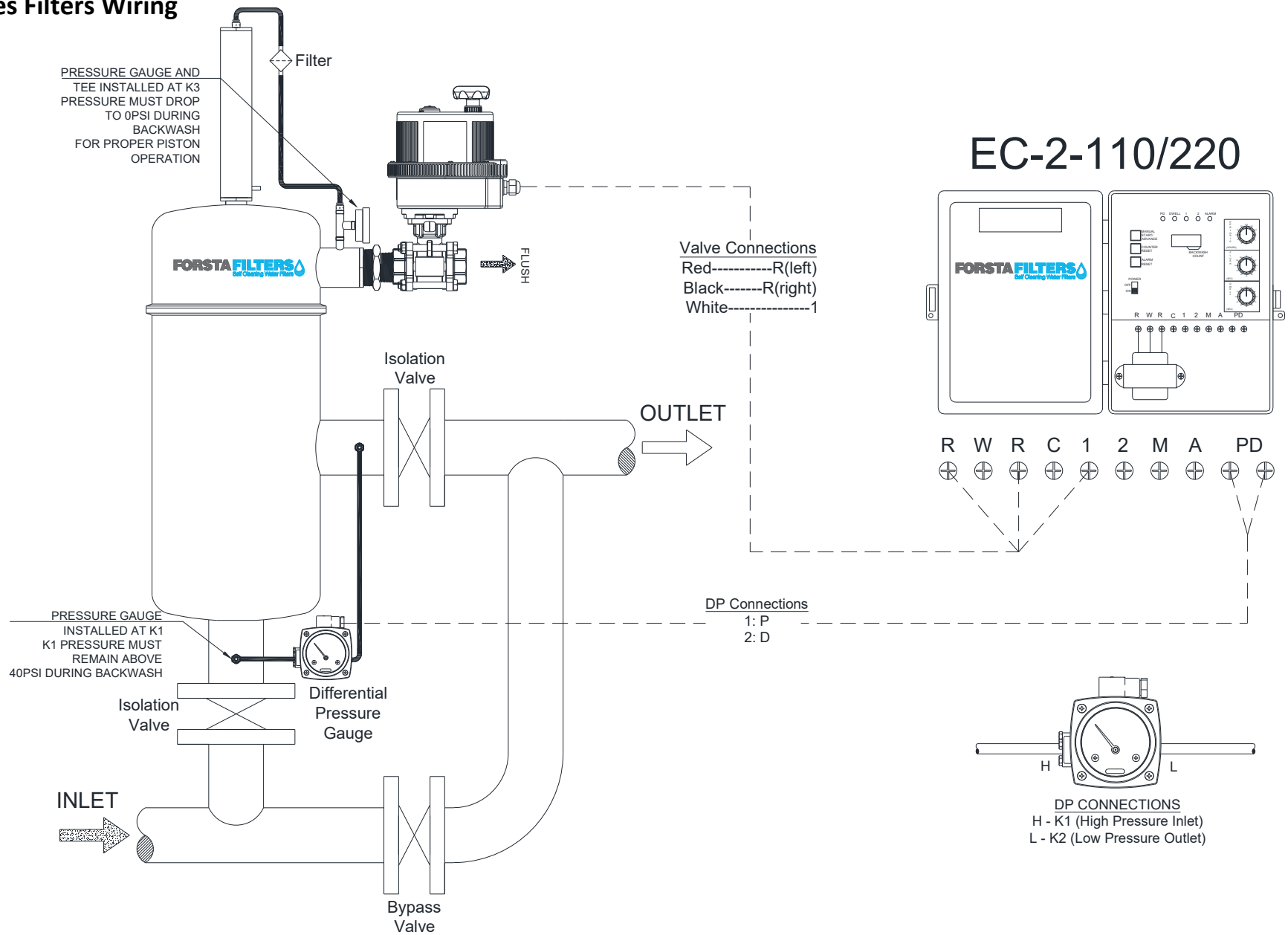


Figure 17: 90 Series Filter – EC-2 Wiring

2x90 Series Filters in Parallel

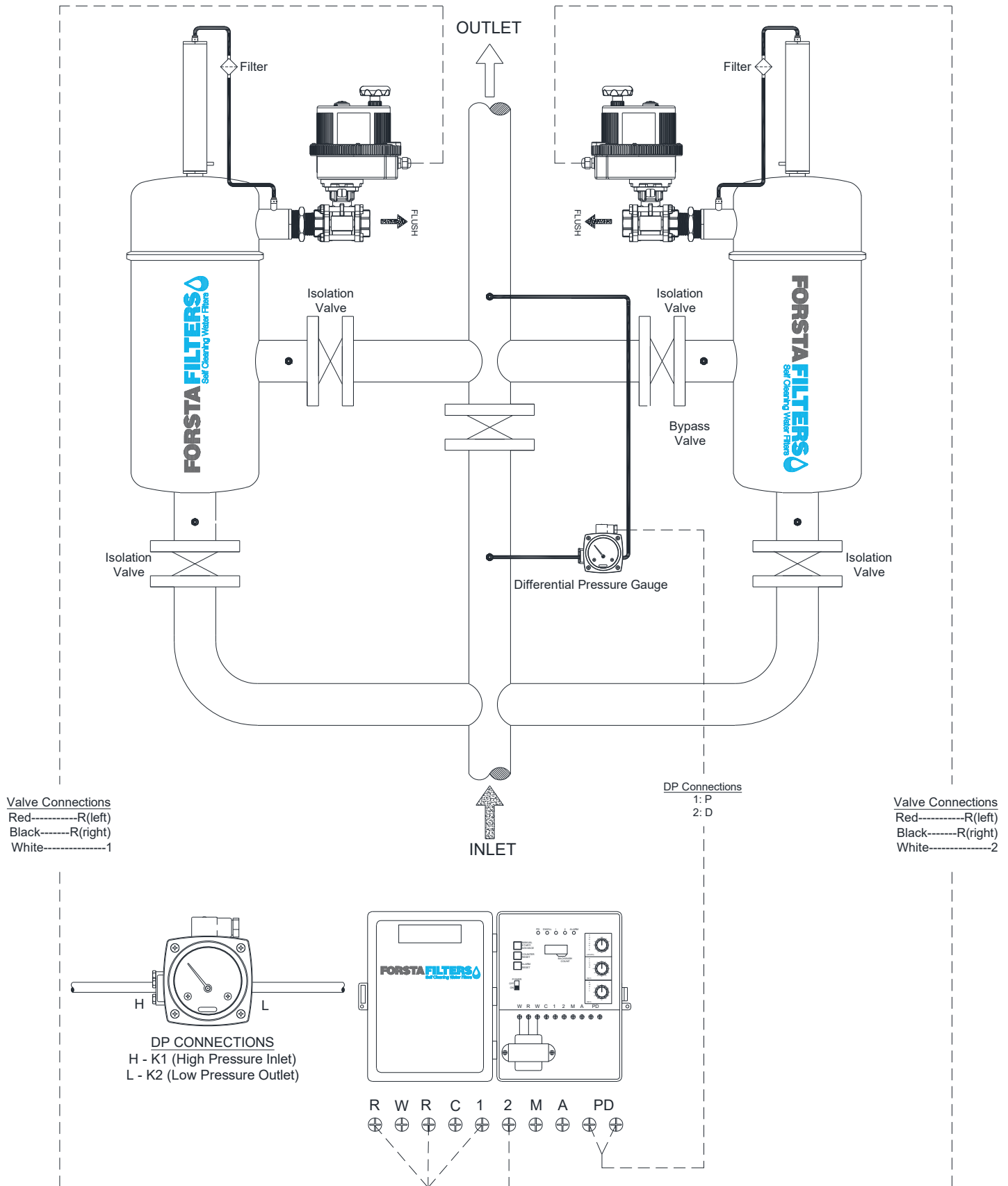


Figure 18: 90 Series Filter – 2x90 in Parallel

FORSTA FILTERS LIMITED WARRANTY

Forsta Filters warrants that all self-cleaning water filters, components, and accessories will be free from defects in materials and workmanship for a period of **one (1) year from the date of installation, or eighteen (18) months from the date of original shipment, whichever occurs first.**

During the warranty period, Forsta Filters will, at its discretion, repair or replace any part determined to be defective, provided the equipment has been properly handled, installed, and operated in accordance with the accompanying Operation & Maintenance Manual and accepted engineering practices.

This warranty is limited to the repair or replacement of defective products supplied by Forsta Filters. Forsta Filters shall not be liable for any incidental, consequential, or indirect damages arising from the use of its products, services, or data.

No agent, distributor, or sales representative is authorized to alter or extend the terms of this warranty without the express written consent of Forsta Filters, Inc.

Return shipping costs are the responsibility of the purchaser. All returned items must be sent directly to Forsta Filters for evaluation.