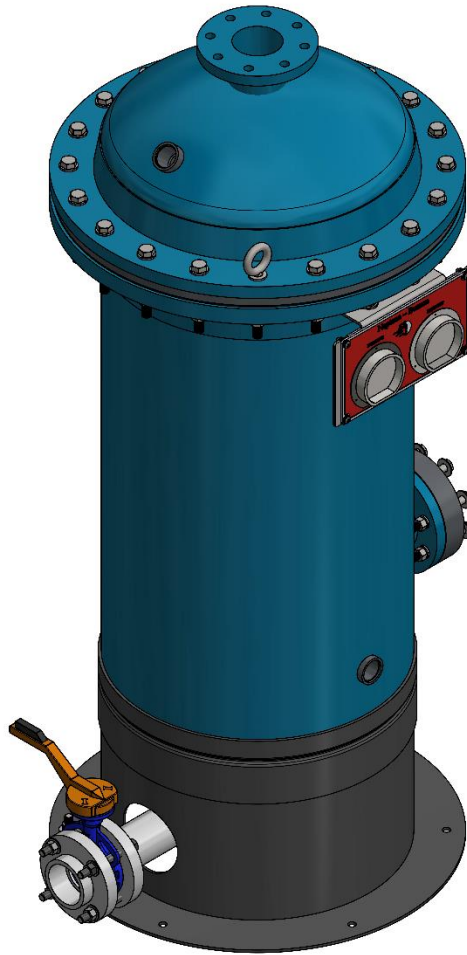


# Defender® FP-Series Featuring PowerBump™ System

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## Installation and Operation Manual



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[www.defenderfilter.com](http://www.defenderfilter.com)

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# INTRODUCTION

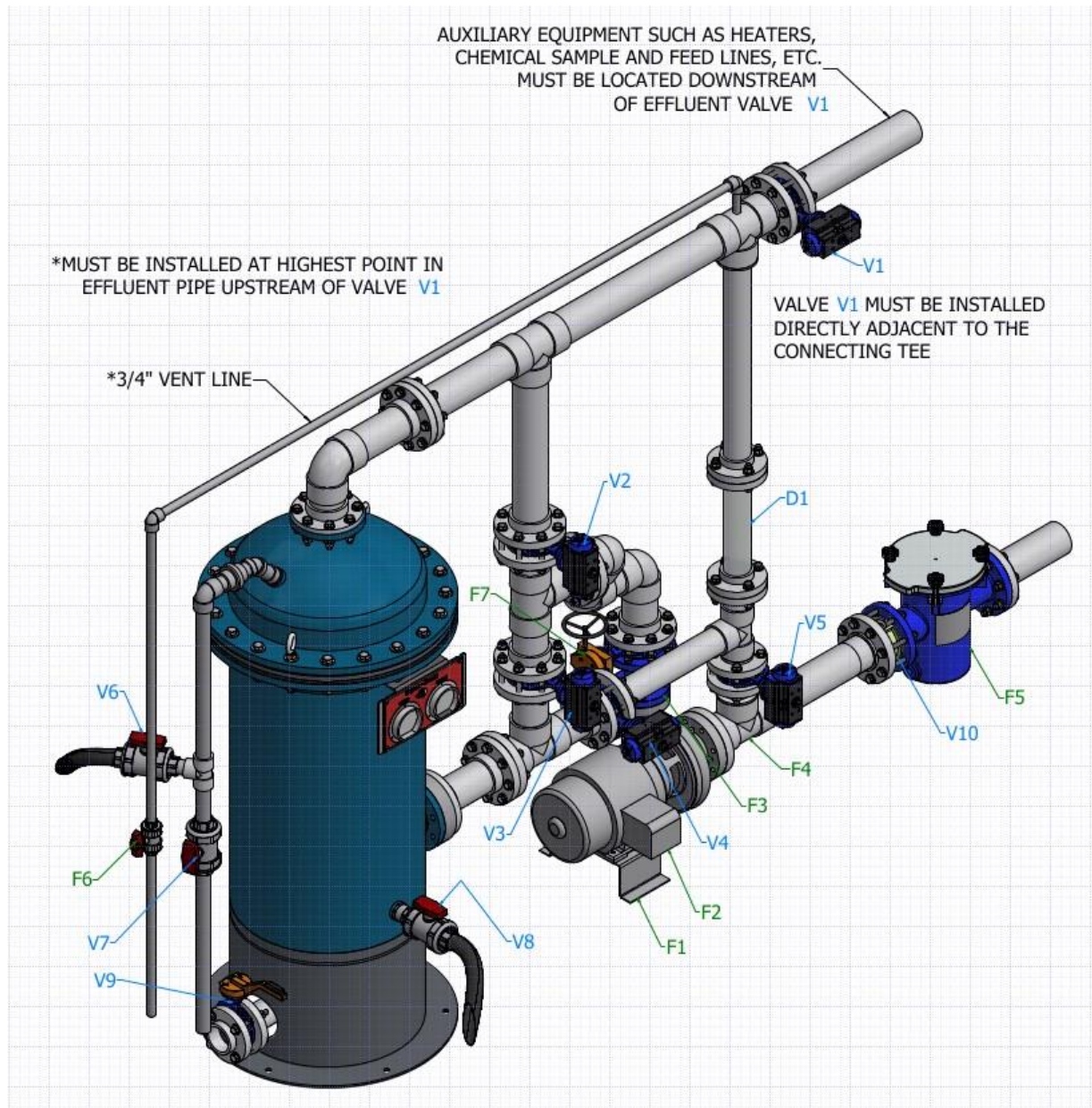


Figure 1: Power Bump Regenerative Media Filter Schematic

| Mark | Reference              |
|------|------------------------|
| V1   | Effluent valve         |
| V2   | Power bump valve       |
| V3   | Power bump valve       |
| V4   | Power bump valve       |
| V5   | Precoat valve          |
| V6   | Vacuum transfer valve  |
| V7   | Vacuum vent valve      |
| V8   | Vacuum hose valve      |
| V9   | Tank drain valve       |
| V10  | Check Valve (4" or 6") |
| V11  | In-line sight glass    |

| Mark | Reference               |
|------|-------------------------|
| F1   | Pump base               |
| F2   | Pump                    |
| F3   | Reducer                 |
| F4   | Precoat tee             |
| F5   | Strainer                |
| F6   | Precoat Line Vent Valve |
| F7   | Pump Throttling Valve   |

# SPECIFICATIONS

| Filter Media                     | Perlite                                     |
|----------------------------------|---------------------------------------------|
| Media Regeneration Method        | PowerBump™                                  |
| Filtration Area                  | 212 ft² (19.7 m²)                           |
| Minimum Flow Rate                | 107 gpm (24 m³/hr)                          |
| Maximum Flow Rate                | 300 gpm (68 m³/hr)                          |
| Maximum Allowable Water Pressure | 50 psi (3.45 Bar)                           |
| Required Air Pressure            | 90-110 psi (6.2 – 7.6 Bar)                  |
| Maximum Water Temperature        | 104°F (40°C)                                |
| Maximum Ambient Temperature      | 110°F (43°C)                                |
| Minimum Ambient Temperature      | 0°F (-17°C) (Above 36°F when full of water) |
| Controller Power                 | 110/230 VAC 15/10A 50-60Hz                  |
| Drain Line                       | 100 gpm (23 m³/hr) Surge Flow (atmospheric) |
| Installation Location            | Indoor/Outdoor                              |

## SAFETY

The Defender FP-Series RMF is a system designed to run 24/7 with limited supervision. Ensure that all precautions are taken to maintain the safety of operators or service technicians and restrict access to unauthorized personnel.

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | Inhalation hazard may be present when loading Perlite media. Minimize dust exposure through proper handling and wear respiratory PPE if necessary.                                                                                                                                                                                                                 |
|  | The potential of skin burn injury exists when handling or servicing the pneumatic actuators and pump when on or shortly after stopping the system. Use caution around the system and avoid the heated areas during operation. Use personal protective equipment to prevent burns if necessary.                                                                     |
|  | A potential hearing hazard exists when pumps and compressors are in operation. Repair malfunctioning equipment immediately and install sound absorbing protective measures if necessary.                                                                                                                                                                           |
|  | Potential electrical hazards exist when servicing the local control panel and pumps. Always isolate electrical power supplies before servicing powered equipment and devices. After isolating, ensure power has dissipated from circuit components before accessing panels and equipment. Exercise caution around pools of water that may have become electrified. |
|  | Potential slip hazards exist over the lifetime of operating equipment. Wear slip resistant shoes and repair leaking connections or piping immediately.                                                                                                                                                                                                             |
|  | A potential moving parts hazard exists when servicing or inspecting centrifugal pumps or actuated valves. Turn off control to pumps and valves before servicing. Do not operate without guards in place.                                                                                                                                                           |

# INSTALLATION

The following sections cover the positioning of the filter, installing the tank leg anchors, gauge panel, the control enclosure and the filter/regulator, connecting the pneumatic actuator tubing, and adjusting the pneumatic actuator.

