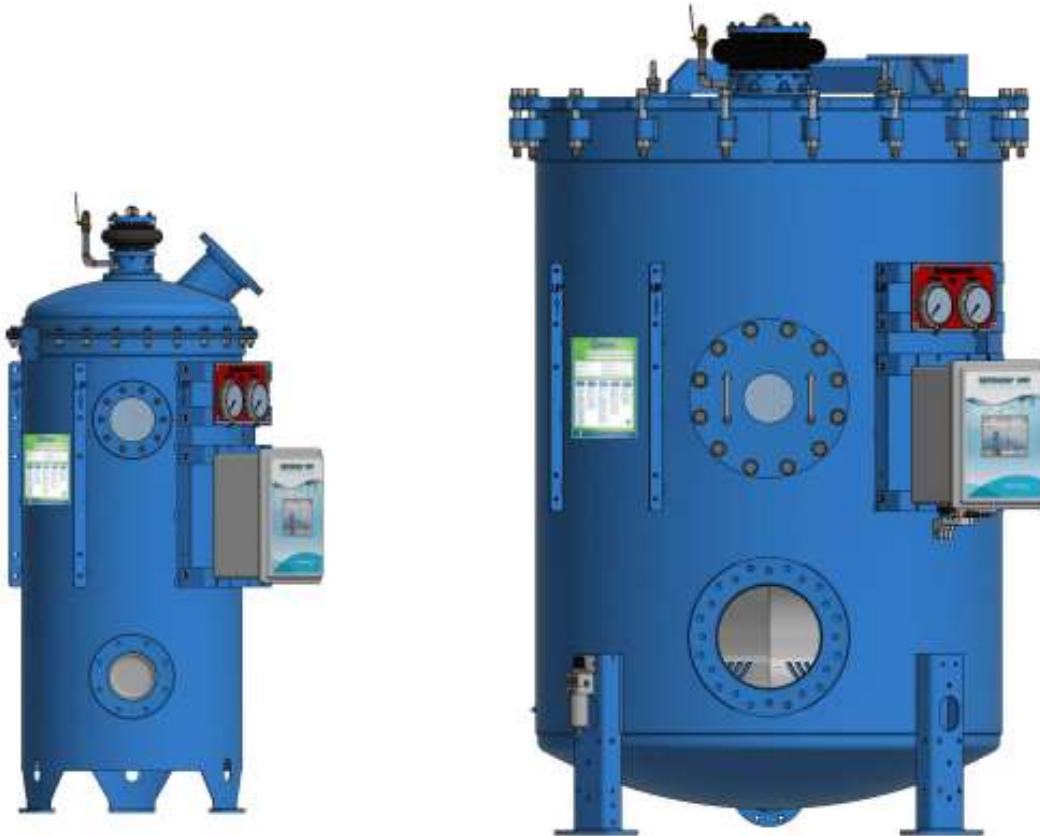


Defender[®] Regenerative Media Filter

Owner's Manual



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INSTALLATION

Verify the suitability and quantity of all supplied items. Refer to the bill of materials on the appropriate schematic in the *Appendix* and on your packing list.

Positioning and Erection of Tanks

1. The filter contains internal parts that are vertically deployed. Always transport and handle the filter in an upright position.

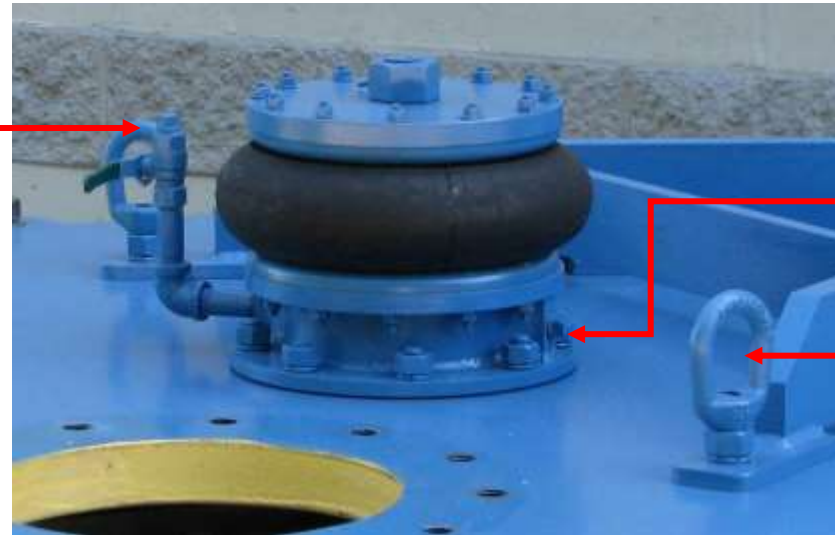
CAUTION

If the filter needs to be positioned horizontally for access reasons, the bump mechanism must be pressurized to a minimum of 75 PSI prior to tilting the tank.

Connect air to valve.

Open to pressurize.

Close after pressurized



Do Not Remove Plug

Lifting

Eye

Lugs

Figure 1: Positioning and Erection of Tanks

CAUTION

- Failure to pressurize the bump mechanism can damage the lift shaft and render the filter inoperable.
- Return the filter to the vertical position as soon as possible.
- Do not leave or store the filter in the horizontal position.
- After the tank is set in its final vertical position, bump the unit five to six times to verify proper operation.

2. Hoist the filter only by the lifting pad eye lugs located on the top of the filter vessel.
3. Keeping the vessel in the vertical position on the hoist, extend the legs from the collapsed position to the extended position. If you are positioning an SP-49-48-1548 or SP-55-48-2076, once the tank is in the final position, remove the shipping tabs, and then attach the regular legs. For reduced-height filters, the legs are welded.
4. Install the filter so that it is level. Shim and grout the leg base pads as required to level the filter. Using the holes in the pads, anchor each leg to the concrete floor.
5. Neptune-Benson™ provides grounding lugs on all steel tanks. Proper grounding is essential to help slow corrosion that can be caused by stray current. Refer to the *Vacuum Transfer System Diagram* for more information on the grounding lug locations.

Tank Leg Anchor Installation

WARNING

The filter is provided 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.

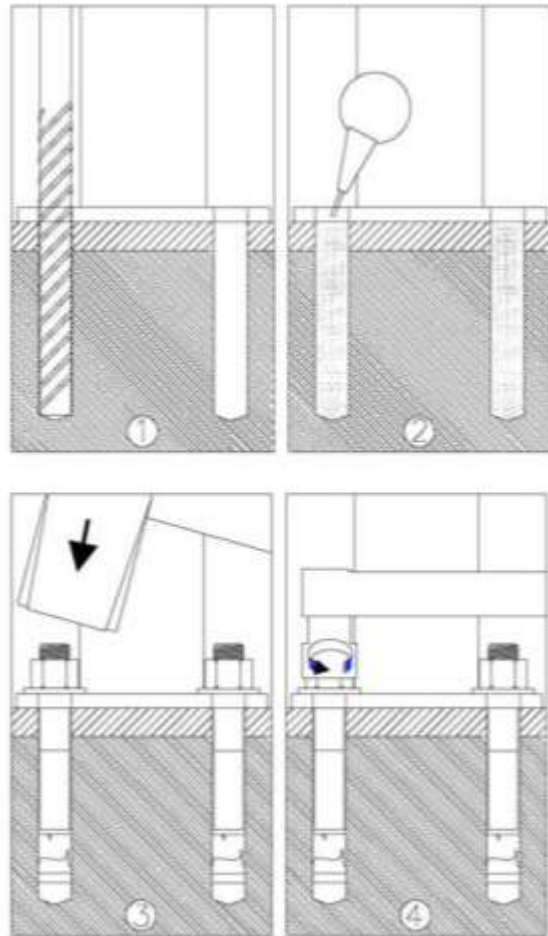


Figure 2: Tank Leg Anchor Installation

1. With the filter tank in its installed location, use a 5/8 inch concrete drill bit and drill a 7 1/2 inch-deep hole in the floor. There should be a total of 8 inches depth from the top of leg plate.
2. Remove all concrete dust from the holes.
3. Place the washers and nuts on the anchor. Insert the anchor through the floor plate into the hole. Being careful not to damage the threads, pound the anchor into the hole as far as it will go.
4. Tighten the bolts to 120 lbf-ft.

Mounting Accessory Components

The filter ships with unconnected accessory components.

Gauge Panel

Bolt the gauge panel to mounting plate with four 1/4 x 1 inch screws, washer, and nuts (included).

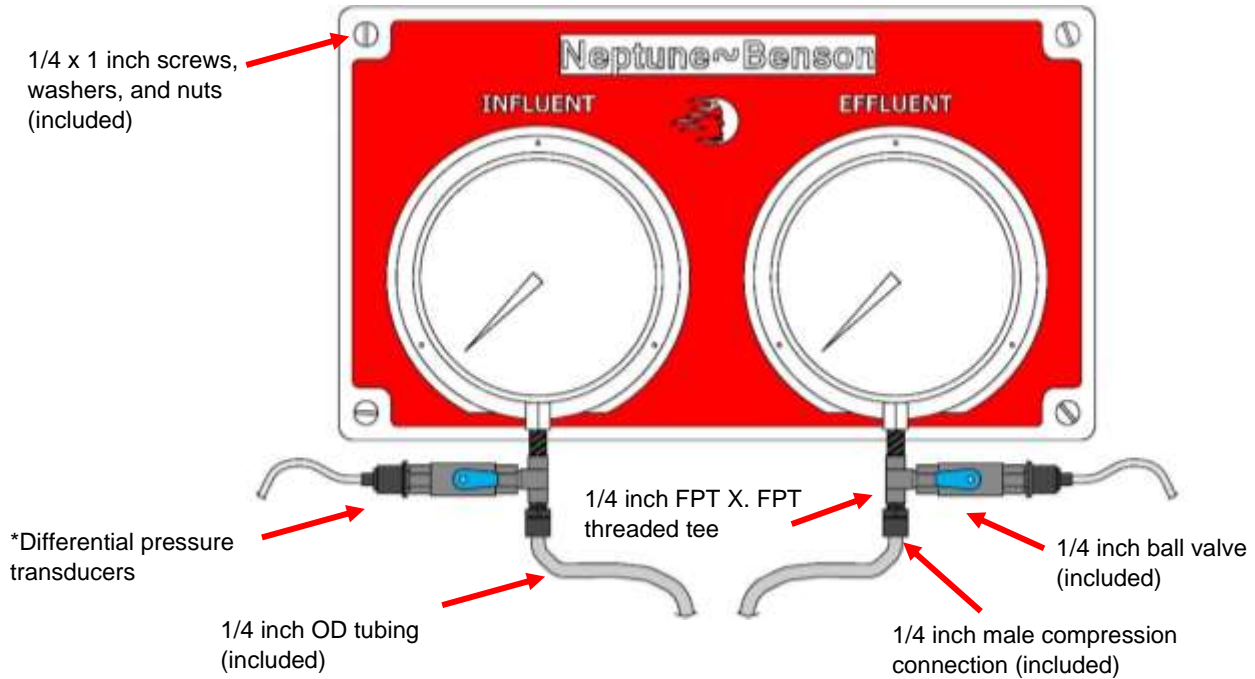


Figure 3: Gauge Panel

Pressure Gauges

All gauges supplied by Neptune-Benson™ are designed with dampening orifice openings to minimize damage due to surges or quick changes in pressure. The small opening is subject to clogging, especially on gauges that are located before the filter.

If a gauge reacts slowly to changes in pressure or tends to remain at an elevated pressure while the system is shut down, remove the gauge for inspection. The opening or orifice is located within the center inside the nozzle connection. If you cannot observe an opening somewhat smaller than a pinhead, clean or replace the gauge.

Switch the positions of gauges to verify the operation of a gauge. Doing so indicates whether a gauge requires repair or replacement. All gauges are provided with 1/4 inch male national pipe thread (NPT) connections. It is recommended that a gauge cock be installed at each gauge.

The gauges in your system provide you with the best data relative to the operation and efficiency of items of equipment. If you keep them in good order, they will help make your daily chores less troublesome.

Do not disregard the gauges when they break down. Replacement gauges are inexpensive and easy to replace.

Control Enclosure



Figure 4: Control Enclosure

Notes

Service Conditions:

The ambient air temperature does not exceed +40°C (104°F) and its average over a period of 24 hours does not exceed +35°C (95°F). The lower limit of the ambient air temperature is -5°C (23°F).

The air is clean, and its relative humidity does not exceed 50% at a maximum temperature of +40°C (104°F). Higher relative humidity may be permitted at lower temperatures, for example 90% at +20°C (68°F). Moderate condensation is taken care of, which may occasionally occur due to variations in temperature.

The altitude of the site of installation does not exceed 2,000 m.

Panel assemblies are intended for Pollution Degree 3 (PD 3).

Basic protection: Enclosures are provided with a cover and lockable tabs. It is advised for operators to install a lock to prevent ease of access.

Terminals for external conductors: Terminals are suitable for connection of copper or aluminum conductors, or both as applicable to the construction.

Mount the control enclosure to the bracket with four #10-32 x 3/4 inch hex head bolts and washers (included).

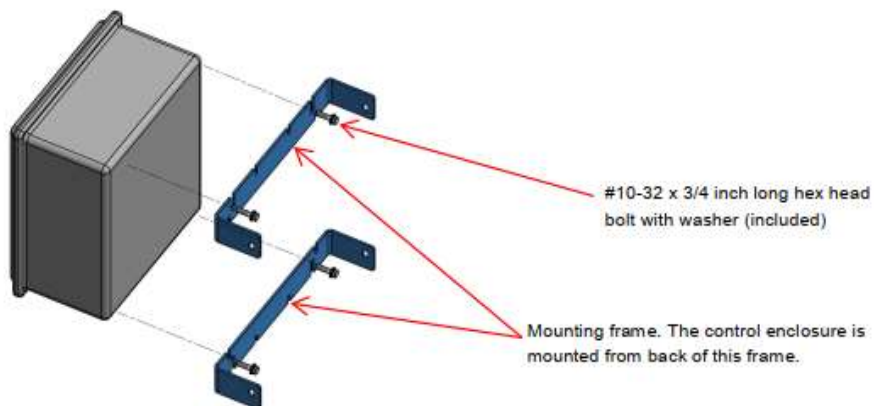
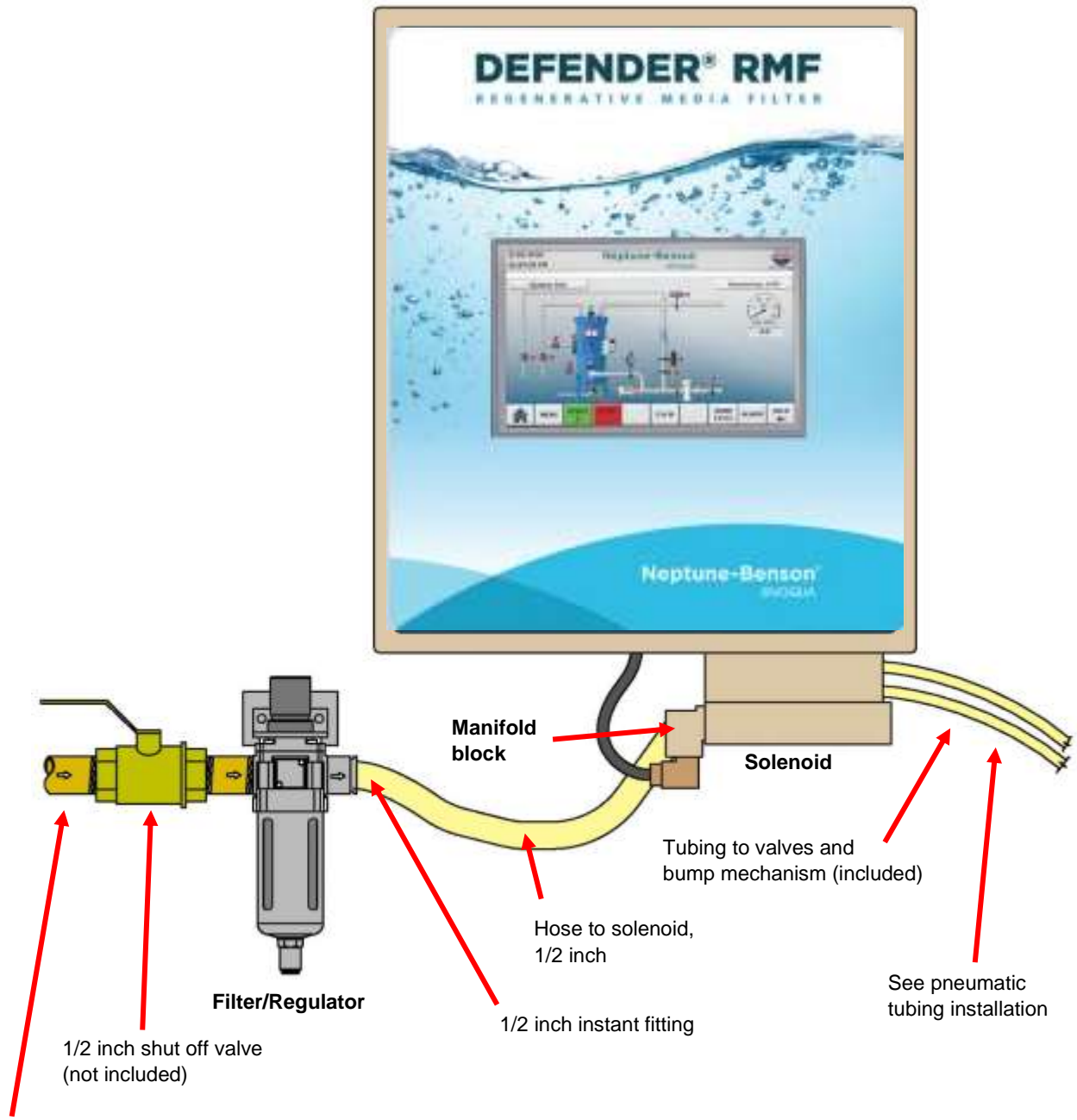


Figure 5 Control Enclosure Mounting

Pneumatic Connections

Control Enclosure and Filter/Regulator



1/2 inch hard pipe from compressor main line
Do not use PVC (not included)

Figure 6: Control Enclosure and Filter/Regulator

Filter/Regulator

1. Connect the line from the compressor to the filter/regulator.
2. Connect the filter/regulator to the Defender leg as pictured in 7-A..
3. Attach the filter/regulator using two 1/4 x 1 inch screws, washers, and nuts (included).