## WARNING

Use of personal protective equipment (PPE) is necessary for the installation and maintenance procedures outlined in this manual. Safety glasses and safety shoes should be worn for all maintenance procedures. Exercise caution around pressurized air lines, electrical hazards, and potentially slippery surfaces when wet.

## Positioning the Filter

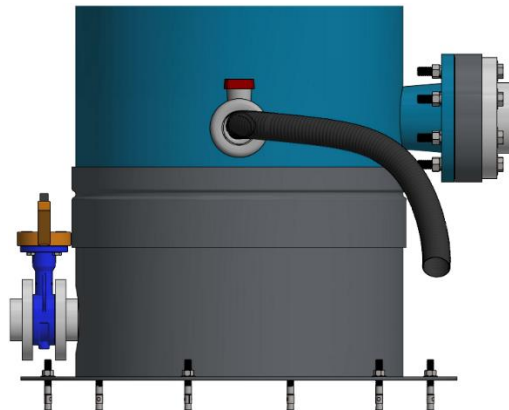
Position the filter using one of the following methods:

- a. Use the two eye bolts to lift the filter into position.
- b. Use a hand truck to position the filter.

## Installing the Tank Anchors

### WARNING

The FP Series RMF filter is equipped with mounting anchors to secure it to the floor. Anchors must be installed per the manufacturer's instructions before attempting to lift the filter head (top plate). Failure to properly bolt the filter to the floor can result in bodily injury and equipment damage.



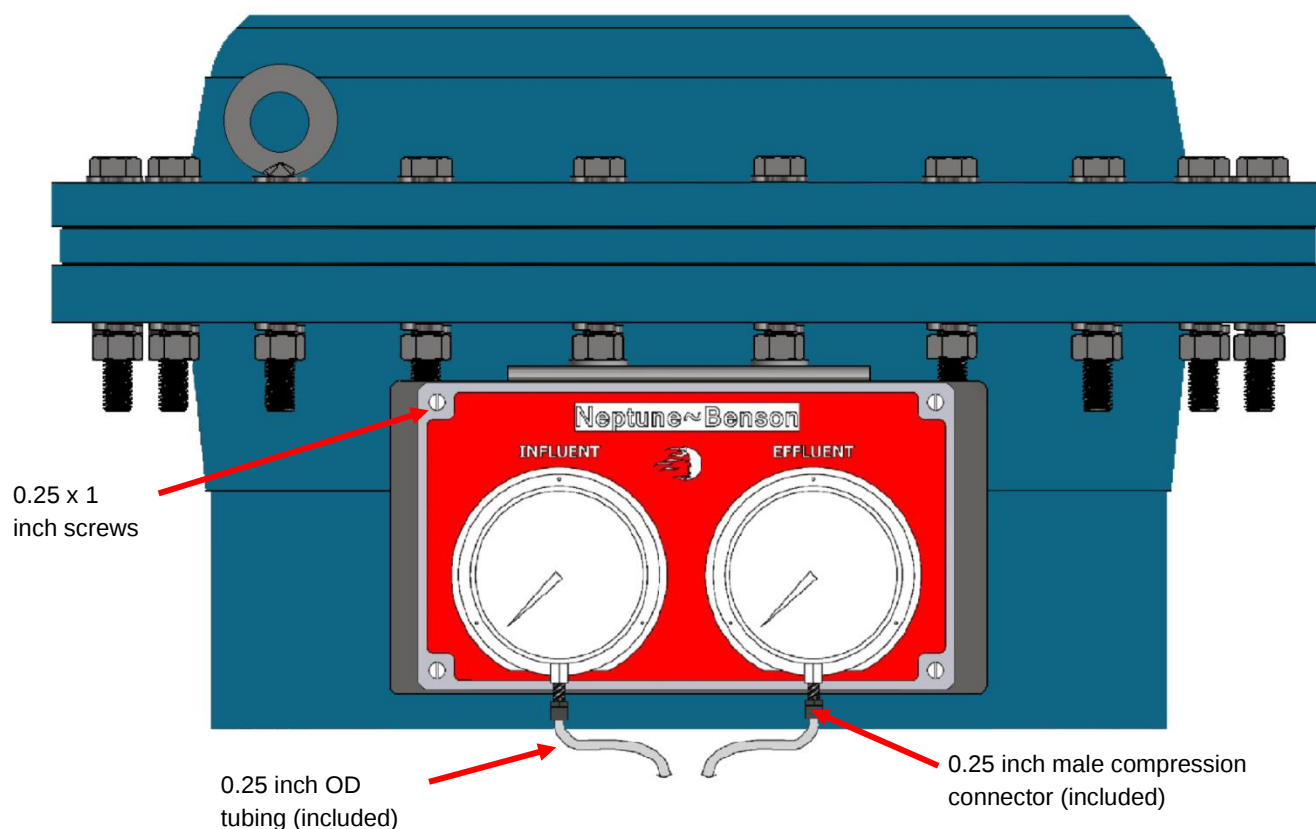
**Figure 2: Tank Anchor Installation Locations**

1. With the filter tank in its installed location, use a 0.5 inch carbide-tipped concrete drill bit to drill a 2.625 inch hole in the floor. There should be 3 inches of depth from the top of the saddle base.
2. Remove all concrete dust from the holes.
3. Place the washers and nuts on the anchor.
4. Insert the anchor through the floor base into the hole.
5. Being careful not to damage the threads, hammer the anchor into the hole as far as it will go.
6. Repeat Steps 3 and 4 for all six anchor locations.
7. Tighten all six bolts to 60 lbf.-f (81 N-m).

## NOTE

In order to conform with the ASCE 7-16 Seismic Design criteria, anchor bolts must be installed at least 10 inches (25.4 cm) from the edge of a concrete pad that is more than 6 inches (15.2 cm) deep. Failure to follow these guidelines will compromise seismic integrity.

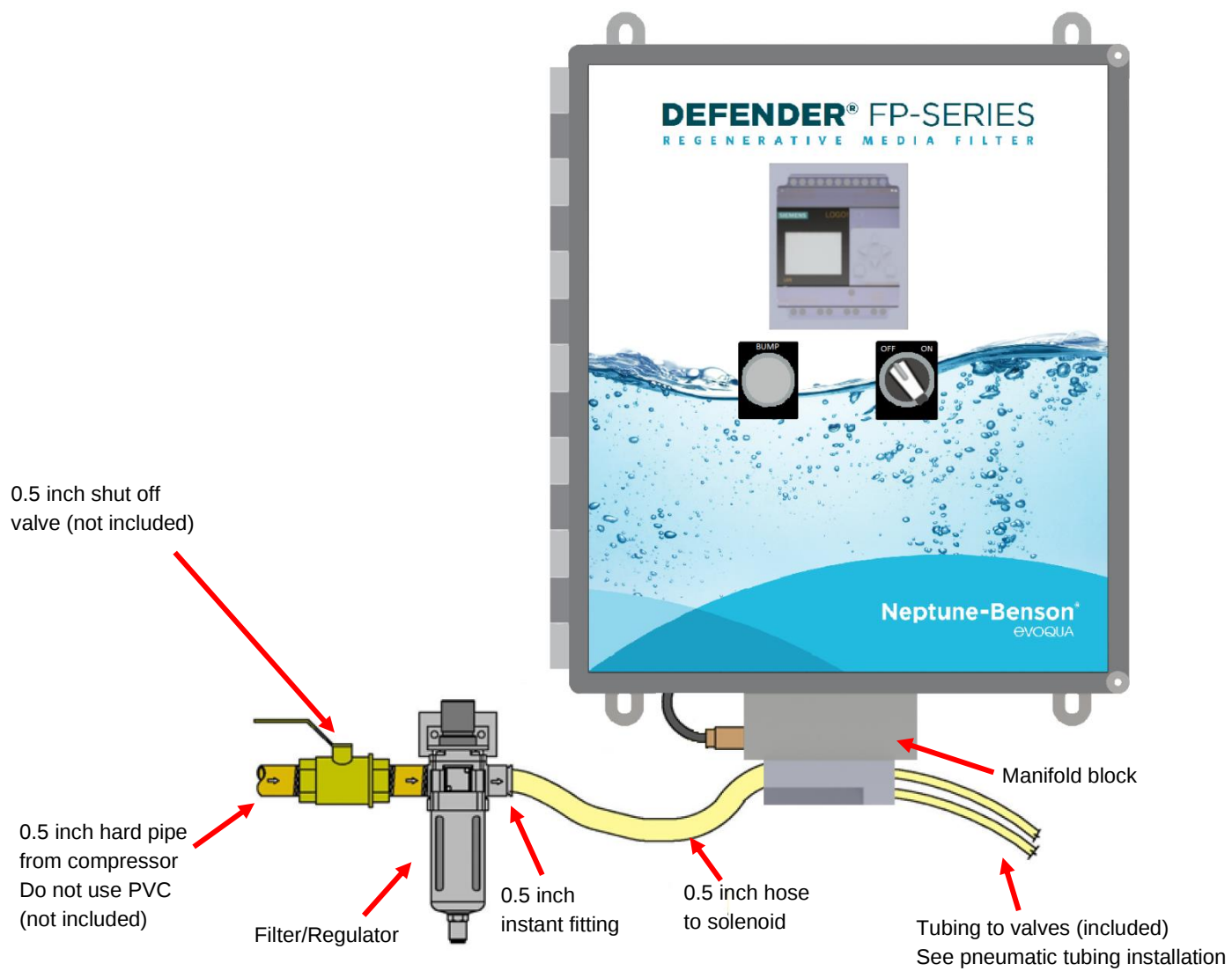
## Installing the Gauge Panel



**Figure 3: Gauge Panel**

1. Remove two (2) adjacent bolts from the top cover in your desired location to make the pressure gauges easily visible.
2. Install the 6 inch bolts (provided) in the empty bolt holes and torque to 55 ft-lbs (75 N-m).
3. Install the gauge panel mounting bracket by inserting the longer flange bolts through the channel in the bracket and secure with 0.75 inch nuts (included)
4. Bolt the gauge panel to the mounting bracket using four 0.25 x 1 inch screws, washers, and nuts (included).
5. Connect 0.25 inch tubing (included) to the gauges using the compression connectors (included)
6. Connect the tubing to the influent and effluent piping as close to the filter as possible.

## Installing the Control Enclosure and Filter/Regulator



**Figure 4: Control Enclosure and Filter/Regulator**

## Control Enclosure

### WARNING

It is the responsibility of the end user to adhere to all regulations regarding electrical equipment installation. Ensure all parts are properly grounded, safe from water intrusion and has a proper disconnect. Consult a licensed electrician.

1. Mount the control enclosure at eye-level to a wall using anchors compatible with the type of wall construction; block, plaster, wood, etc. The anchors are not included.

### NOTE

When mounting the control enclosure, ensure that there is enough clearance for the pneumatic tubing from the compressor to the panel and the pneumatic tubing from the panel to the valves.

2. Power to the control panel should be provided by a disconnect with GFCI and overcurrent protection supplied by others. Recommended protection is 120/230 VAC, 15/10 A.
  - **Line Power:** Connect to TERMINAL 100.
  - **Neutral:** Connect to TERMINAL 100A.
  - **Ground:** Connect to GROUND LUG (located at the upper right corner of the panel).
3. Connect the dry contact run signal and return signal from pump
  - Terminals 232 and 232A provide a (NO) dry contact signal to be sent to the pump when the filter is on
  - Terminal 205 can be used to return a (NC) +24V DC signal from the pump to indicate the pump is running

### NOTE

If no return signal is available from your pump to indicate no fault, a jumper will need to be installed. Use a small piece of wire to connect terminals 110 and 205. If this is not done, the controller will interpret a fault.

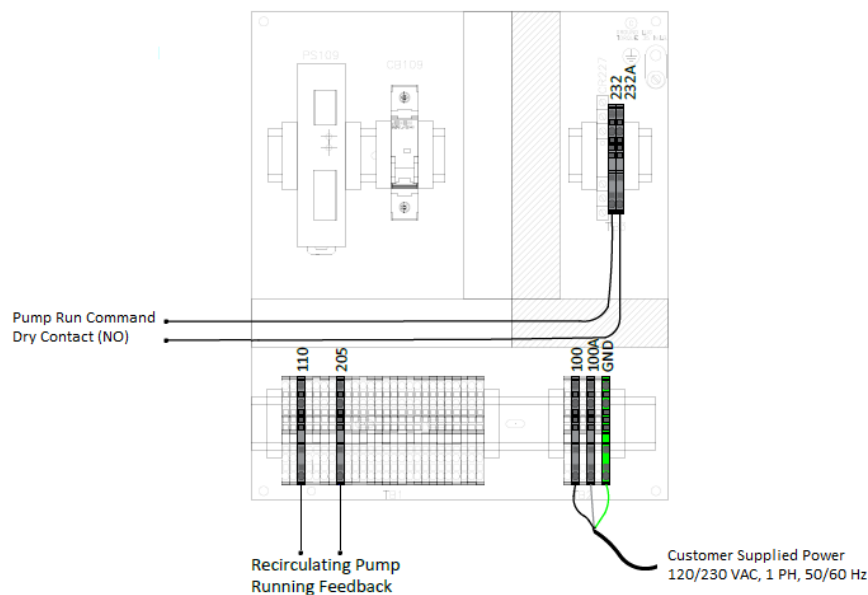


Figure 5: Field wiring diagram

### WARNING

The control enclosure can be supplied with either 120/230 VAC which is a danger to life. Lock out and tag out (LOTO) the electrical disconnect supplying the controller before servicing.

## Filter/Regulator

### NOTE

2.6 CFM at 90 psig of Clean/Dry air is required to maintain the life of the solenoid valves and pneumatic actuators. A Filter/Regulator and Water Separator can be sourced independently or purchased through Neptune Benson. Failure to use these items will void the warranty of affected parts.

1. Attach the filter/regulator to a wall using anchors compatible with the type of wall construction, Block, plaster, wood, etc. The anchors are not included.
2. Add an isolation valve before the filter/regulator. Mount the valve on the wall
3. Use iron piping, galvanized piping, or an air hose (not PVC) to connect the compressor to the filter/regulator.
4. Connect the line from the compressor to the filter/regulator.
5. Connect the filter/regulator to the manifold tab.

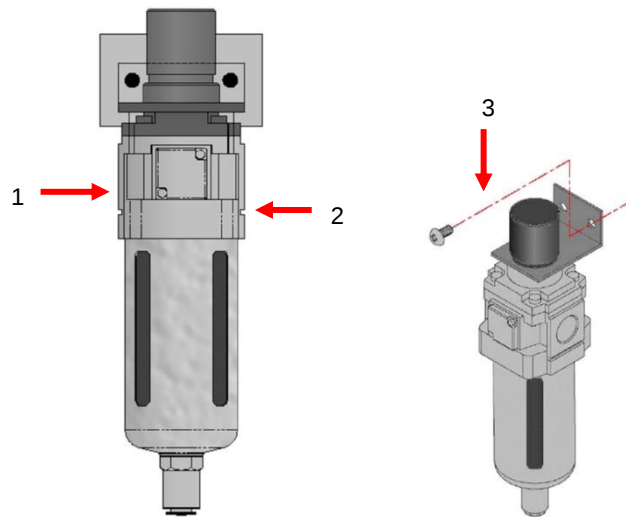
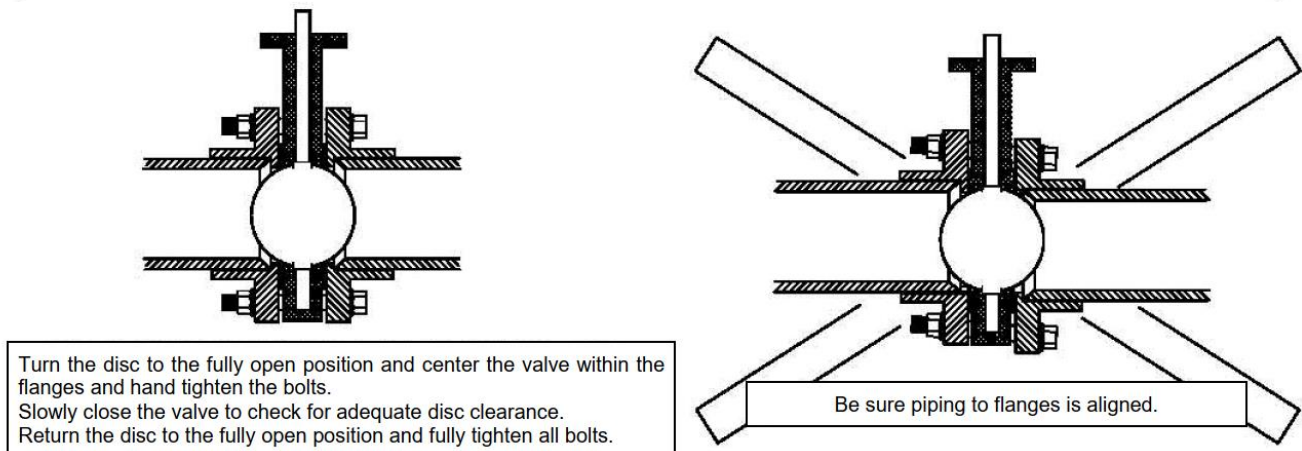
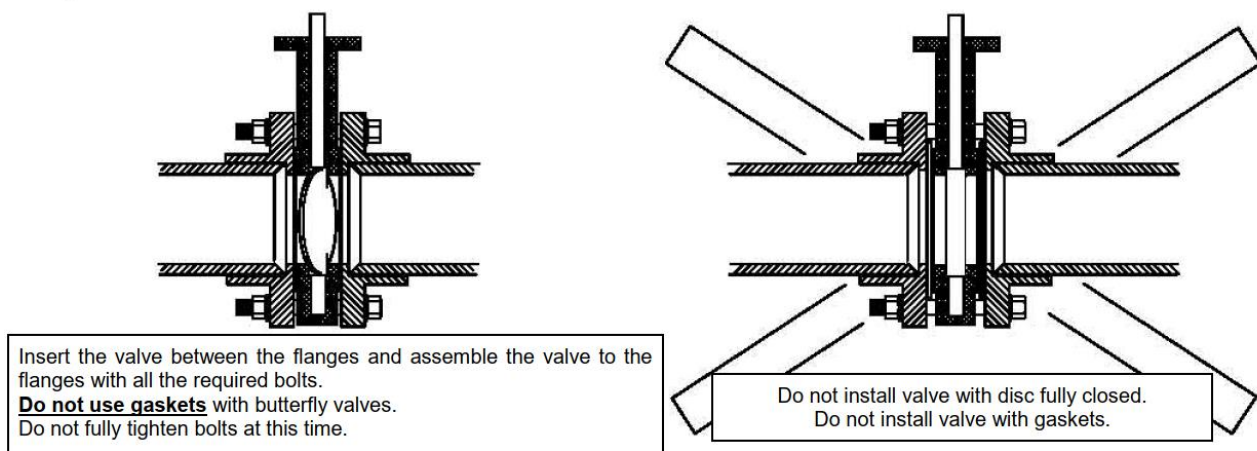
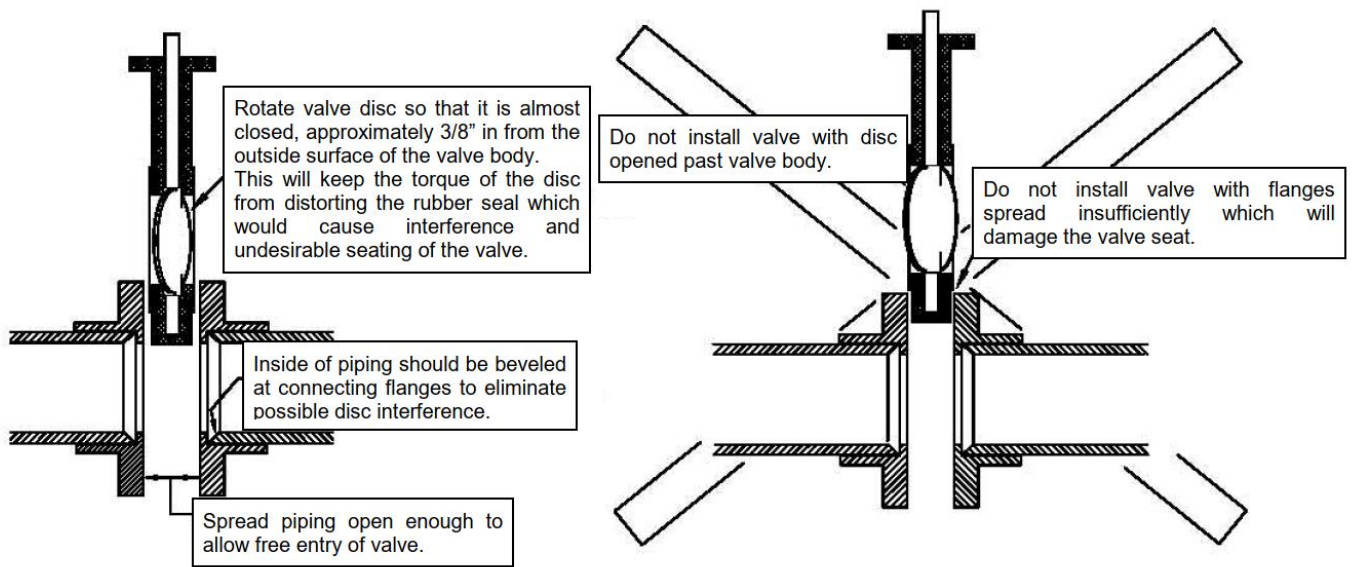