For Assero models attach the filter/regulator to mounting tab on desired Defender head bolt pictured in 7-B.

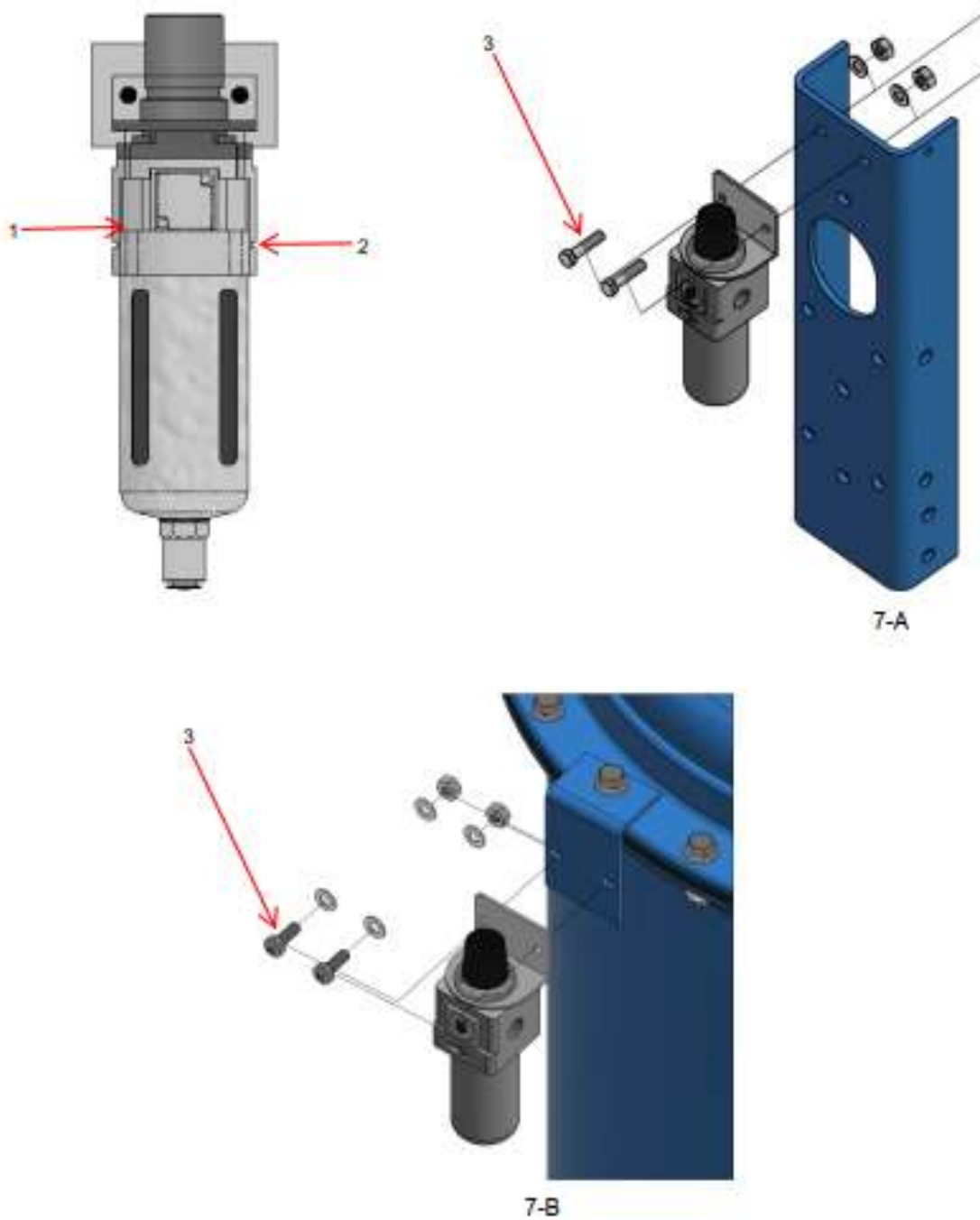


Figure 7: Filter/Regulator

Pneumatic Solenoid Valves

Using 1/2 inch poly tubing, connect the manifold block of the pneumatic solenoid valve to the filter/regulator.

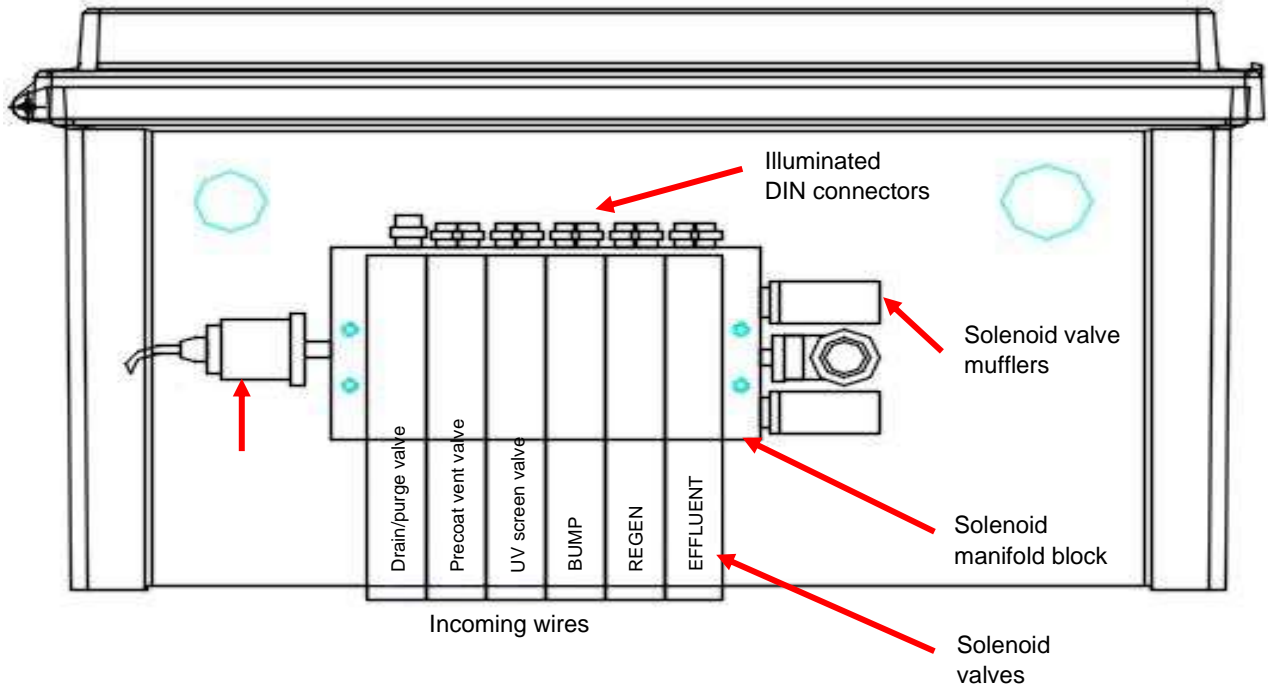


Figure 8: Pneumatic Solenoid Valves (Bottom View)

Pneumatic Tubing Installation

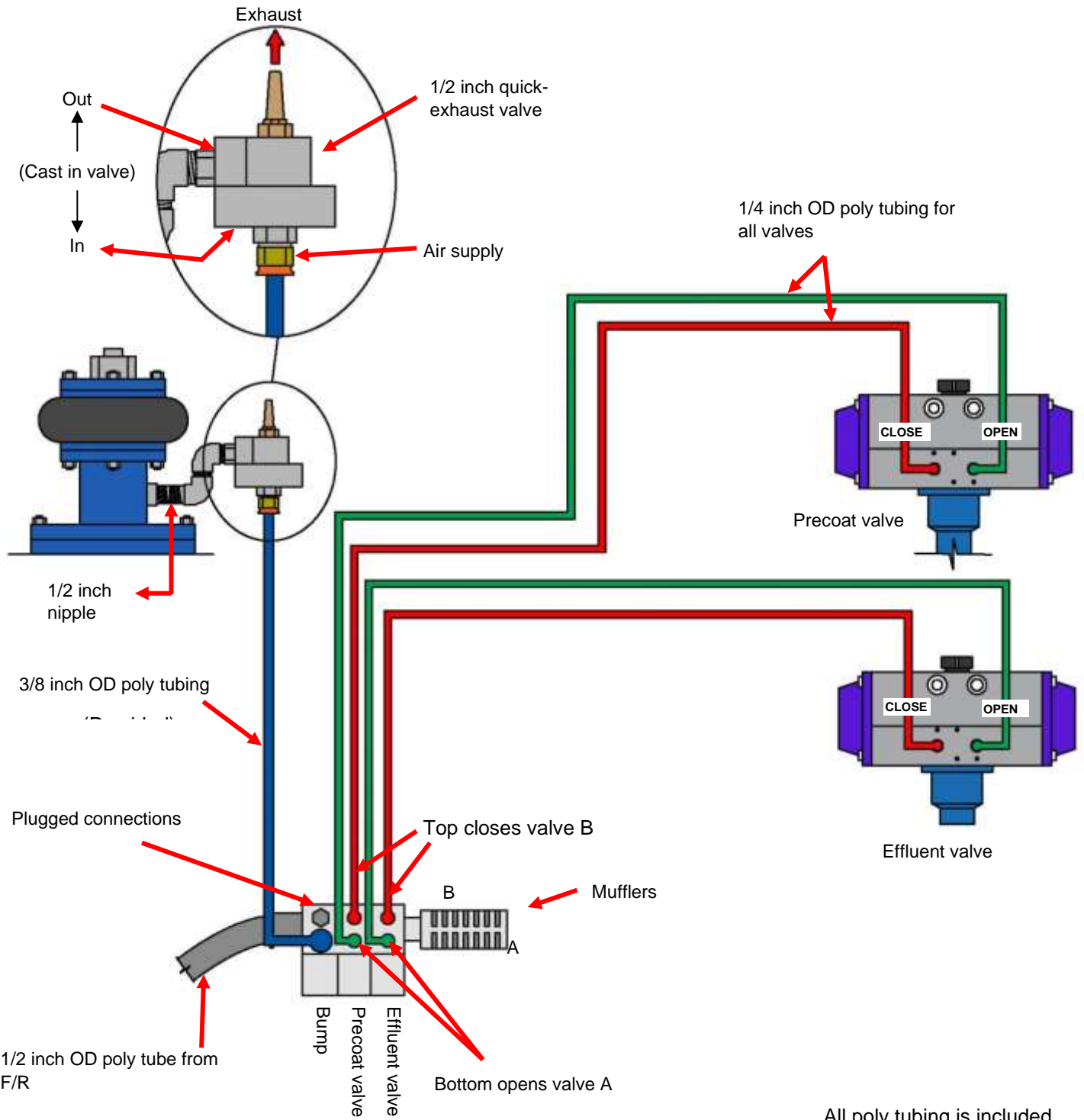


Figure 9: Solenoid Tubing Connections

Pneumatic Actuator Tubing Connections

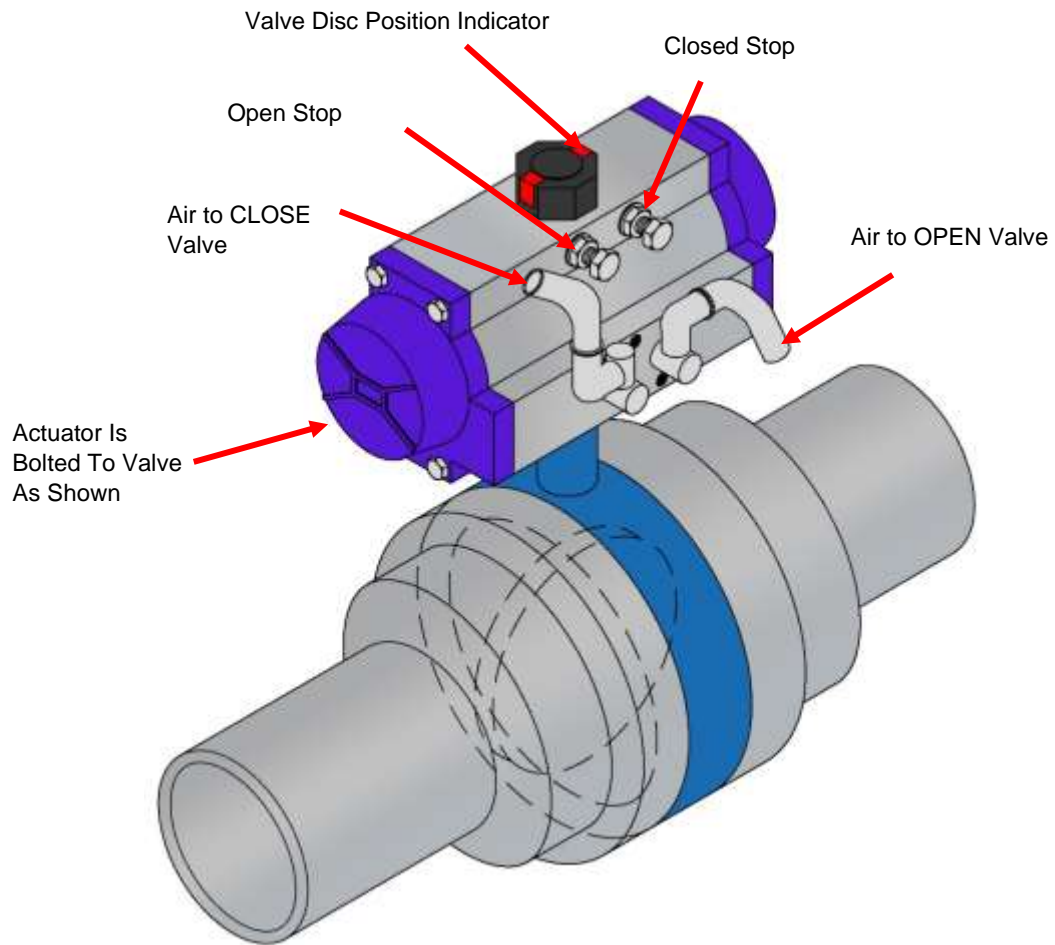


Figure 10: Pneumatic Actuator Setup

Pneumatic Actuator Adjustments

Actuator Mounted Parallel with the Piping (Recommended)

NOTE

While facing the pneumatic actuator with flow control valves, the air in on right opens the valve; the air in on left closes the valve.