Figure 6: Filter/Regulator/Water Separator Unit

## Installing the Butterfly Valves



# Making the Pneumatic Actuator Tubing Connections

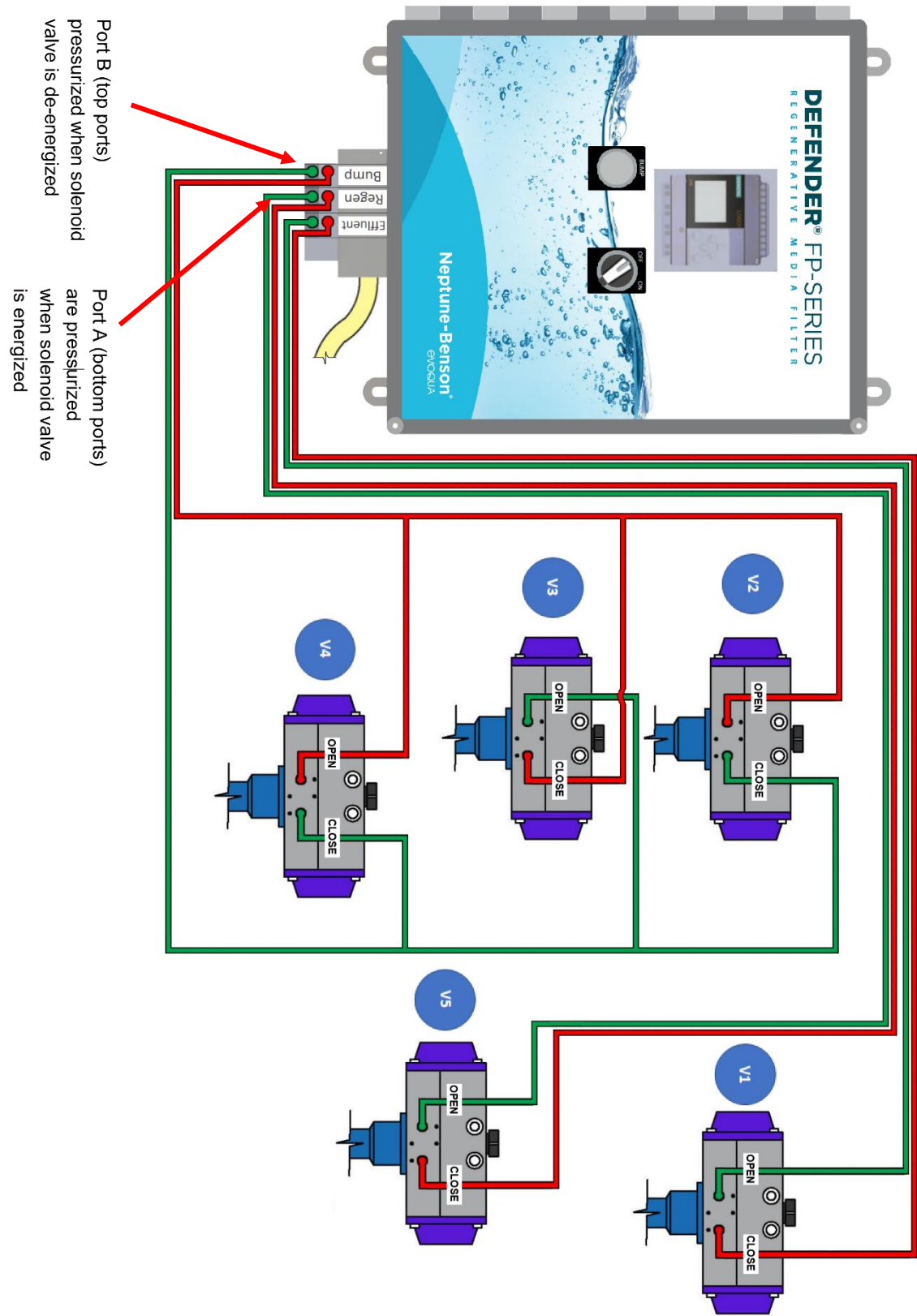
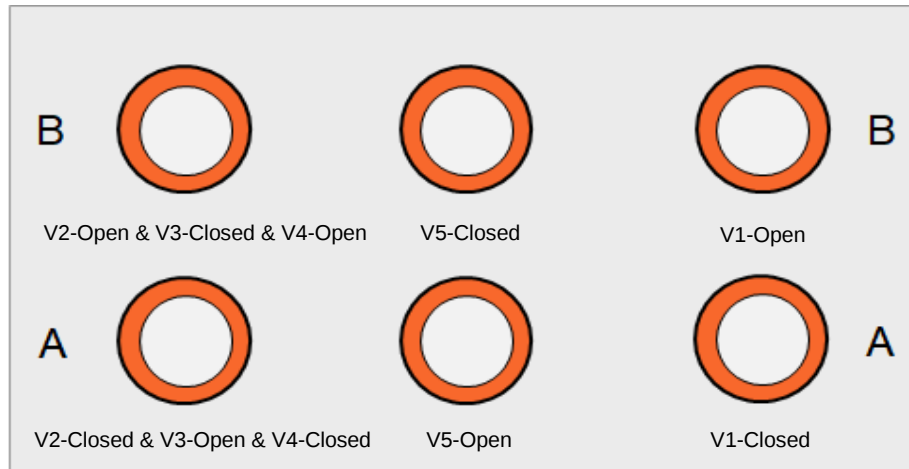
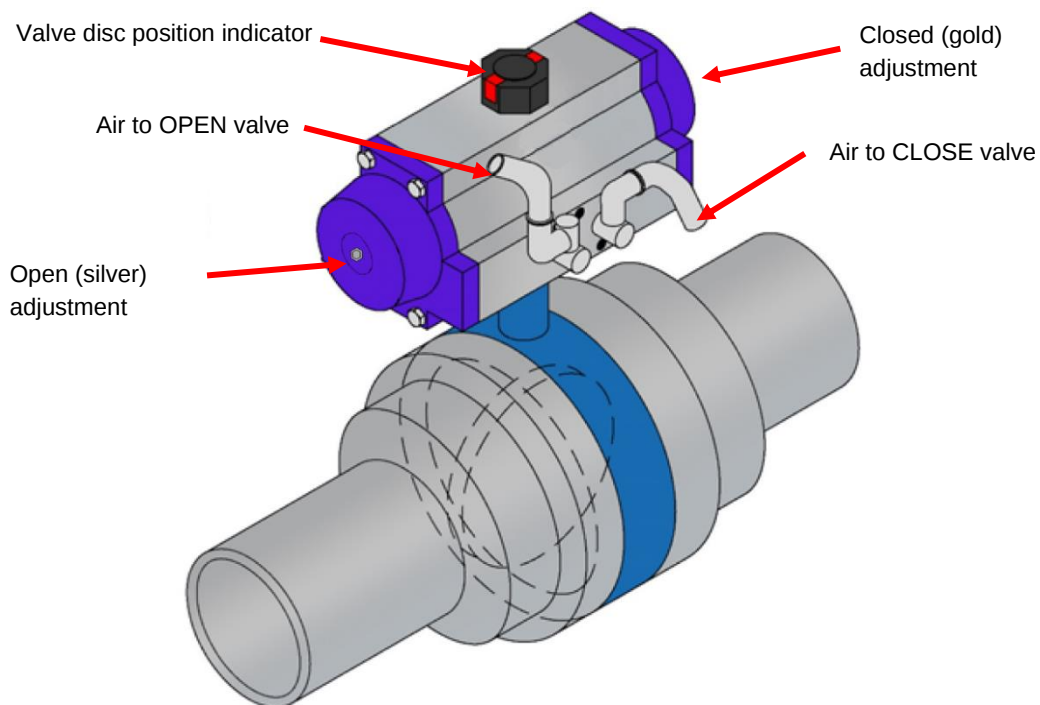


Figure 7: Pneumatic Tubing Diagram



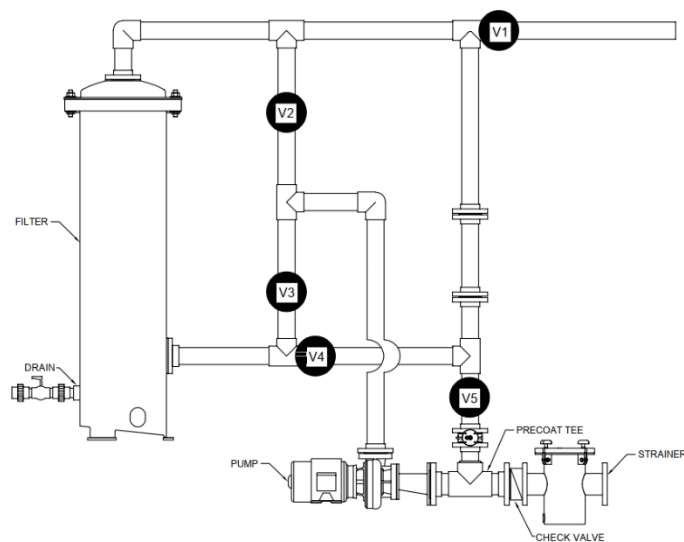
**Figure 8: Solenoid manifold tube connections**



**Figure 9: Pneumatic Actuator Setup**

**NOTE**

Standard actuators for the Defender FP are Rotork pneumatic actuators as included in valve kit 1002-1214/1002-1543. If using any other actuator, consult your system designer on proper actuator installation.



| VALVE STATES |        |         |        |            |
|--------------|--------|---------|--------|------------|
| MARK         | IDLE   | PRECOAT | FILTER | POWER BUMP |
| V1           | CLOSED | CLOSED  | OPEN   | CLOSED     |
| V2           | OPEN   | CLOSED  | CLOSED | OPEN       |
| V3           | CLOSED | OPEN    | OPEN   | CLOSED     |
| V4           | OPEN   | CLOSED  | CLOSED | OPEN       |
| V5           | CLOSED | OPEN    | CLOSED | OPEN       |

Figure 10: Valve position and state matrix

NOTE

After making pneumatic actuator connections, raise the air pressure to 90 psi and confirm the valve positions match the “Idle” state presented in the valve matrix table above. If a valve state is incorrect, reverse the tubing between the top and bottom port.

## Adjusting the Pneumatic Actuators

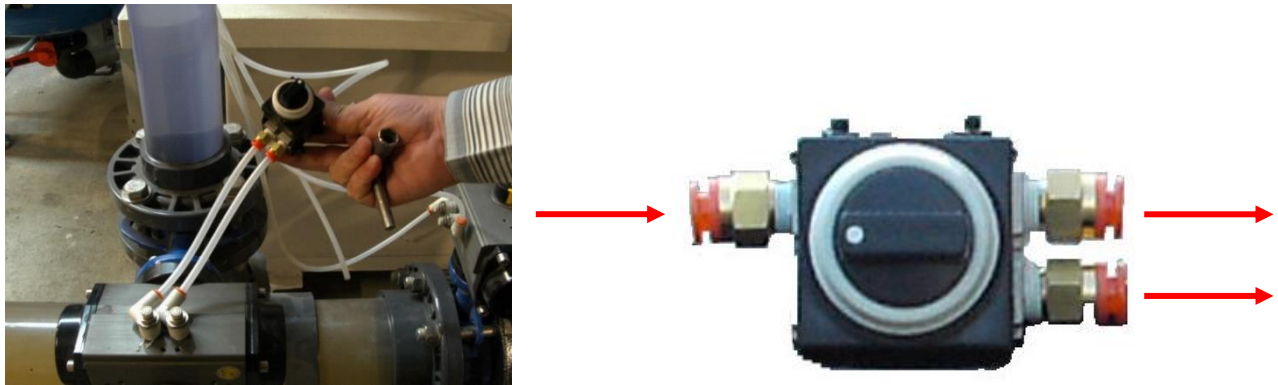
### Actuator Mounted Parallel with the Piping (Recommended)

1. Ensure the actuator is de-pressurized before making any adjustments, by turning the Filter/Regular knob counterclockwise until the pressure reads 0 psi. Make all adjustments on the outside of the actuator.
2. To make the closing adjustment, loosen the gold nut. Turn the stop pin outwards counterclockwise to the limit closing to less than 100%.

#### NOTE:

The right-side Silver Nut is for Open adjustment clockwise rotation. Opening adjustment is not typically required.

### Flow (Speed) Control Valves Adjustment



**Figure 11: Flow Control Valves**

Pneumatic actuators are provided with the flow control valves. The flow control valves connected to the pneumatic actuators are used to regulate the speed of the butterfly valve operation. To adjust the speed of the butterfly valves:

1. Shut off the air supply.
2. Remove the tubing from the closed port of the pneumatic actuator. Refer to the above to determine which port is the closed port.
3. Connect the tubing to the air supply in on the air switch.
4. Remove the tubing from the open port of the pneumatic actuator.
5. Connect the tubing from the air switch to both ports of the pneumatic actuator.
6. Open the air supply.
7. Move the switch to both the open and closed positions to verify proper operation of the valve in both positions.

If necessary, adjust the valves. To adjust the valves:

1. Loosen the lock nut, and then close the control valves by turning them clockwise.
2. Open each valve 1.5 turns counterclockwise.

If necessary, adjust the valves for smooth operation. To make this adjustment:

1. The control valve on the closed port regulates the butterfly valve's opening speed.
2. The control valve on the open port regulates the butterfly valve's closing speed.
3. Closing the valves slows the speed of the butterfly valve.
4. Opening the valves increases the speed of the butterfly valve.

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**NOTE:**

Make sure to remove the flow control valve before returning the system to normal operation.