Flow (Speed) 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.

1. Shut off the air supply.
 2. Remove the tubing from the closed port of the pneumatic actuator. Refer to *Pneumatic Actuator Tubing Connections* to determine which port is the closed port. Connect it to the air supply in on the air switch.
 3. Remove the tubing from the open port of the pneumatic actuator.
 4. Connect the tubing from the air switch to both ports of the pneumatic actuator.
 5. Open the air supply.
 6. Move the switch back and forth to check the open and closed operation of the valve.
 7. If necessary, adjust the valves:
 - a. Loosen the lock nut, and then close the control valves by turning them clockwise.
 - b. Open the valves 1.5 turns each by turning them counter clockwise.
 - c. If necessary, adjust the valves to allow for smooth operation:
- The control valve on the CLOSED PORT regulates the butterfly valve's opening speed.
 - The control valve on the OPEN PORT regulates the butterfly valve's closing speed.
 - Closing the valves slows the speed of the butterfly valve.
 - Opening the valves increases the speed of the butterfly valve.

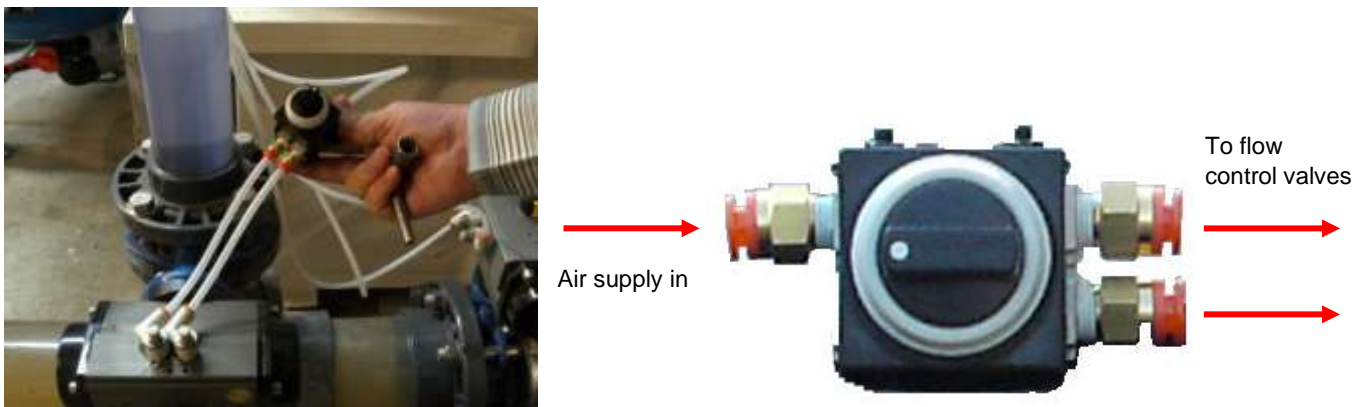


Figure 11: Flow Control Valves

Automated Drain Option

This option is available for a periodic flush of the tank bottom without the need to replace the media.

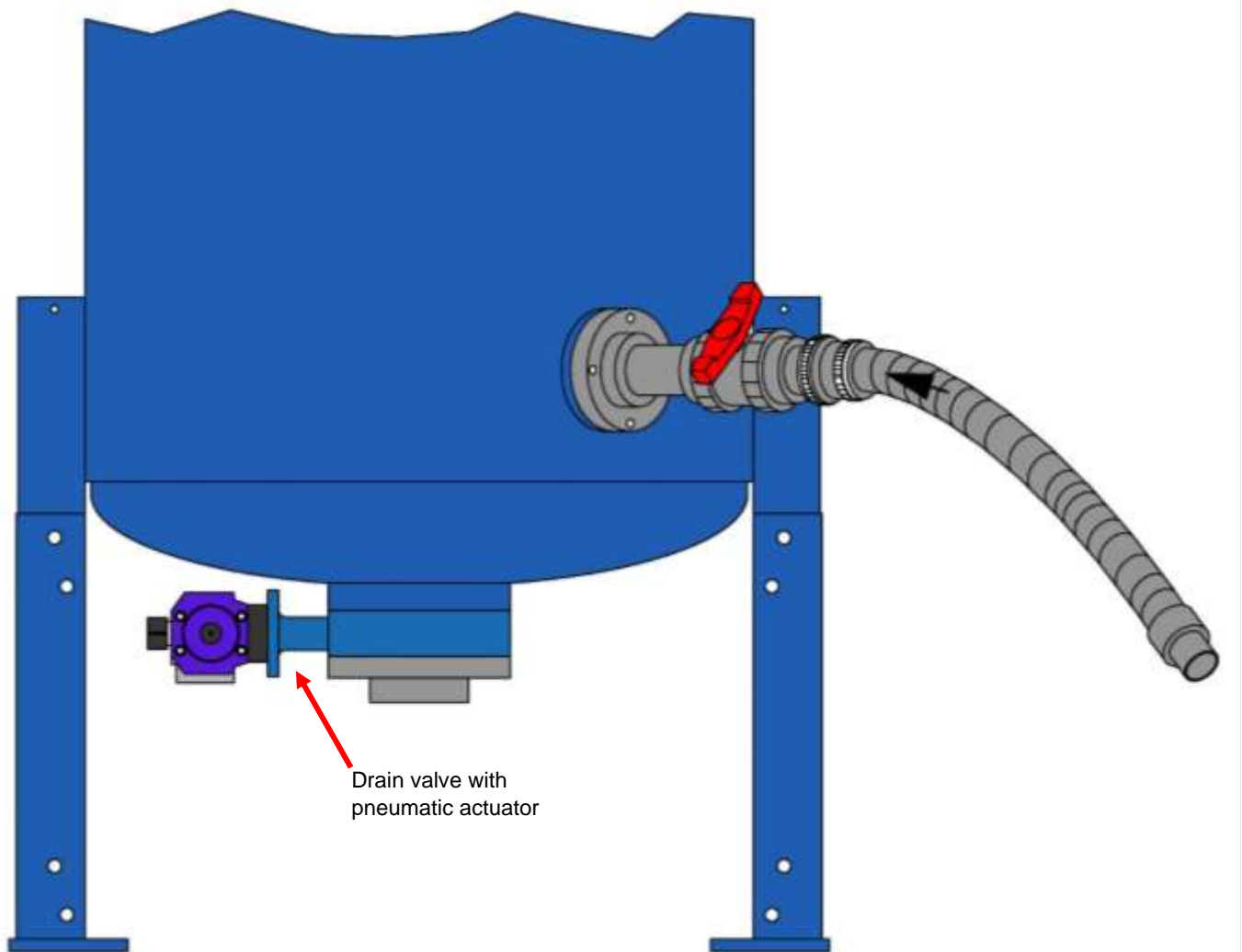


Figure 12: Automated Drain Option

Vacuum Transfer Unit

Vacuum Transfer System Diagram

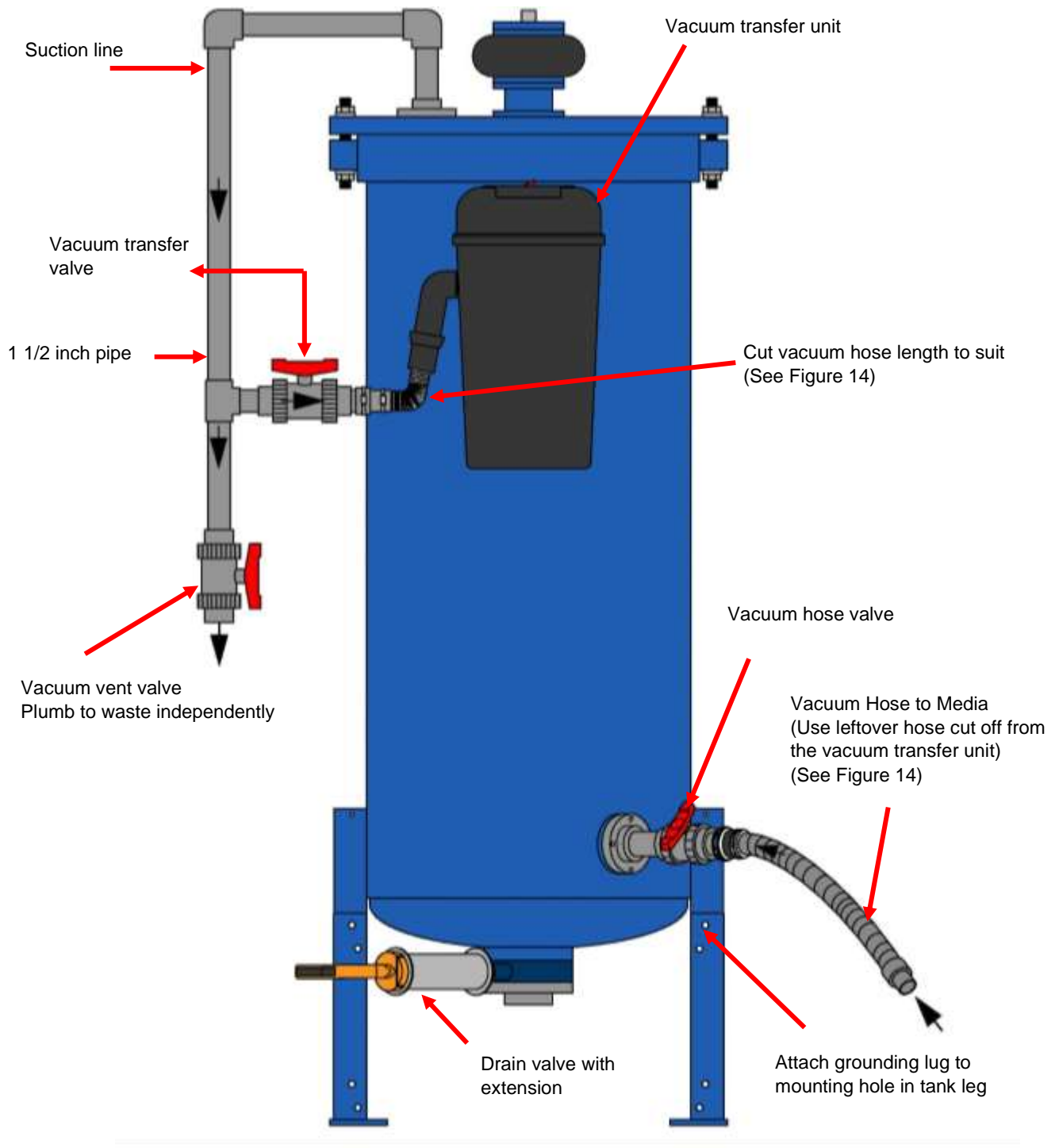


Figure 13: Vacuum Transfer System

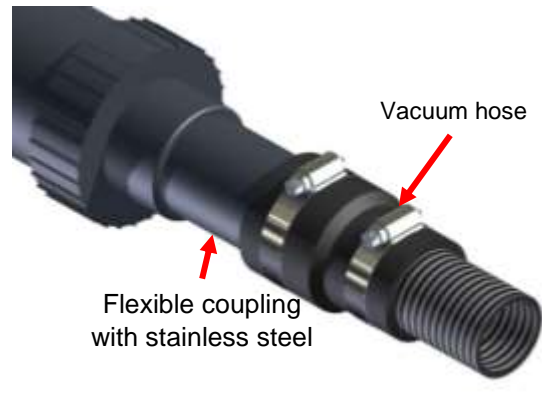


Figure 14: Vacuum Hose Connection Detail

CAUTION

The filter must be grounded to help slow corrosion that can be caused by stray current.

NOTE

All fittings, valves, and hardware as shown are Schedule (SCH) 80 polyvinyl chloride (PVC) and are supplied by Neptune-Benson™.

NOTE

The filter and most of its accessories are acceptable for unprotected installations that are exposed to the elements. If installed in an unenclosed environment, the vacuum transfer unit and the compressor require supplementary covers to protect these units from the elements. Neptune-Benson™ recommends a minimum enclosure of an open shelter with a roof to provide protection from direct exposure to rain and snow.

Vacuum Hose Bracket

Bolt the vacuum hose bracket to desired Defender leg as pictured in 15-A with the the mounting location with the 1/2 x 1.5 inch screws, washers, and nuts (included).

Foe Assero models bolt to the vacuum bracket as pictured in 15-B.

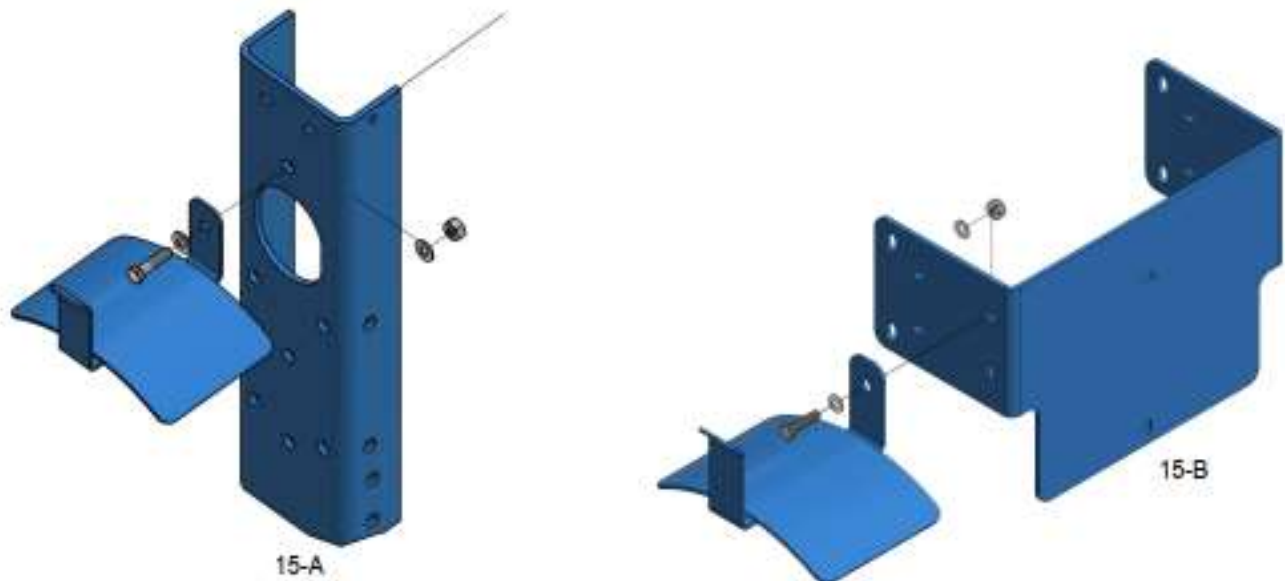


Figure 15: Vacuum Hose Bracket

Vacuum Transfer Unit Wiring

NOTE

All electrical connections are for schematic reference only. They do not indicate exact locations.

1. Mount the pre-wired junction box, as shown.
2. Cut the plug end from the vacuum.
3. Insert the vacuum power cable into junction box with the provided wire nuts.

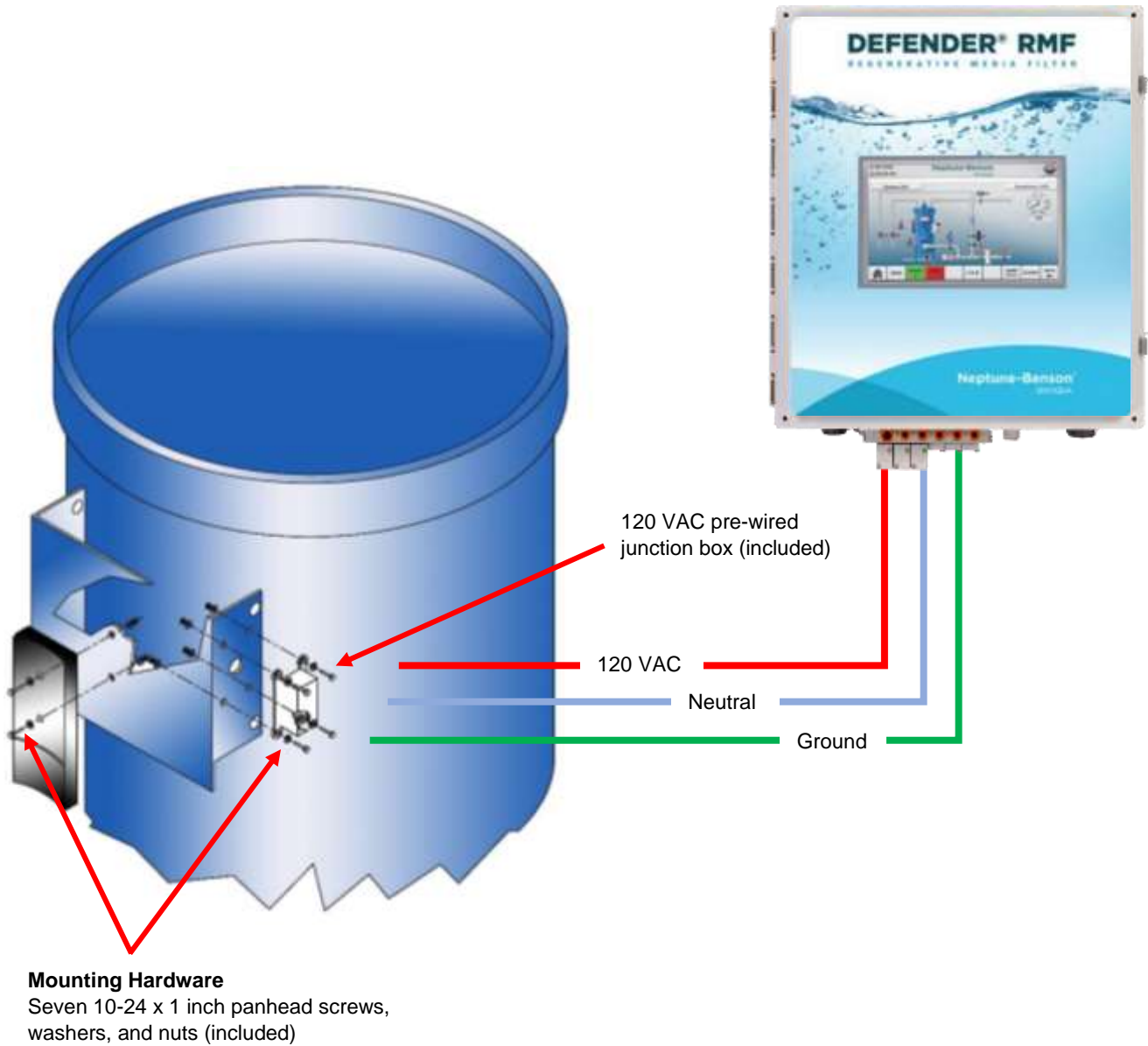


Figure 16: Vacuum Transfer Unit

NOTE

The filter and most of its accessories are acceptable for unprotected installations that are exposed to the elements. The vacuum transfer unit and the compressor manufacturer prohibit exposure to the elements. Neptune-Benson™ recommends a minimum enclosure of an open shelter with a roof to provide protection from direct exposure to rain and snow.

Valves

Butterfly Valves

Dominion™ Butterfly Valves have nylon-coated cast aluminum bodies and nylon-coated ductile iron discs with stainless steel stems.

The valves have bushings around the handle shaft to keep the water from leaking out of the shaft. As the valve ages, these bushings tend to dry out. The dryness, combined with dust and dirt, inhibits valve operation which increases the force required to turn the valve handle. This is not a serious problem when the valves are operated individually – until the problem gets progressively worse and excessive force is required to turn the valve handle. If the valve resistance becomes too high, the actuator can develop enough torque to shear the valve stem.

Routine preventive maintenance for these valves, without removing them, is to lubricate the stem and bushing with a food grade, silicone base, penetrating lubricant. The pneumatic operator must be removed to expose the shaft and bushing.

The valves are highly corrosion resistant and should provide satisfactory service for many years; however, it is possible for them to become coated with foreign material due to an imbalance of the water chemistry or the build-up of hair, lint, or other material that can wrap itself around the valve stems.

If you are inspecting a valve, it is necessary to remove most of the securing bolts at that valve. The resilient lining provides the seal between the valve and the flanges so that no gaskets are required. The flanges must be opened or spread slightly so the valve can slide out of position. Ensure that the valve disc is in the closed position before attempting removal.

The valve shaft is square with a scribe mark. If the scribe marks run in the same direction as the piping (parallel) the disc is in the open position. If the scribe marks are perpendicular to the piping, the disc is closed. The disc does not have to be 100% closed for shut-off purposes.

The resilient lining of the valve provides a seal between the process water and the stainless steel shaft. If the position of the lining is altered due to coating or buildup of scale, etc., this seal could be broken. If the valve resists turning after cleaning, lubricate the shaft ends from the inside and outside. If your service schedule includes removal of the valves for inspection, the resilient lining should be coated with the same lubricant.

If the valve disc does not move freely with normal pressure after treating it with the lubricant, consider replacing the valve. Replacement valves are not expensive and usually cost less than the labor and replacement parts required to repair an existing valve.

Installation of Butterfly Valves

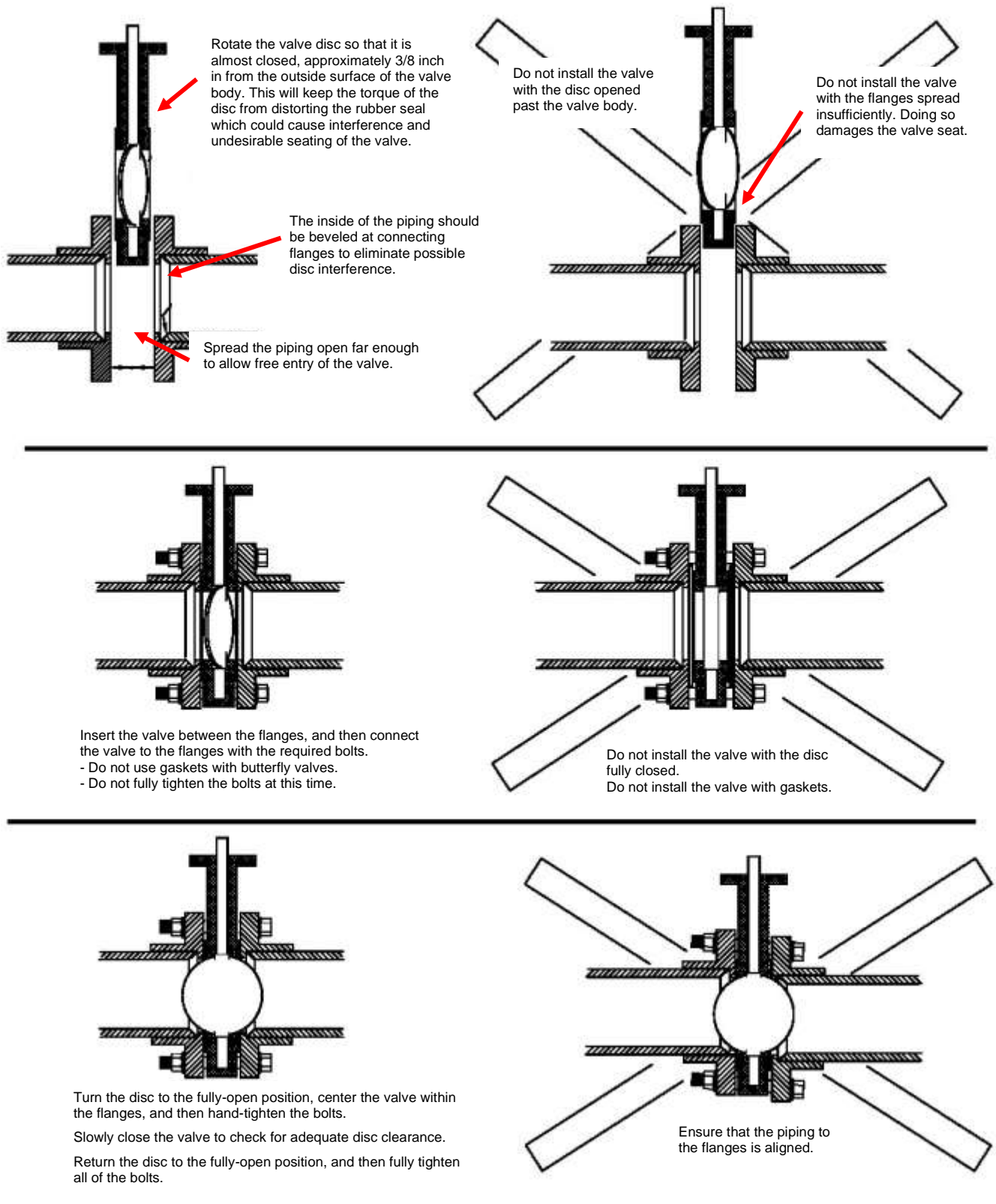


Figure 17: Butterfly Valve Installation

PVC Flange Installation Data

- Follow the illustrated bolt-tightening sequence.
- Recommended gaskets are full face, 1/8 inch thick, elastomeric, 50–70 Shore A hardness.
- Fully lubricate the bolt threads.
- Always use full size flat washers with bolts and nuts.
- Use primer and heavy-bodied PVC cement.

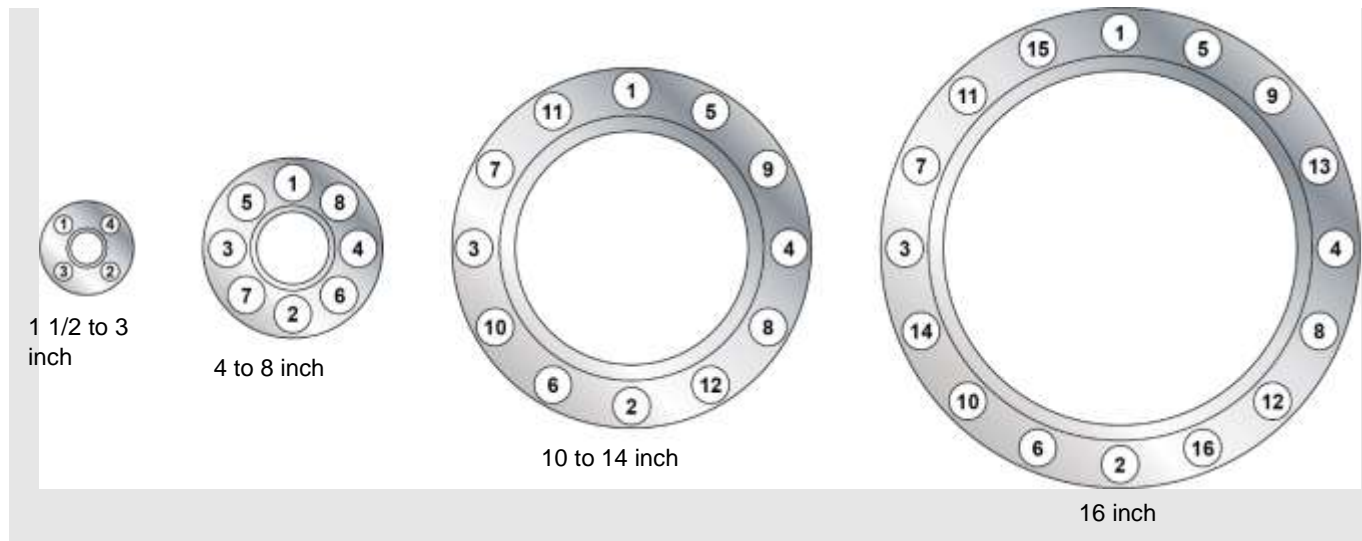


Figure 18: PVC Flange Installation

| Piping Size* | Bolt Circle Diameter | Bolt Size | Recommended Torque (lbf-ft) |
|--------------|----------------------|------------|-----------------------------|
| 1/2 | 2 3/8 | 1/2–13 UNC | 15–20 |
| 3/4 | 2 3/4 | 1/2–13 UNC | 15–20 |
| 1 | 3 1/8 | 1/2–13 UNC | 15–20 |
| 1 1/4 | 3 1/2 | 1/2–13 UNC | 15–20 |
| 1 1/2 | 3 7/8 | 1/2–13 UNC | 15–20 |
| 2 | 4 3/4 | 5/8–11 UNC | 20–30 |
| 2 1/2 | 5 1/2 | 5/8–11 UNC | 20–30 |
| 3 | 6 | 5/8–11 UNC | 20–30 |
| 4 | 7 1/2 | 5/8–11 UNC | 20–30 |
| 5 | 8 1/2 | 5/8–11 UNC | 25–35 |
| 6 | 9 1/2 | 3/4–10 UNC | 33–50 |
| 8 | 11 3/4 | 3/4–10 UNC | 33–50 |
| 10 | 14 1/4 | 7/8–9 UNC | 53–75 |
| 12 | 17 | 7/8–9 UNC | 53–75 |
| 14 | 18 3/4 | 1–8 UNC | 100–110 |
| 16 | 21 1/4 | 1–8 UNC | 100–110 |

* All dimensions are in inches.

NOTE

Flanges conform to ANSI B16.5, Class 150.

Support Spacing for PVC

Support and spacing requirements for PVC pipe, fittings, and valves should be designed into the installation to allow for increased temperature. As temperature increases, the tensile strength of PVC decreases, so the pipe and associated fixtures must be well supported.

Horizontal piping systems should be supported on uniform centers, which are determined by maximum operating temperature. These spacings apply to uninsulated lines, either in a building or exposed to the atmosphere. The formula used to determine the spacing data takes into account the heating effect of the sun on low-temperature lines. For insulated lines, it is necessary to reduce spans by 30% to allow for the additional weight of the insulation.

Adjustable clevis, ring, or roll hangers and roll stands with broad support surfaces are best for use with PVC pipe. Other suitable types include pipe clamps, straps, and riser clamps. A broader and flatter support surface is preferred. The support components should be filed smooth, taped, or padded to avoid the possibility of damaging the pipe. Remove sharp edges or burrs from the clamps, anchors, or any other support components that could frequently come in contact with the pipe. Anchor the pipe so that it is held absolutely rigid or constricted. Some slight axial movement is necessary.

For vertical lines, it is recommended that you band the pipe at the intervals determined by the vertical load. Riser clamps are best utilized if they are supported on spring hangers. Short risers should include a saddle at the bottom and might require an additional hanger at the top. Longer risers might require oversized U-bolts or similar devices to prevent lateral motion.

All valves and points of concentrated loads such as tees and flanges should have support that is independent of the normal span support. Metallic or lined valves should be fully supported because of the increased weight. At higher temperatures or when the line is transporting hazardous liquids, it might be more economically practical to use a continuous support system.

When pipe clamps are used, they should not force the pipe and fitting into position. To remedy this, each section of the pipeline should be laid out and all connections – whether solvent cemented, screwed, or flanged – should be made while the pipe is held in a temporary support. Once the joints have been completed, the final clamping can be completed. When correctly installed, a clamp, holder, or pipe connection can be loosened or removed without the pipeline shifting position.