## Vacuum Transfer Unit Installation

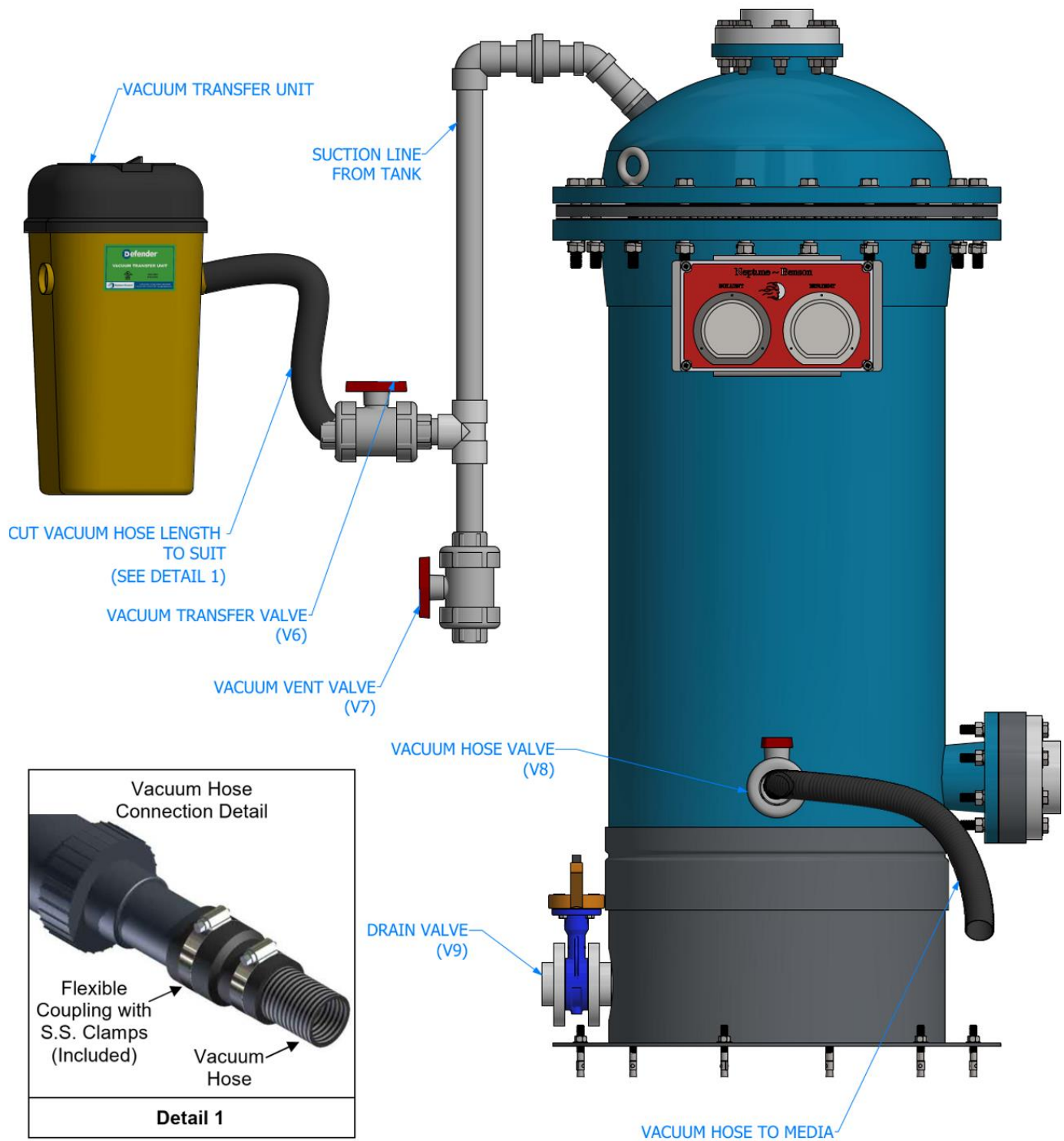


Figure 12: Vacuum transfer setup

### NOTE:

Most standard shop style vacuums will be appropriate for loading media. A vacuum can be provided by Neptune Benson on request.

# OPERATION

The following sections describe system requirements, the pre-startup check, dry testing procedure, quick start instructions, loading/recharging media, filtration mode and PowerBump sequence.

## System Requirements

- Water supply
- Air supply: Pressure should be a minimum of 90 psi (6.2 Bar)
- 17 lb.(7.7 kg) of perlite (EWT Part Number: 1000-5852)

### NOTE

Defender® filters are designed to operate with perlite media. Use of any other media may compromise filter performance.

### NOTE

To drain the system, isolate the filter unit from the pool and then open drain valve V9. Vent valve F6 can be opened to increase the drain rate.

## Pre-Startup Check

### NOTE

All plumbing and valving must be installed per the filter schematic. Refer to *Introduction*.

1. Verify power is supplied to the following items prior to scheduling a start-up:
  - Compressor
  - Control Panel is wired (Refer to Installing the Control Panel and Filter Regulator)
  - Set the filter/regulator to 90 PSI (6.2 Bar).
  - Pump rotates in the proper direction and is ready to run

## Performing a Dry Test

2. With the pump off, connect jumper between terminal 110 (+24V) and terminal 205 (NC pump fault signal)
3. Turn the switch on the Control Panel to Filter Mode and then press the Bump button
4. Ensure all valves transition smoothly without slamming open or closed (Refer to Adjusting the Pneumatic Actuators)
5. Confirm that the valve states correspond to Figure 10 in all modes.
6. Turn the switch on the control panel to OFF
7. Remove the jumper and proceed with startup.

Check for air leaks at the tubing connections. If leaks occur:

1. Turn the compressor off.
2. Remove the tubing. Verify it is cut square and free of defects.
3. Reinstall the tubing. Pull to ensure it is connected securely.

If leaks still occur:

The tubing might be the incorrect OD (outer diameter). All tubing is to be imperial and 0.5 inch O.D. and 0.25 inch O.D. Refer to *Installing the Control Enclosure and Filter/Regulator*.

## Performing a Quick Start

Once initial preparation is completed, the unit is ready to be started. For start-up to work properly, shut down all auxiliary equipment (including pumps). Place the unit into idle by turning the switch on the PowerBump Control Panel to the left (OFF).

## Loading Media into the System (Precoat Process) – Vacuum Transfer

Refer to the schematic found in *Introduction*.

### NOTE

While loading media, it is recommended to wear safety glasses and a dust mask. Perlite is non-hazardous but a fine powder that could cause irritation.

### NOTE

The filter vessel must be fully drained prior to beginning this process.

1. Ensure the system is OFF and the pump is ready to run
2. Close pump discharge throttling valve F7
3. Open vacuum drain valve V7 to drain any water in the vacuum transfer piping.
4. Close vacuum drain valve V7.
5. Open vacuum transfer valve V6 and vacuum hose valve V8.
6. Verify tank drain valve V9 is closed.
7. Turn vacuum on and vacuum 17 lb. (7.7 kg) of perlite media into the filter tank.
8. Turn vacuum off.
9. Close vacuum hose valve V8 and vacuum transfer valve V6.
10. Open the 0.75 inch precoat vent line valve F6 and 1.5 inch vacuum drain line valve V7.
11. Open pump discharge throttling valve F7 and purge the air from the system.

### NOTE

If the filter is below grade, it starts to fill automatically. If the filter is above grade, start the pump manually. As the tank is filling, air is escaping from both the 1.5 inch vacuum drain valve and the 3/4 inch precoat vent line valve F6.

12. As soon as a steady stream of water exits this line, close the vacuum drain valve V7 and close the precoat vent line valve F6.
13. Turn the switch on the PowerBump Control Panel to the right (ON) to run the pump and start the precoat/regeneration process.

After 5 seconds the precoat valve V5 opens to start the precoat/regeneration process. After 10 minutes, the effluent valve V1 will open. The precoat valve V5 will close 15 seconds later. The system is now in Filter Mode.

14. After initial precoat is completed, press the Bump button. This ensures an even precoat and only needs to be done after loading media.

### NOTE

On initial filter start-up, drain and recharge the media as soon as the pool water is clear. This will rid the filter of construction debris and contaminants. If the pool make-up water is extremely dirty, additional draining and media recharge might be required.

## Entering Filtration Mode

The initial step in the filtration mode is the precoat process. A precoat cycle will automatically begin whenever the control panel filter switch is turned on. Once the precoat cycle is complete, the filter will automatically advance to filtration mode. The system is now recirculating and filtering water from the pool.

1. Examine and record the filter inlet and outlet pressures. The difference between the two readings is the system's initial differential pressure.

### NOTE

It is recommended that a PowerBump be performed at least once every day, or if the pressure differential reaches 12 PSI. Depending on the bather load, PowerBumping might be required more frequently.

## Performing the Power Bump Sequence

The PowerBump process reverses water flow through the flexible tube elements, forcing perlite and accumulated debris off the tubes and into suspension.

1. Push the PowerBump button on the control panel to initiate the process.
2. Precoat valve V5, will open.
3. Effluent valve V1, closes.
4. Valve V2 opens, valve V3 closes, and valve V4 opens.

After 40 seconds the valves will change state to begin a 10-minute precoat process prior to returning to filtration mode.

## Recharging the Media

Depending upon bather load and other factors, the media might require recharging anywhere between 2 weeks and 3 months. The exact frequency will become apparent as operating experience with the system increases. The following are good indicators to determine when it is time to recharge the media:

- Pressure differential returns to 10-12 PSI shortly after bumping.
- Design flow rate for the system cannot be maintained.

Perform the following steps to recharge the media:

1. While still in Filter Mode, partially open drain valve V9 to clear any debris from the pipe then close the valve.
2. Press the PowerBump button on the control panel and allow approximately 40 seconds for the system to enter Precoat mode.
3. Turn the Filter switch to the OFF position. Confirm the pump is off.
4. Close pump discharge throttling valve F7.
5. Open drain valve V9.
6. Open vacuum drain valve V7 to increase drainage flow.
7. Once the tank is completely drained, close the drain valve V9.
8. Refill the tank with water by opening discharge throttling valve F7. If the filter is above grade, you will need to start the pump manually.
9. Repeat steps 4-8 to drain the tank and rinse again.
10. Refer to *Once initial preparation is completed*, the unit is ready to be started. For start-up to work properly, shut down all auxiliary equipment (including pumps). Place the unit into idle by turning the switch on the PowerBump Control Panel to the left (OFF).
11. Loading Media into the System (Precoat Process) – Vacuum Transfer.