Recommended Support Spacing (in feet)

| Nominal Pipe Size (inches) | PVC Pipe | | | | | | | | CPVC Pipe | | | |
|-------------------------------------|---|------|------|-----|------------------|------|------|-----|------------------|------|------|------|
| | Schedule 40 | | | | Schedule 80 | | | | Schedule 80 | | | |
| | Temperature (°F) | | | | Temperature (°F) | | | | Temperature (°F) | | | |
| | 60 | 80 | 100 | 120 | 60 | 80 | 100 | 120 | 60 | 80 | 100 | 120 |
| | Recommended Support Spacing (feet) | | | | | | | | | | | |
| 1 | 5.5 | 5 | 4.5 | 3 | 6 | 5.5 | 5 | 3.5 | 6.5 | 6.5 | 6 | 5 |
| 2 | 6 | 5.5 | 5 | 3.5 | 7 | 6.5 | 6 | 4 | 7.5 | 7.5 | 7 | 6 |
| 3 | 7 | 7 | 6 | 4 | 8 | 7.5 | 7 | 4.5 | 8.5 | 8 | 7.5 | 4.5 |
| 4 | 7.5 | 7 | 6.5 | 4.5 | 9 | 8.5 | 7.5 | 5 | 9.5 | 8 | 8 | 5 |
| 6 | 8.5 | 8 | 7.5 | 5 | 10 | 9.5 | 9 | 6 | 10.5 | 10 | 9.5 | 9 |
| 8 | 9 | 8.5 | 8 | 5 | 11 | 10.5 | 9.5 | 6.5 | 11 | 10.5 | 10 | 9.5 |
| 10 | 10 | 9 | 8.5 | 5.5 | 12 | 11 | 10 | 7 | 11.5 | 11.5 | 11 | 10.5 |
| 12 | 11.5 | 10.5 | 9.5 | 6.5 | 12 | 11 | 10 | 7 | 12.5 | 12.5 | 12.5 | 11 |
| 14 | 12 | 11 | 10 | 7 | 13.5 | 13 | 11 | 8 | | | | |
| 16 | 12.5 | 11.5 | 10.5 | 7.5 | 14 | 13.5 | 11.5 | 8.5 | | | | |

OPERATION

Pre-Startup Check

1. Use iron or galvanized piping (not PVC) from the compressor up to the filter/regulator mounted on the filter tank. Add a valve for isolating just before the filter/regulator.
2. All plumbing and valving must be installed per the appropriate *Defender® Regenerative Media Filter Schematic and Parts List*. A water separator with automatic drain must be installed as shown on the schematic. An SMC® AMG350-N04D is recommended.
3. Check critical items prior to scheduling the startup:
 - Power up all system components:
 - a. Compressor
 - b. Control enclosure
 - c. Vacuum transfer motor
 - Set the pressure regulator to 90 PSI (minimum).
4. Check for air leaks at tubing connections. If leaks occur shut off the compressor. Remove the tubing to verify that it is cut square. Correct any tube defects. Reinsert the tubing, ensuring that it is fully engaged. Pull on the tubing to verify that it is connected securely. If leaks still occur, the tubing might be the incorrect OD (outer diameter). All tubing is to be imperial and either 1/4, 3/8, or 1/2 inch OD, as shown on the appropriate *Defender® Regenerative Media Filter Schematic and Parts List*.

Dry Testing (Using the IO Diagnostics Screen)

This feature tests the pneumatics pumps, vacuums, and relays prior to starting the filter.

1. In System Idle mode, press **MENU**.
2. Press **SETUP**.
3. In the **Log-in** pop-up box, enter the passcode **22222** (factory default), and then press **OK**.
4. Press **ADVANCE**.
5. Press **IO DIAGNOSTICS**.



Figure 19: IO Diagnostics Screen

The **IO Diagnostics** screen allows you to test each function by pressing the corresponding button; for example, press **Bump Control** to toggle it to **OFF** and deflate the bump tire. Press the up and down arrows to scroll through the list of diagnostics. Be sure to return all features to their original **ON** or **OFF** setting before proceeding.

Setup Instructions

The Defender® Remote Media Filter (RMF)-D7 (D7) has several selections available for programming to your specific facility needs.

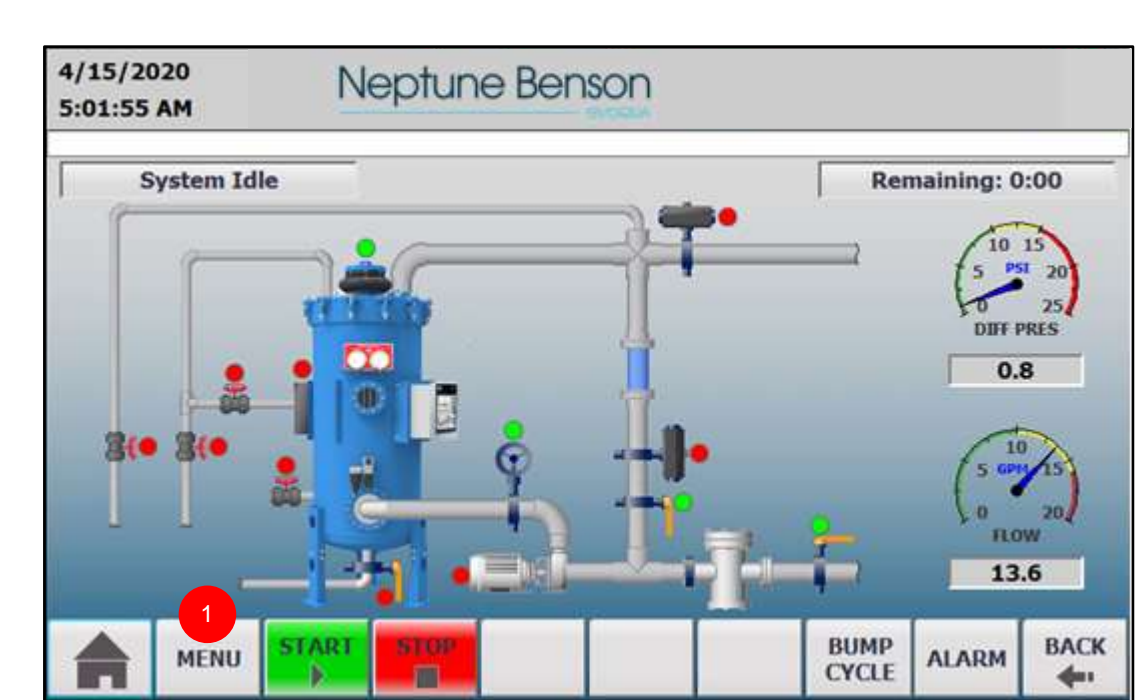


Figure 20: System Idle Screen

1. From the **System Idle** screen, press **MENU**.

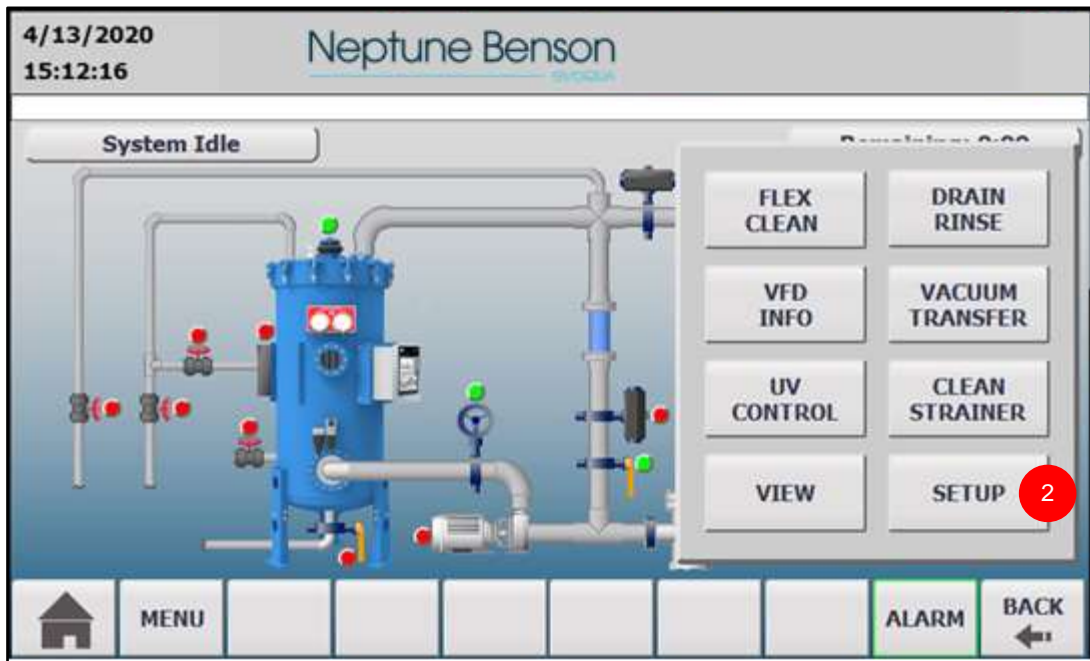


Figure 21: Menu Screen

2. Press **SETUP**.

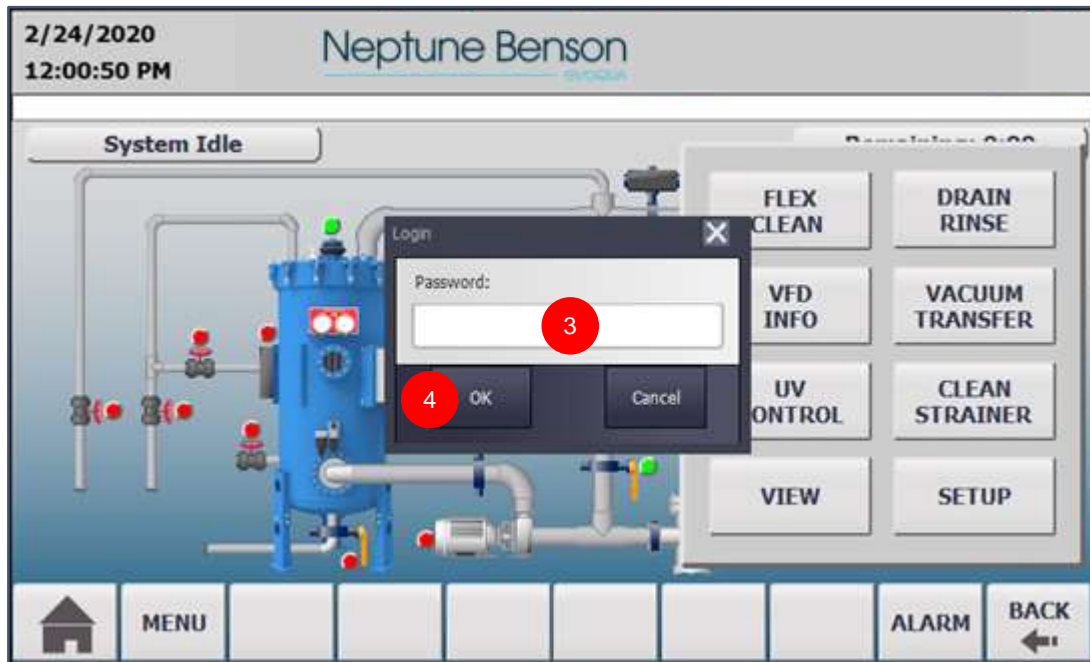


Figure 22: Login Pop-Up Window

3. From the **Login** pop-up window, press the **Password** field, and then enter the password using the pop-up keyboard. **The default password is 22222.**
4. Press **OK** to confirm the password and close the pop-up window.

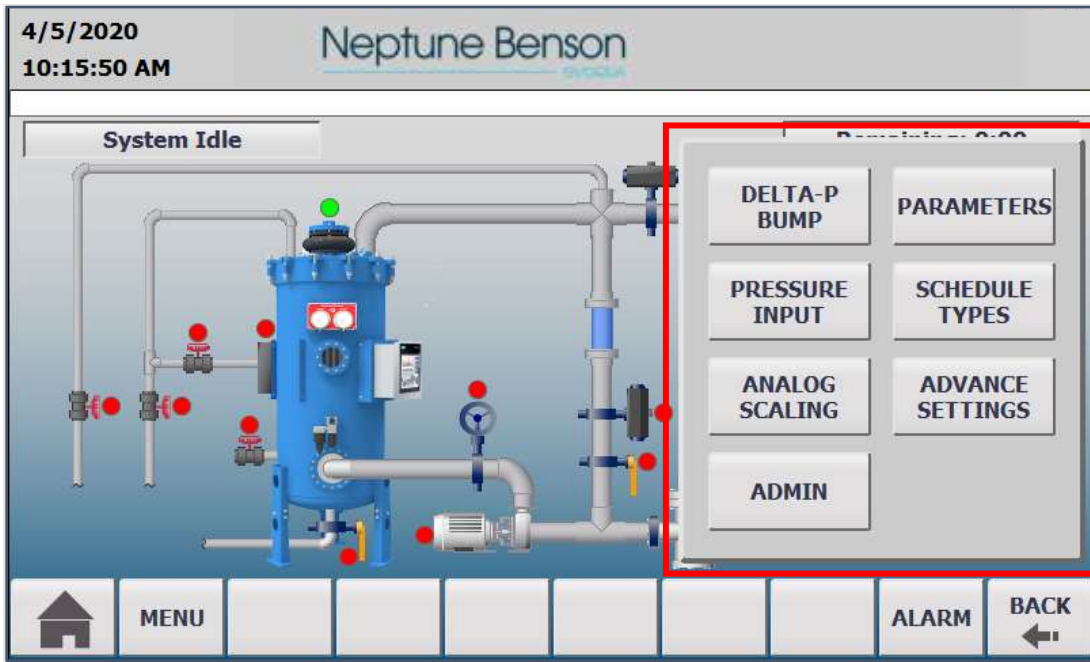


Figure 23: Setup Submenu Screen

The **Setup Submenu** screen contains several options. Press **BACK** from any of the submenu screens to return to the previous screen. Press the home button at the bottom left to return to the **System Idle** screen.

PARAMETERS

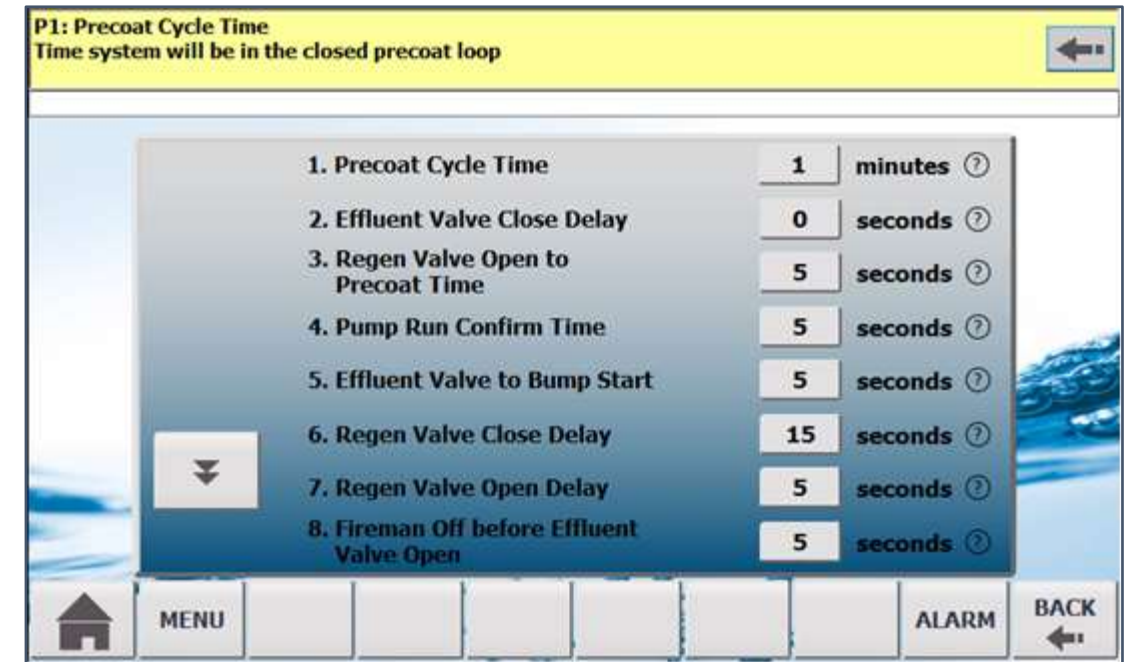


Figure 24: Parameters Screen

Press the up or down arrows to scroll through the list of parameters. The field to the right of each parameter should ideally contain a default value. You can change these values, if needed. Press the ? to right of the parameter value to display a description of the parameter.

From the **Menu** screen, the **VIEW** option allows you to view the parameters; however, you cannot edit the parameters from that screen.

Parameters and their default values (factory setting):

| Parameter | Default | Notes |
|---|-------------|---|
| 1. Precoat Cycle Time | 10 minutes | Time system is in the closed precoat loop. |
| 2. Effluent Valve Close Delay | 0 seconds | Time after bump is initiated to close the effluent valve. |
| 3. Regen Valve Open to Precoat Time | 5 seconds | Time display on the screen prior Opening Precoat Valve to start of Precoat Timing. |
| 4. Pump Run Confirm Time | 5 seconds | Time the control enclosure waits for a closed contact from the pump motor starter. If the closed contact signal is not received, the system shuts down. |
| 5. Effluent Valve to Bump Start Time | 5 seconds | Delay to start bump after the effluent valve closes. |
| 6. Regen Valve Close Delay | 15 seconds | Delay time between the effluent relay energizing to effluent valve opening after the precoat cycle and the regen relay de-energizes to close the regen valve. |
| 7. Regen Valve Open Delay | 5 seconds | Delay time for the regen valve relay to energize to open the regen valve once the start button is pressed. |
| 8. Fireman Off Before Effluent Valve Open | 0 seconds | Delay time after precoat before the effluent valve opens. |
| 9. Fireman On to Effluent Valve Close Time | 0 seconds | Set to the desired delay, if used. Relay energizes when an automatic or manual bump is initiated and shutoff auxiliary equipment. System does not bump until the delay times out. |
| 10. Bump Set Off Time | 5 seconds | Time bump solenoid de-energizes when Bump Set is pressed. |
| 11. Bump Set On Time | 2 seconds | Time bump solenoid energizes when Bump Set is pressed. |
| 12. Bump Auto/Man Off Time | 5 seconds | Time bump solenoid de-energizes when an automatic or manual bump is initiated. |
| 13. Bump Auto/Man On Time | 2 seconds | Time bump solenoid is energized. |
| 14. Flex Clean (Flexible Tube Chemical Cleaning) Loop Time | 120 seconds | Time that the pump is on in precoat mode during chemical cleaning. Set to 0 if using Neptune-Benson Chem Clean Express. |
| 15. Flex Clean (Flexible Tube Chemical Cleaning) Loop Delay | 15 minutes | Delay time between system idle to bumping and precoating, as in Parameter 14. |
| 16. Auto Bump Loops | 10 | Number of bumps, when initiated. |
| 17. Required Bump Passcode | OFF | When set to ON , bump cannot be initiated without a passcode. |
| 18. Tank Drain Option (Auto Drain Valve Open to flush tank bottom) | OFF | |
| 19. Tank Drain On Time | 5 Seconds | Time that the valve is open. |
| 20. Precoat Line Option (Auto Valve to allow make up water for TDS control) | OFF | |
| 21. Precoat Line On Time | 5 seconds | Time that the valve is open. |
| 22. UV Screen Cycle Option (Automatic UV Screen) | OFF | Set to ON if the option is used. |
| 23. UV Screen Cycle Time | 0 hours | If on, set to the desired time for self-cleaning. |
| 24. Water Level Enable | OFF | If set to ON , probes and sensing chamber are required for water level control. |
| 25. Water Level Fill Delay | 0 seconds | Set to the required time from when the water level reaches the hi level probe to the desired optimum water level. |

| Parameter | Default | Notes |
|--|-----------|---|
| 26. Level Stabilize Delay | 0 seconds | |
| 27. Level Valve Max Open Time | 0 seconds | To prevent overfilling the pool, this is the maximum time that the solenoid valve is open during fill. |
| 28. VFD Display Enable | OFF | To utilize this feature, interlock wiring is required from VFD to D7. |
| 29. VFD Units | GPM | Other available units of measurement include m³/hour and l/second . |
| 30. Low Pressure Cutoff | 50 PSI | Never operate the filter with this parameter disabled. |
| 31. Delta-P Difference Value | 12 PSI | If enabled, the filter automatically bumps when a pressure differential reaches 12 PSI, unless the bump block is scheduled. |
| 32. Flow Rate Enable | OFF | Use this for a 4–20 mA flow sensor when you do not have a VFD. |
| 33. Flow Units | GPM | Other available units of measurement include m³/hour and l/second . |
| 34. Output Log Frequency (minutes) | OFF | |
| 35. Precoat Pump Enable | OFF | Set to ON when a separate precoat pump is used. |
| 36. Main Pump On to Effluent Open Delay | 6 seconds | Time that the main filtration pump is on before the effluent valve opens. |
| 37. Precoat Pump Off after Regen Close Delay | 5 seconds | Time that the precoat pump is on before the valve closes. |
| 38. Dual Mode Option | OFF | This parameter is for industrial use where two filters alternate filtration. |
| 39. Main Drain Delay - Dual D4 | 0 seconds | |
| 40. Language | English | Other available languages include German, Chinese, Spanish, and French . |
| 41. Pressure Units | PSI | Other available units of measurement include BAR and KPI . |
| 42. Auto Restart after Power Fail | OFF | When set to ON , the system restarts automatically after a power failure. |
| 43. Remote ON/OFF Control | OFF | When set to ON , the system can be controlled via remote access. |
| 44. Alarm Relay Output | OFF | When set to ON , turns on the relay when any alarm is active, and turns it off when the alarm is cleared. |
| 45. Optional Relay 1 Control | NA | Extra valve is considered to be controlled by a relay. There are four options available. This will control the valve in different steps, differently. |
| 46. Start Fill Level | 0% | Filling can be started at this setting. |
| 47. Pool Name | N/A | A name can be entered in this field that displays on the header of the HMI. |
| 48. USA Swimming logo display | ON | USA Swimming logo display on/off. |

DELTA-P BUMP

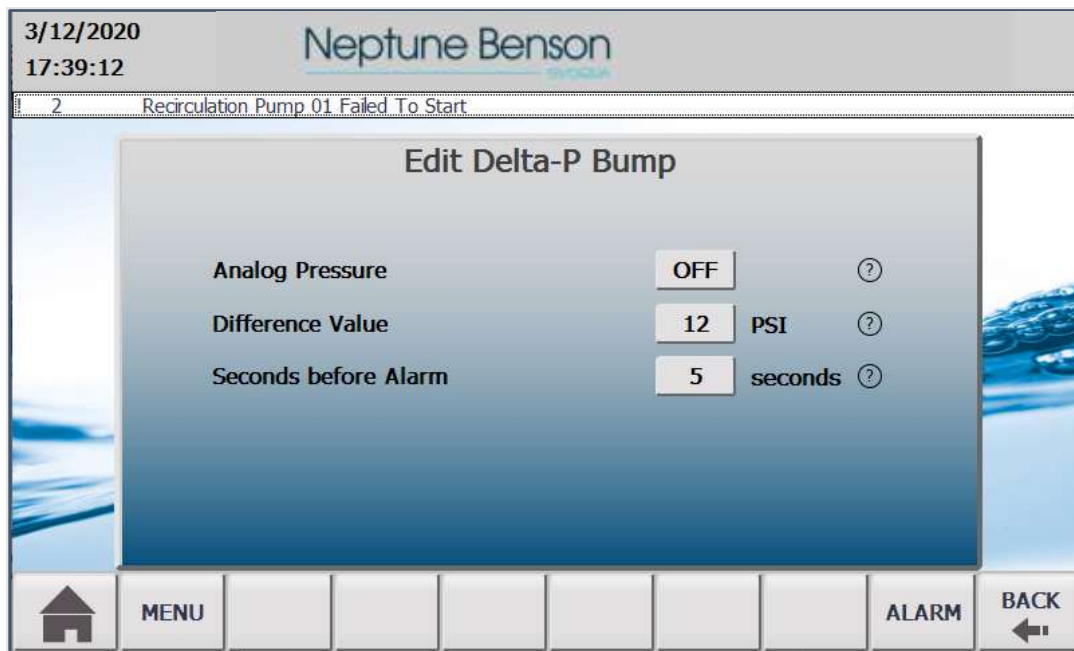


Figure 25: Edit Delta-P Bump Screen

On this screen, you can enable the filter to automatically bump when a preset pressure differential is reached by using the following settings:

- **Analog Pressure Enable: ON.** Never operate the system with this set to **OFF**.
- **Difference Value: 12 PSI** (factory default)
- **Seconds before Alarm: 5 seconds** (factory default)

PRESSURE INPUT

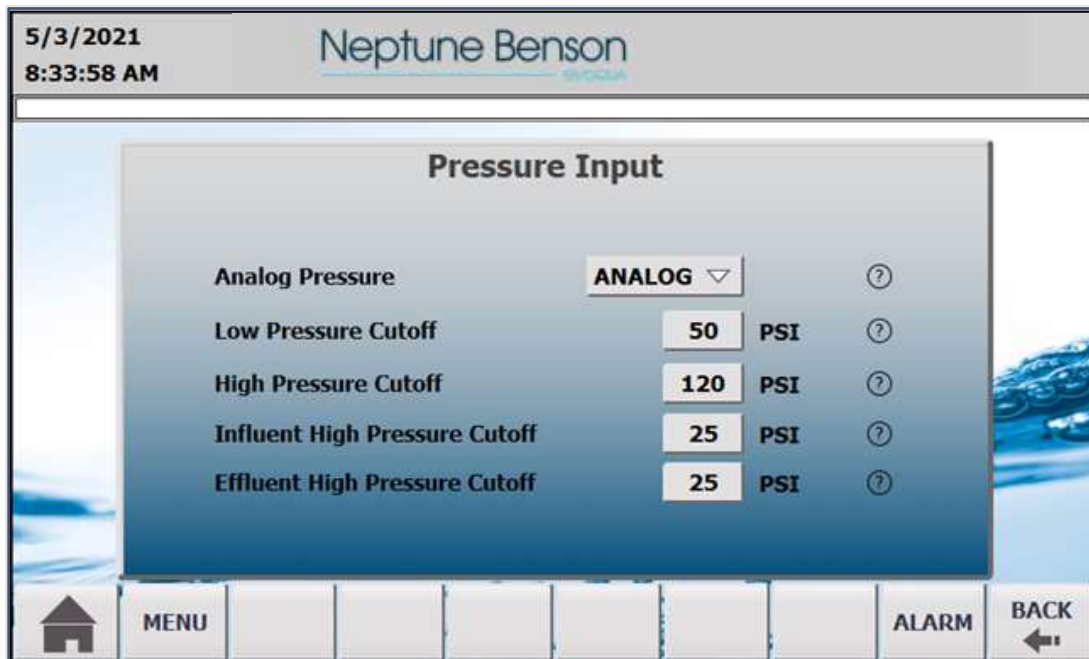


Figure 26: Pressure Input Screen

On this screen, you can configure the filter to monitor the available air pressure and shut down the system if the value falls below the preset value:

- **Analog Pressure: Analog**
- **Low Pressure Cutoff: 50 PSI** (factory default)

ADMIN

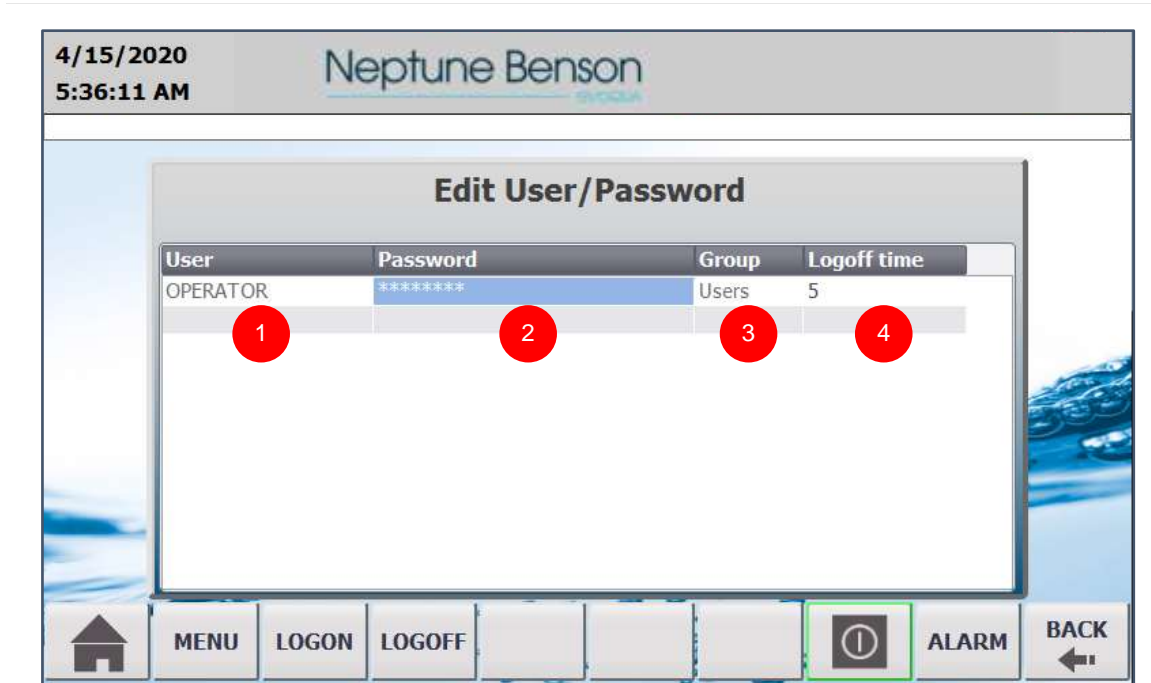


Figure 27: Admin Screen

On this screen, you can add new users or edit existing user details and other administrative functions.

Add a User:

1. Press the empty **User** field, and then enter a user name using the pop-up keyboard.
2. Enter the required **Password**, as described in the following procedure.
3. Select a suitable user **Group** (Administrator, User, etc.) from the drop-down list.
4. Enter a **Logoff time**.



Figure 28: Admin Screen with Change Password Pop-Up Window

Change a User's Password:

1. Press the **Password** field of the user whose password you want to change.
2. In the **Change password** pop-up window, press the **New Password** field, and then enter the new password using the pop-up keyboard.
3. Re-enter the password in the **Confirmation** fields.
4. Press **OK** to confirm the change and close the pop-up window.

LOGOFF/LOGON: Use these buttons to log-off the existing user or log in with a different user name.

Exit Runtime: Press the power button to exit the panel runtime.

ANALOG SCALING

On this screen, you can set the transducers range values to agree with your analog gauges.

4/15/2020
7:44:00 AM

Neptune Benson

Analog Scaling

| | Scale Minimum | Scale Maximum | Scale Value | | |
|-----------------------------------|---------------|---------------|-------------|-----|---|
| 1. Influent Probe Scale Value | 0.0 | 20.0 | 14.5 | PSI | ? |
| 2. Effluent Probe Scale Value | 0.0 | 10.0 | 5.4 | PSI | ? |
| 3. Air Pressure Probe Scale Value | 0.0 | 100.0 | 61.5 | PSI | ? |
| 4. Flow Probe Scale Value | 0.0 | 25.0 | 13.6 | GPM | ? |
| 5. Pool Level Probe Scale Value | 0.0 | 100.0 | 54.3 | % | ? |

HOME MENU ALARM BACK



Figure 29: Analog Scaling Screen

SCHEDULE TYPES

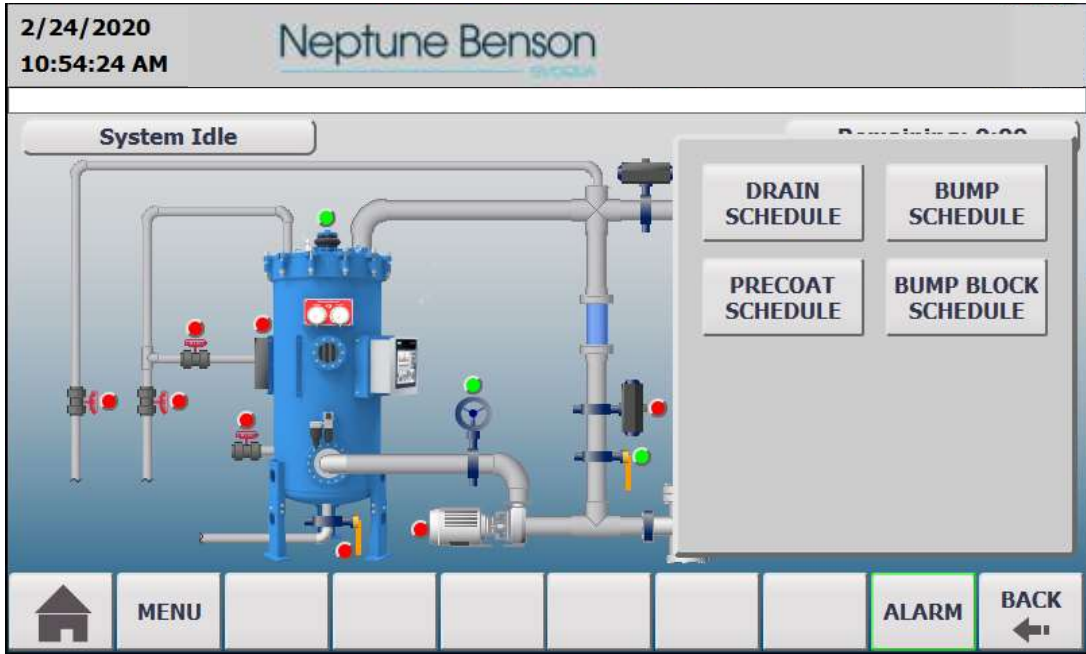


Figure 30: Schedule Types Screen

This screen contains four submenus. All of the screens on these submenus contain seven sets of selections representing the seven days of the week and a time schedule, allowing you to program the event for specific days and times.