# MAINTENANCE

The filter is virtually maintenance free. Visually inspect the finish and touch-up any blemishes. Inspect all tubing and connections for any signs of wear. Replace any worn tubing.

## WARNING

Before servicing the Defender unit, ensure that the piping has de-pressurized and the isolation valves are locked out. The control enclosure should be disconnected and locked out before opening. Do not service the pneumatic components without relieving the air pressure.

## General Maintenance

| Component              | Frequency                                                                                                                                                                                            | Procedure                                                                                                                                  |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Tubing                 | Every 3 months                                                                                                                                                                                       | Inspect all tubing and connections for wear and replace if needed                                                                          |
| Head bolts             | Every 3 months                                                                                                                                                                                       | Check the torque and tighten to 55 ft-lb. (75 N-m) if necessary                                                                            |
| Filter/regulator       | Every 3 months                                                                                                                                                                                       | Refer to the manufacturer's owner's manual for details. When replacing the airline filter element, use SMC® Corporation Part # AF40P-060S. |
| Flexible tube cleaning | <ul style="list-style-type: none"><li>Varies depending on bather load.</li><li>Required when the system influent pressure builds to 10 psi within an hour after new media has been loaded.</li></ul> | Refer to Flexible Tube Element Wash procedure.                                                                                             |
| Head gasket            | <ul style="list-style-type: none"><li>Inspect after every upper head removal to ensure proper sealing.</li></ul>                                                                                     | Wipe any dirt or perlite media off the gasket to ensure a proper seal. Replace gasket if necessary.                                        |

## Indoor Pool Chemical Cleaning Frequency

- Water parks and multi-use community centers: Twice annually.
- Competition pools/Lap pools/Dive pools etc.: Once annually.

## Outdoor Pool Chemical Cleaning Frequency

- Up to four months of operation: At the end of the season.
- Up to nine months of operation: At the middle and the end of the season.
- Year-round operation: Three times at convenient intervals throughout the year.

## Suggested Chemicals

- Chem Clean Express: 15 lb. (6.8 kg) (EWT Part Number: 1000-5865)
- Filter Cleanse: 21 lb. (9.5 kg) (EWT Part Number: 1000-5539)
- Use of enzymes on an ongoing basis to minimize fouling of flexible tube elements may be considered. Consult a local service provider to discuss this options.

### WARNING

Safety glasses and gloves should be worn to safely use the recommended chemicals. Read and understand the Safety Data Sheets (SDS) before handling any chemical. Consult your local laws regarding chemical disposal.

## Chemical Clean Procedure

1. Vacuum chemicals into the tank. Refer to Once initial preparation is completed, the unit is ready to be started. For start-up to work properly, shut down all auxiliary equipment (including pumps). Place the unit into idle by turning the switch on the PowerBump Control Panel to the left (OFF).
2. Loading Media into the System (Precoat Process) – Vacuum Transfer.
3. Purge the air from the system.
4. Switch to Filter Mode.
5. Precoat for two minutes.
6. Turn the Filter switch to the OFF position and confirm the pump is not running
7. Open the precoat vent valve F6. This must remain open during the chemical cleaning to prevent overpressurizing.
8. For Chem Clean Express, soak for 5 hours.
9. For filter cleanse, soak for 24 hours.
10. Drain and rinse the system until the water from the drain line is clear.
11. Drain the system and load media Refer to Once initial preparation is completed, the unit is ready to be started. For start-up to work properly, shut down all auxiliary equipment (including pumps). Place the unit into idle by turning the switch on the PowerBump Control Panel to the left (OFF).
12. Loading Media into the System (Precoat Process) – Vacuum Transfer.
13. Purge the air from the system
14. Return to Filter Mode.

## Flexible Tube Element Wash Procedure

1. Ensure the system is OFF and pump is not running.
2. Drain the tank.
3. Disconnect plumbing from filter head at nearest mechanical connections (refer to *Introduction*)
4. Remove the flange bolts
5. Lift the filter head and set on a flat surface.
6. Lift the tube sheet assembly using the eyebolt in the center.
7. Thoroughly clean and rinse the tube elements, allowing any debris to drain out the bottom
8. Inspect both gaskets after each head removal procedure. Replacing after each Flexible Tube Element Wash Procedure is recommended (see *Parts List Assembly*).
9. Place the gasket onto the upper flange surface of the filter tank.
10. Carefully place (lower) the tube sheet assembly onto the gasket. Ensure the bolt holes align.
11. Place another gasket on top of the tube sheet assembly.
12. Place the filter head onto the gasket.
13. Connect the filter head to the tank using the fasteners with 1 1/8" wrench. Tighten the fasteners to 20 ft-lb (27 N-m) in the order presented in Figure 10, and then tighten to 55 ft-lb (75 N-m) in the same manner.
14. Reinstall the tube sheet assembly and head.
15. Load media. Refer to Once initial preparation is completed, the unit is ready to be started. For start-up to work properly, shut down all auxiliary equipment (including pumps). Place the unit into idle by turning the switch on the PowerBump Control Panel to the left (OFF).
16. Loading Media into the System (Precoat Process) – Vacuum Transfer.
17. Return the filter to service.

### NOTE

The tube sheet weighs approximately 100 lbs (45 kg). Use proper PPE and lifting techniques when removing the filter head and tube sheet. It may be desired to use a mechanical lifting device.