- **DRAIN SCHEDULE** (optional, to periodically flush bottom of the tank)
- **PRECOAT SCHEDULE** (optional, to allow for makeup water for pool water TDS control)
- **BUMP SCHEDULE**
- **BUMP BLOCK SCHEDULE**

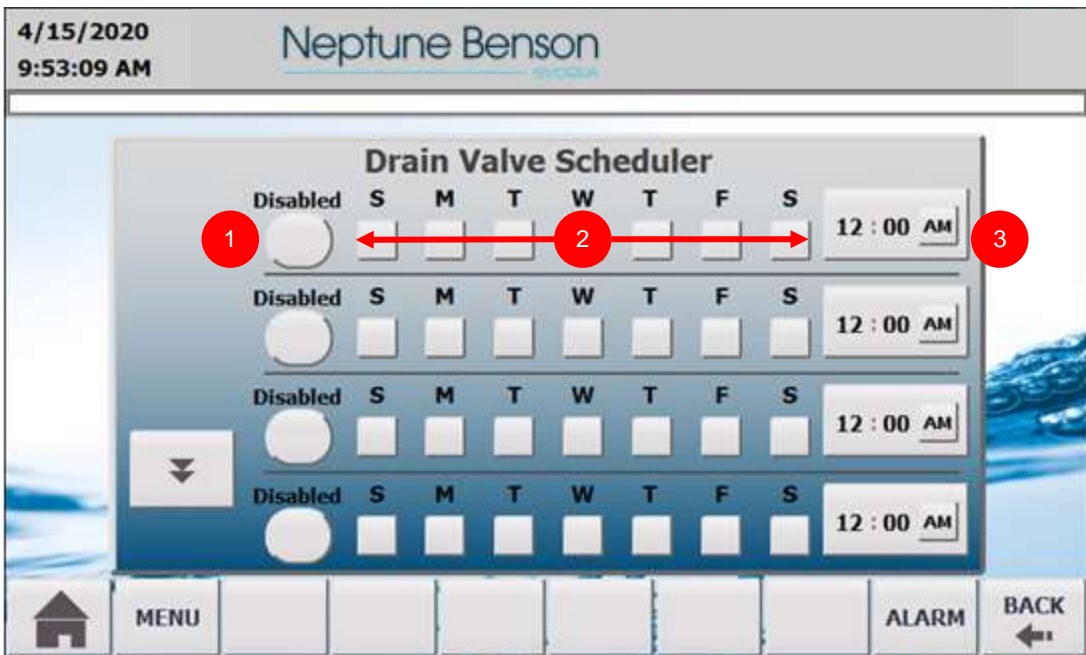


Figure 31: Drain Valve Scheduler Screen

Drain Valve Scheduler: Set the schedule for the auto drain valve to open and close to flush the tank bottom if Parameter 18 from the **Parameter** menu is set to **ON**.

There are two screens for the drain valve scheduler. The down arrow opens the second screen.

1. Press **Disabled** to toggle it to **Enabled**. The green color confirms that schedule is enabled.
2. Select the appropriate days of the week. The selected days turn green.
3. Enter the time at which you want the drain schedule to automatically start.

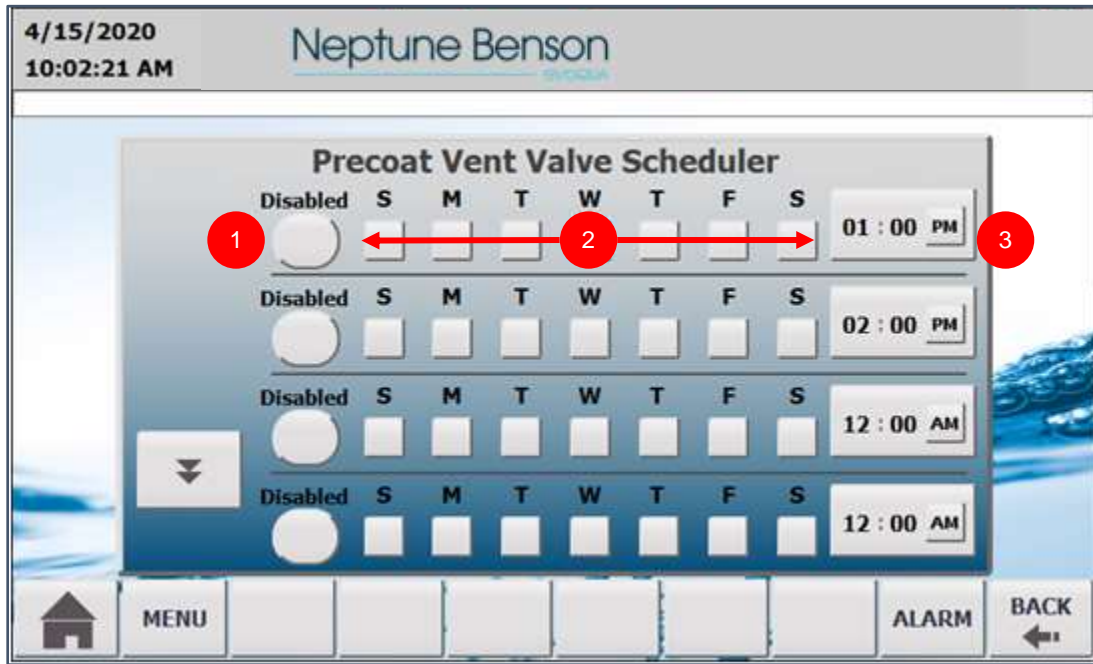


Figure 32: Precoat Vent Valve Scheduler Screen

Precoat Vent Valve Scheduler: Set the schedule for the automatic operation of the precoat valve to allow for makeup water if Parameter 20 from the **Parameter** menu is set to **ON**.

There are two screens for the precoat vent valve scheduler. The down arrow opens the second screen.

1. Press **Disabled** to toggle it to **Enabled**. The green color confirms that schedule is enabled.
2. Select the appropriate days of the week. The selected days turn green.
3. Enter the time at which you want the precoat valve to automatically start.

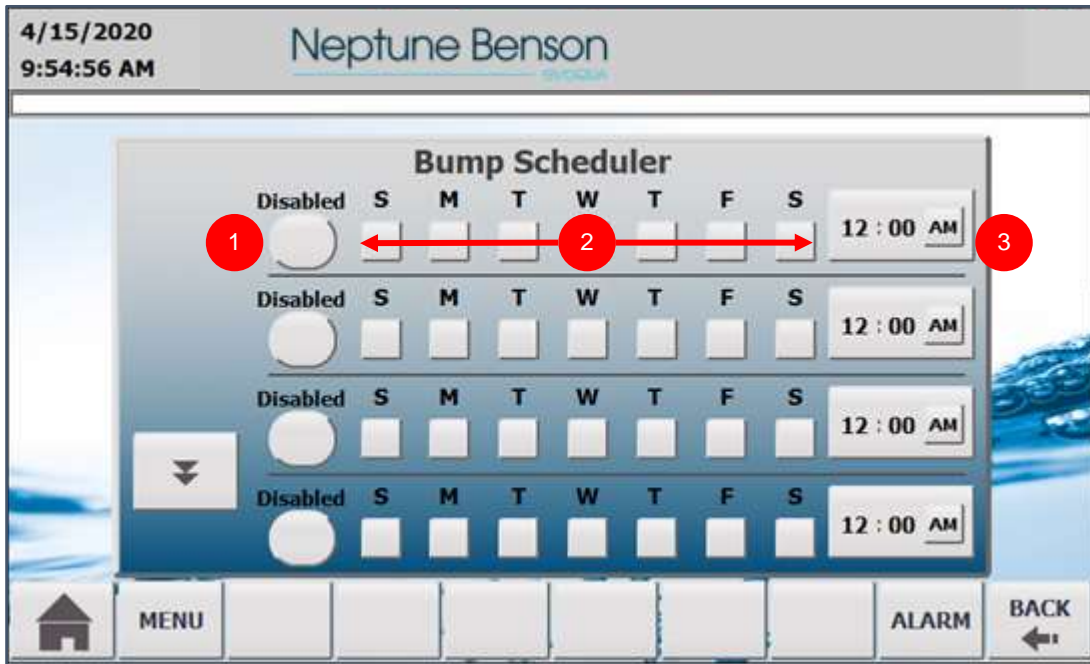


Figure 33: Bump Scheduler Screen

Bump Scheduler: Set the schedule for the automatic bumping function. Typically, one bump per day, seven days a week is sufficient. The D7 has the capacity to program up to seven bumps per day.

There are two screens for the bump scheduler. The down arrow opens the second screen.

1. Press **Disabled** to toggle it to **Enabled**. The green color confirms that schedule is enabled.
2. Select the appropriate days of the week. The selected days turn green.
3. Enter the time at which you want the bump to automatically start.

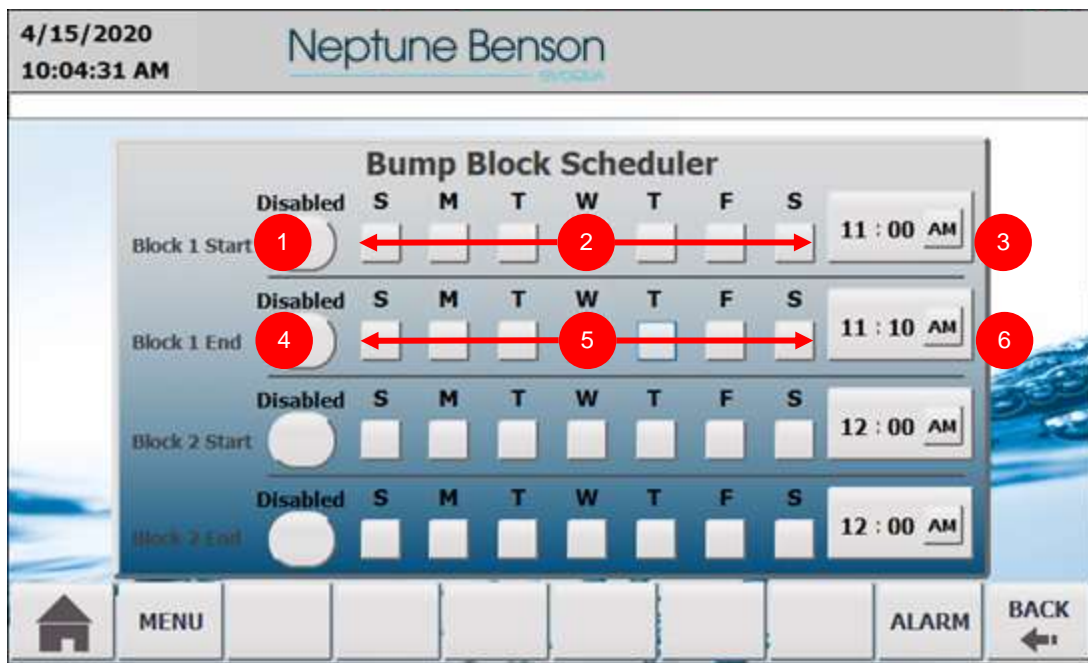


Figure 34: Bump Block Scheduler Screen

Bump Block Scheduler: Set a window of time to block a bump from occurring if **Analog Pressure Enable** is set to **ON** on the **Delta P Bump** screen and if you have set up a daily bump schedule. This is used if you want to prevent a bump from occurring once the pressure differential is reached or during hours when the pool is open. For this you need to select a start and end window schedule.

1. In the **Block # Start** row, press **Disabled** to toggle it to **Enabled**. The green color confirms that schedule is enabled.
2. Select the appropriate days of the week. Selected days turn green.
3. Enter the time at which you want the bump block to start.
4. In the **Block # End** row, press **Disabled** to toggle it to **Enabled**. The green color confirms that schedule is enabled.
5. Select the appropriate days of the week. The selected days turn green.
6. Enter the time at which you want the bump block to end.

NOTE:

Both automatic and manual bumps are blocked during the scheduled bump block. To perform a manual bump during the scheduled bump block, turn the appropriate bump block schedule off by pressing the **Enabled** buttons to toggle them to **Disabled**.

ADVANCE SETTINGS

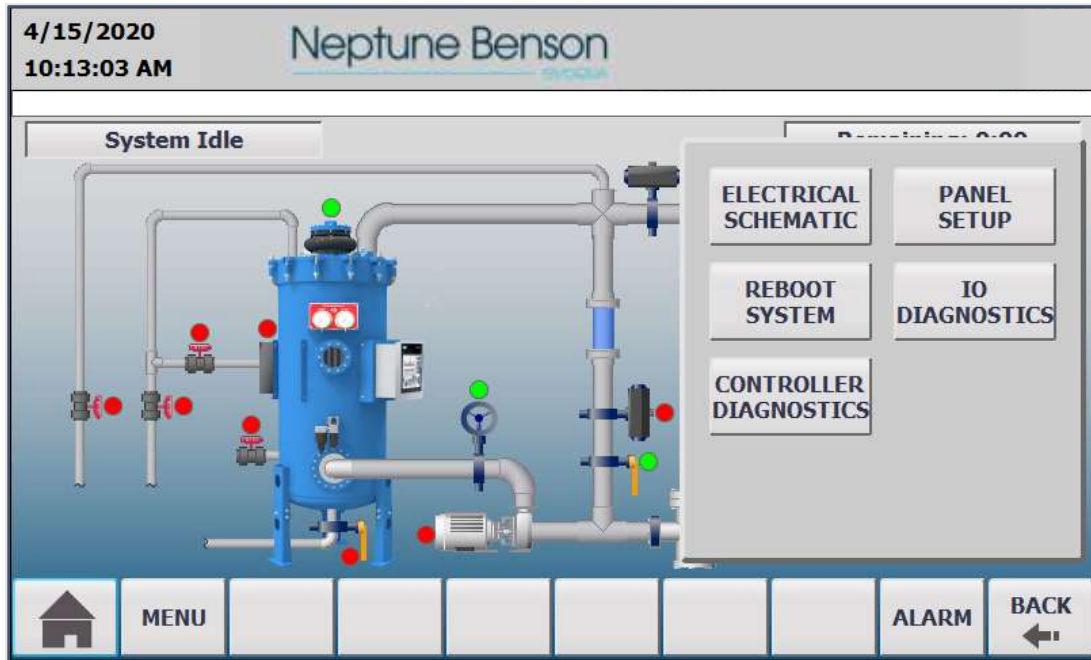


Figure 35: Advanced Settings Screen

The **Advance Settings** screen has five submenus:

- **ELECTRICAL SCHEMATIC:** Opens electrical drawings.
- **REBOOT SYSTEM:** Reboots the operator panel.
- **CONTROLLER DIAGNOSTICS:** Displays the diagnostic information of the controller.
- **PANEL SETUP:** Provides Operator Panel setup options. Refer to *Advanced Topics*.
- **IO DIAGNOSTICS:** Allows individual manual testing of all relays. Used for dry testing.