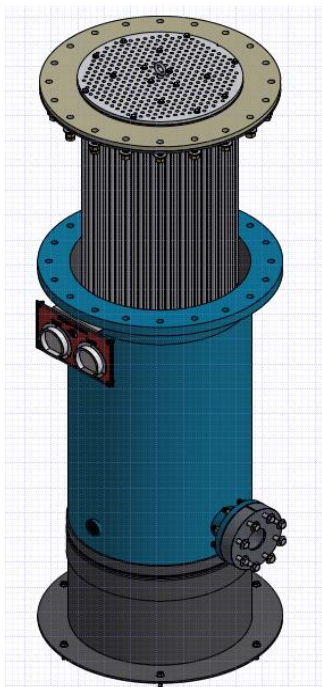


Figure 13: Head Removal for Service Cleaning

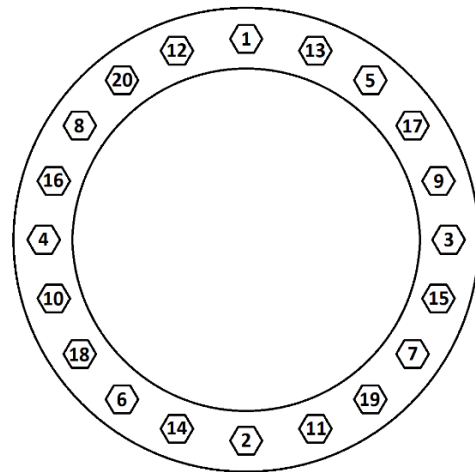


Figure 14: Flange Bolt Torque Pattern

Parts List Assembly

Exploded View

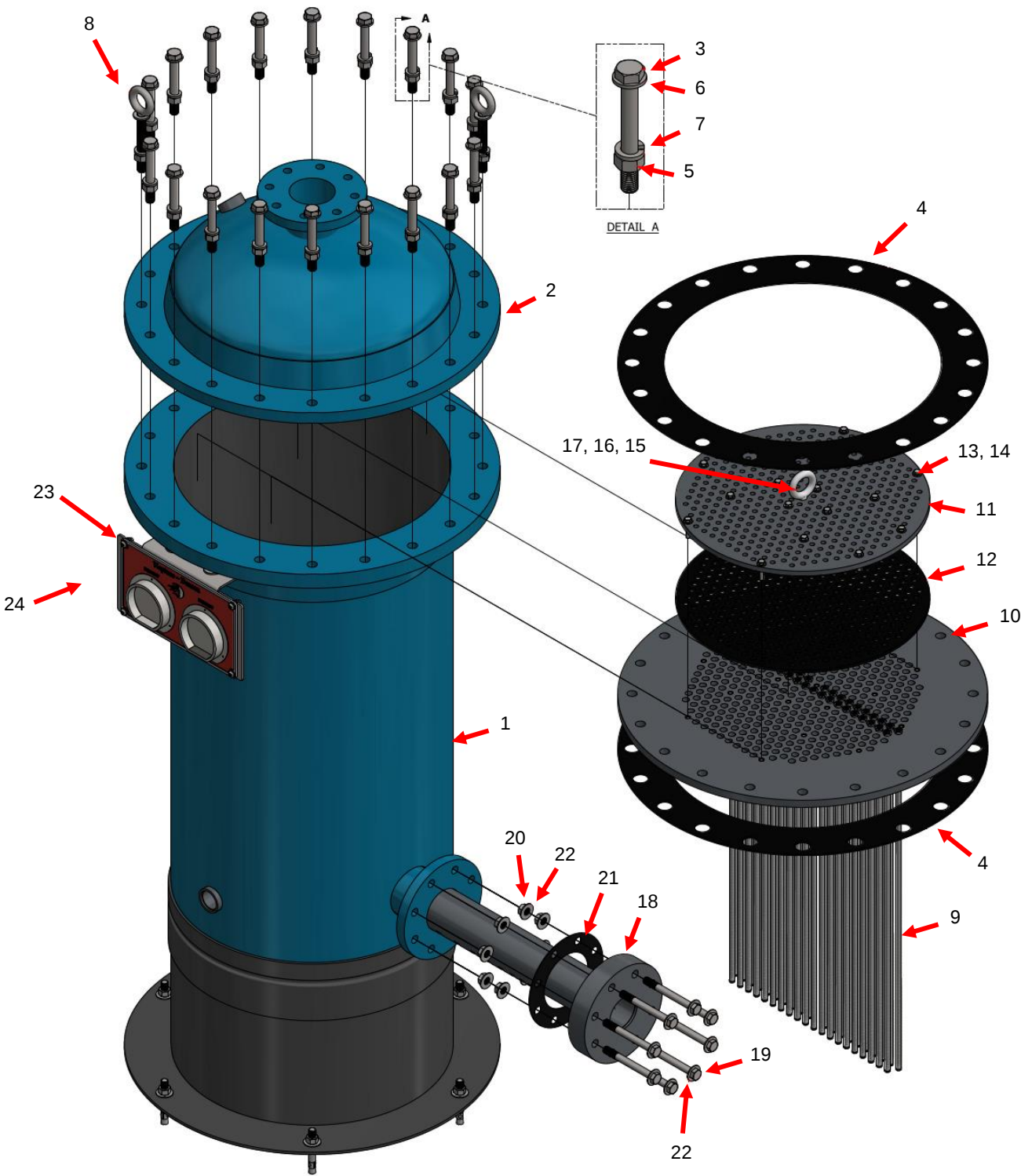
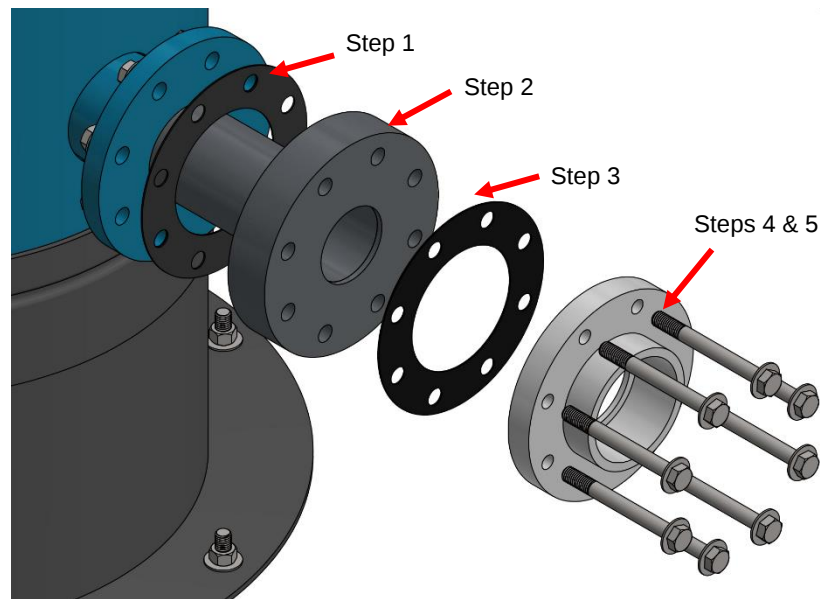


Figure 15: Exploded View

## Parts List

| MARK | REFERENCE                                | QTY REQUIRED | PART NUMBER |
|------|------------------------------------------|--------------|-------------|
| 1    | TANK FRP W/4" FLG, BASE, DRN ASSY-NO TOP | 1            | 1002-1108   |
| 2    | FILTER HEAD W/4" FLANGE COMPACT DEFENDER | 1            | 1002-1107   |
| 3a   | BOLT HEX HEAD 3/4"-10 18-8 5" LONG       | 18           | 1002-1407   |
| 3b   | BOLT HEX HEAD 3/4"-10 18-8 6" LONG       | 2            | 1002-1109   |
| 4    | GASKET FULLF FLG 24.0 3/8 NEOPRENE 50DUR | 2            | 1002-1418   |
| 5    | NUT HEX THICK 0.65" 3/4-10 BRS           | 22           | 1002-1124   |
| 6    | WASHER FLAT .75" 18-8SS                  | 40           | 1002-1120   |
| 7    | WASHER SPLIT LOCK .75" 18-8SS            | 20           | 1002-1121   |
| 8    | EYE BOLT 3/4"-10 18-8SS 6" LG FULLTHREAD | 2            | 1002-1412   |
| 9    | DEFENDER TUBE ELEMENT 36 T316            | 366          | 1000-7552   |
| 10   | TUBESHEET PLATE PVC BOTTOM FP SERIES     | 1            | 1002-1160   |
| 11   | HOLD DOWN PLATE PVC TUBESHEET FP-SERIES  | 1            | 1002-1161   |
| 12   | GASKET FELT F/TUBESHEET COMPACT DEFENDER | 1            | 1002-1106   |
| 13   | BOLT HEXHEAD.375X1.75 T316 16 UNC        | 16           | 1002-1413   |
| 14   | WASHER FLAT .375" T316 SS                | 16           | 1002-1112   |
| 15   | NUT HEX .5 T316 SS                       | 1            | 1000-7503   |
| 16   | WASHER SAE .50DIA T316                   | 1            | 1000-7516   |
| 17   | EYEBOLT .50 DIA X 3" LG T316 SHOULDERED  | 1            | 1002-1409   |
| 18   | DIFFUSER ASSY PVC F/COMPACT DEFENDER     | 1            | 1002-1172   |
| 19   | BOLT HEX HEAD 5/8"-11 18-8 6" LONG       | 8            | 1002-1126   |
| 20   | NUT 5/8"-10 BRASS                        | 8            | 1002-1128   |
| 21   | GASKET FULLF FLG 4.0 1/8 NEOPRENE        | 1            | 1000-7182   |
| 22   | WASHER FLAT .625" 18-8SS                 | 16           | 1002-1129   |
| 23   | GAUGE PANEL BRACKET F/FP SERIES          | 1            | 1002-1172   |
| 24   | GAUGE PANEL KIT ONLY                     | 1            | 1000-8245   |

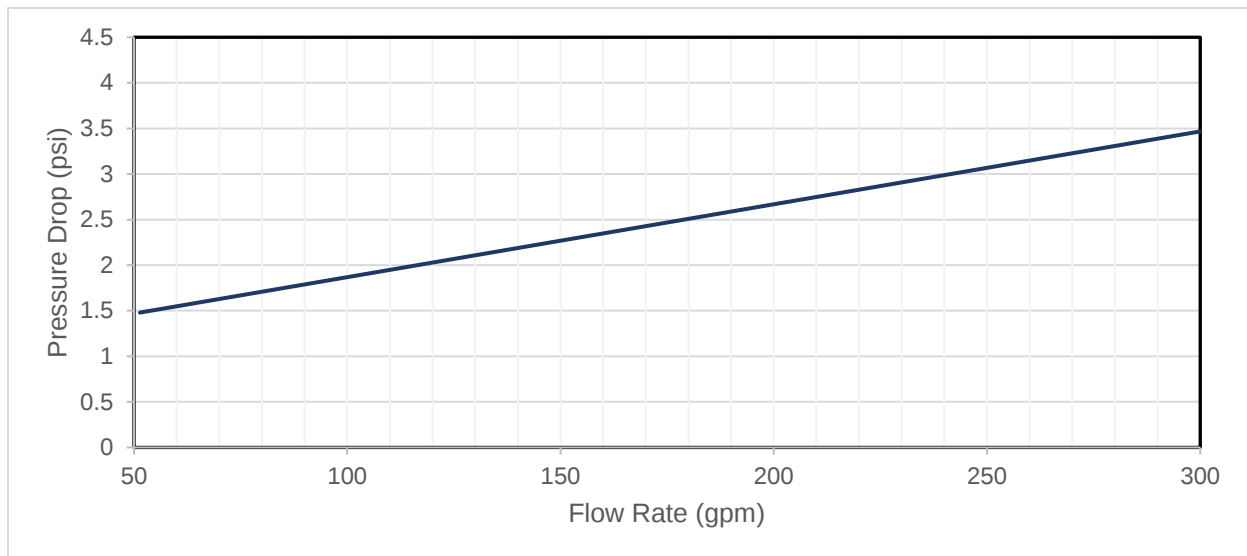
## Diffuser Assembly



**Figure 16: Diffuser Assembly**

1. Place the gasket onto the Defender FP flange face.
2. Insert the diffuser assembly into the flange pipe so that the flow openings are facing downward inside the filter.
3. Install a second gasket between the diffuser and flange connected to the installation piping
4. Tighten the diffuser assembly with the gaskets and flange plate using the bolts.
5. Torque the fasteners to 25 lbf.-ft (34 N-m)

## Head Loss Chart



**Figure 17: Pressure Drop Data for Clean Filter**



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