Once you have completed your initial preparation you are ready to start your Defender® Regenerative Media Filter.

Startup

Media Requirements

Obtain an appropriate amount of perlite. Specific requirements are located on the data plate on the opposite side of the D7 controller. Refer to the *Appendix* for a table indicating the amount of perlite for your Defender® model.

The D7 provides step-by-step screen prompts for the instructions and a confirmation to press **NEXT** to move you to the next step. All functions are controlled by the buttons on the screen.

Loading Perlite-Vacuum Transfer

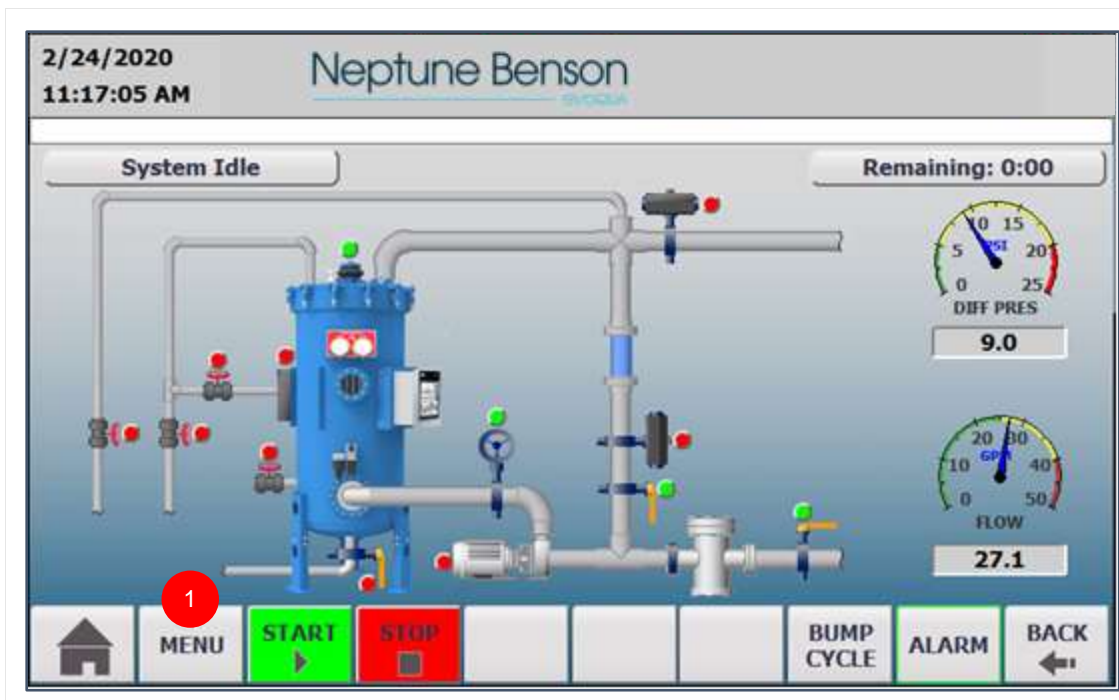


Figure 36: System Idle Screen

1. From the **System Idle** screen, press **MENU**.

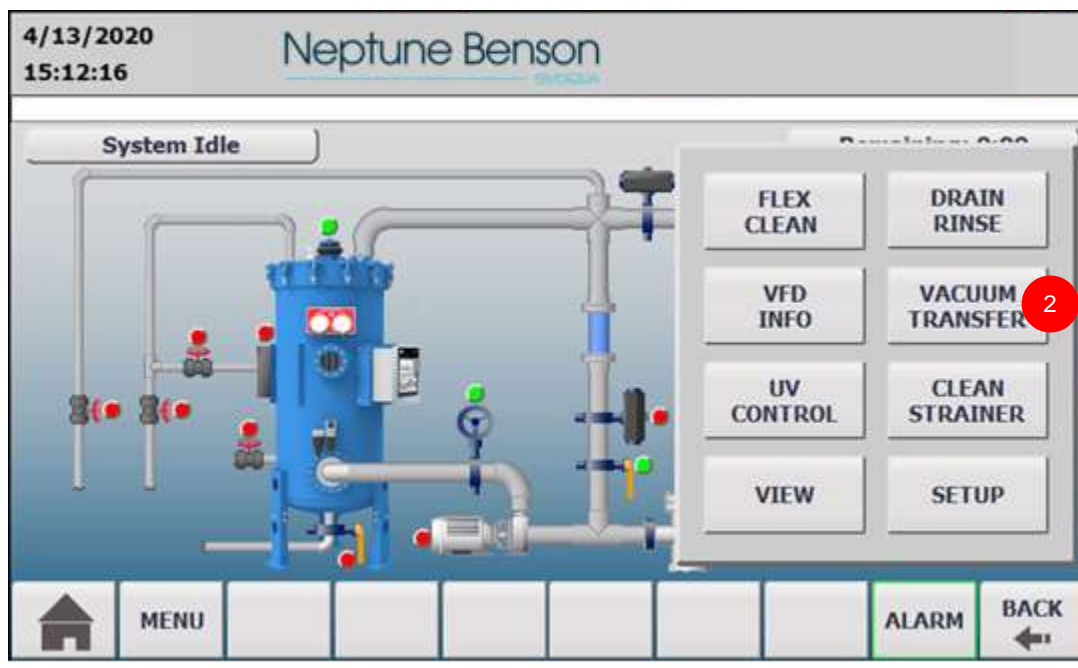


Figure 37: Menu Screen

2. Press **VACUUM TRANSFER**.

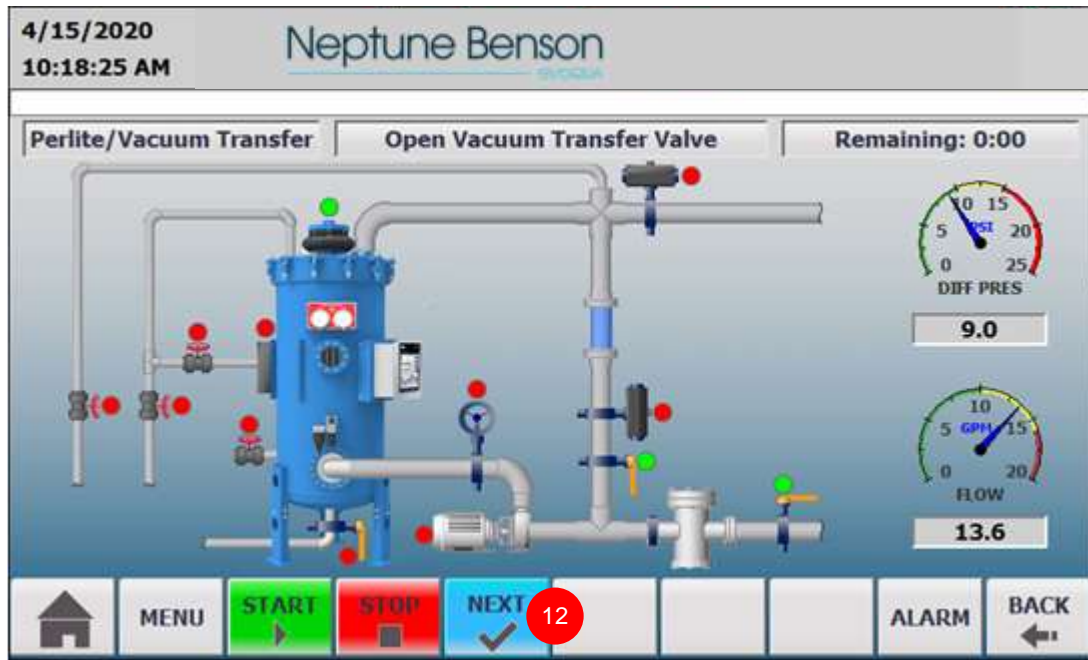


Figure 38: Open Vacuum Transfer Valve Screen

3. Open Vacuum Transfer Valve.
4. Open Vacuum Hose Valve.
5. Insert Transfer Hose into Perlite.
6. Turn Vacuum On, turn the Vacuum Off when done.
7. Close Vacuum Hose Valve.
8. Close Vacuum Transfer Valve.
9. Open Precoat Line Vent Valve.
10. Open Pump Discharge Valve.
11. Open Vacuum Drain Valve.
12. Press **NEXT** to open the **Fill Tank** screen.

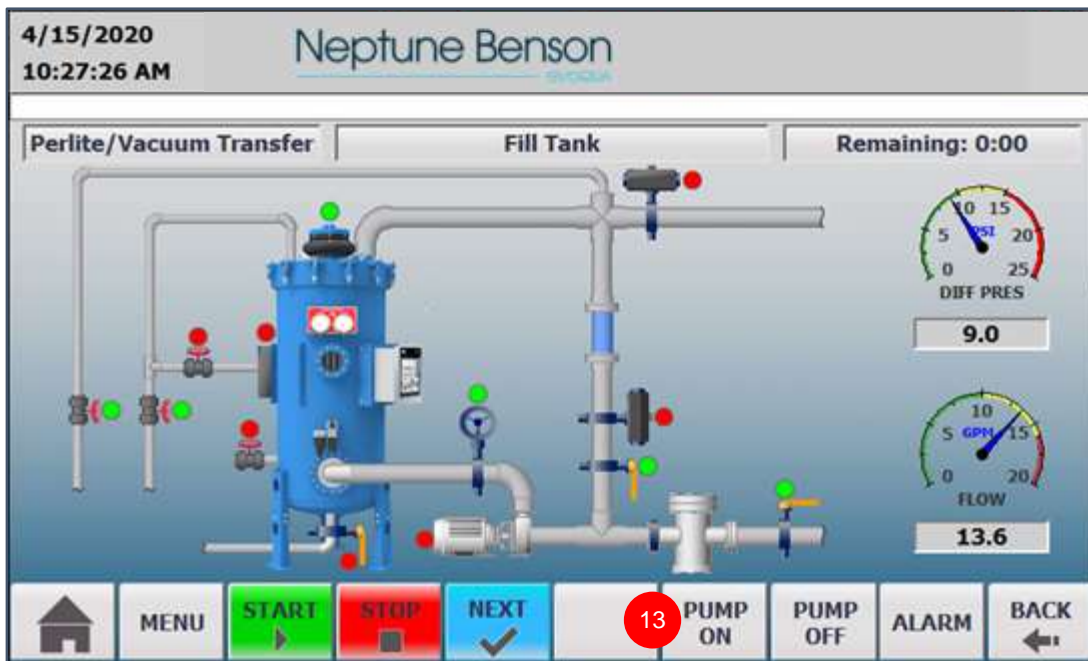


Figure 39: Fill Tank Screen

13. Press **PUMP ON**.
14. Close Vacuum Drain Valve when the water exits the drain and all of the air is exhausted.
15. Close Precoat Line Vent Valve when the water exits the drain and all of the air is exhausted.

The **Precoat/Regen** screen opens.

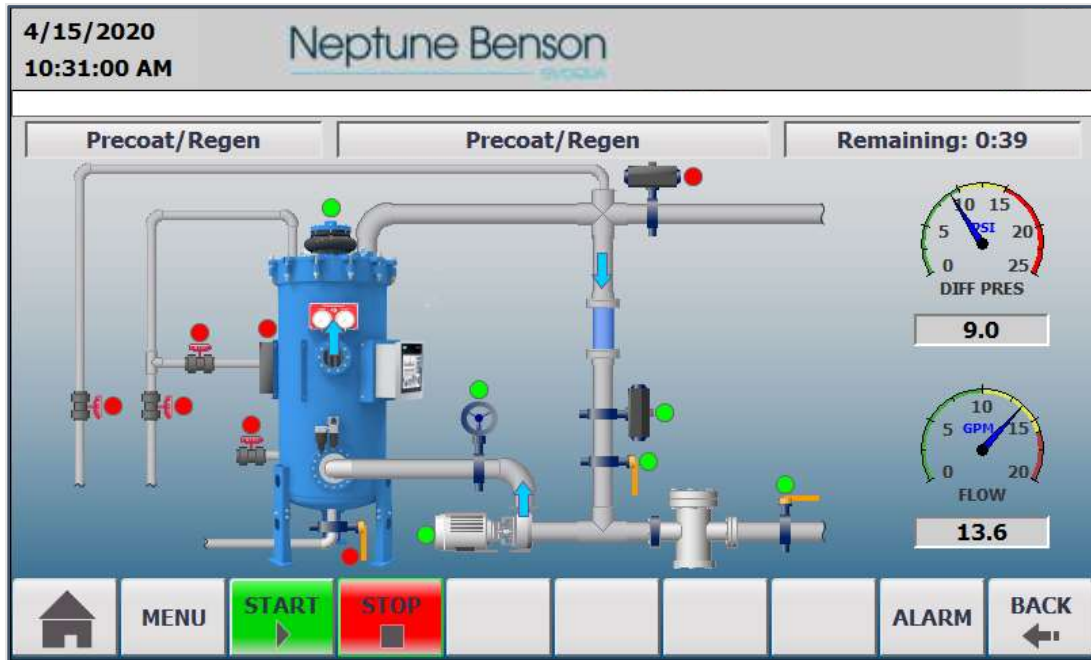


Figure 40: Precoat/Regen Screen

If the Service Engineer is logged in and the system is in **Precoat/Regen** mode, the **END PRECOAT** button is visible. You can use it to manually end the **Precoat/Regen** mode.

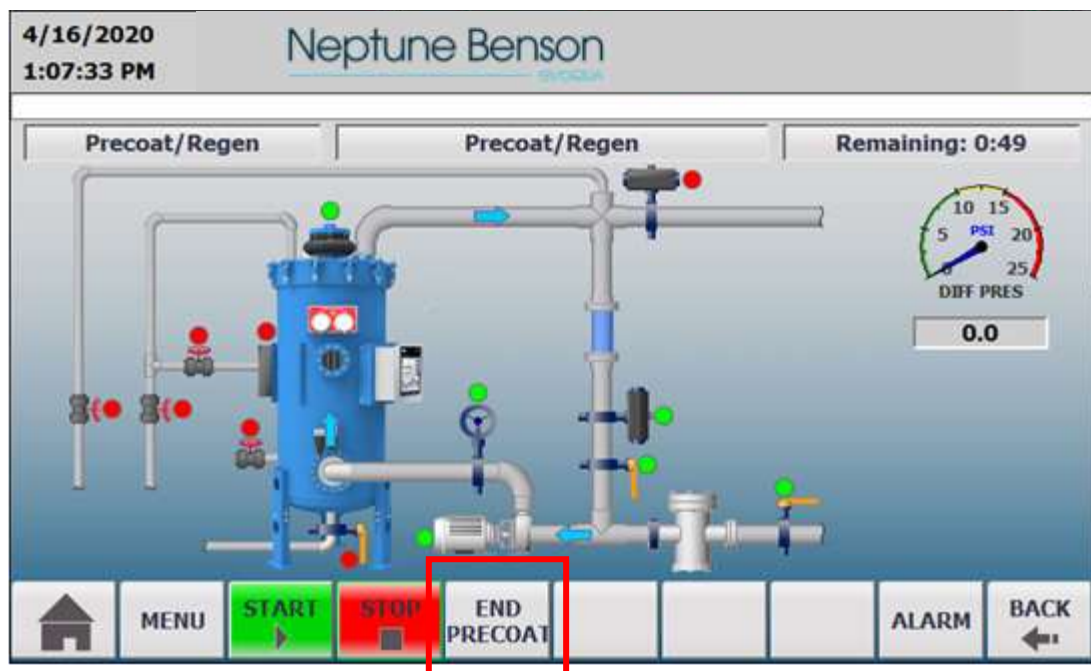


Figure 41: Precoat/Regen Screen with END PRECOAT Button

After 10 minutes, the effluent valve opens. 15 seconds later, the precoat valve closes. The **Filter Mode** screen displays.

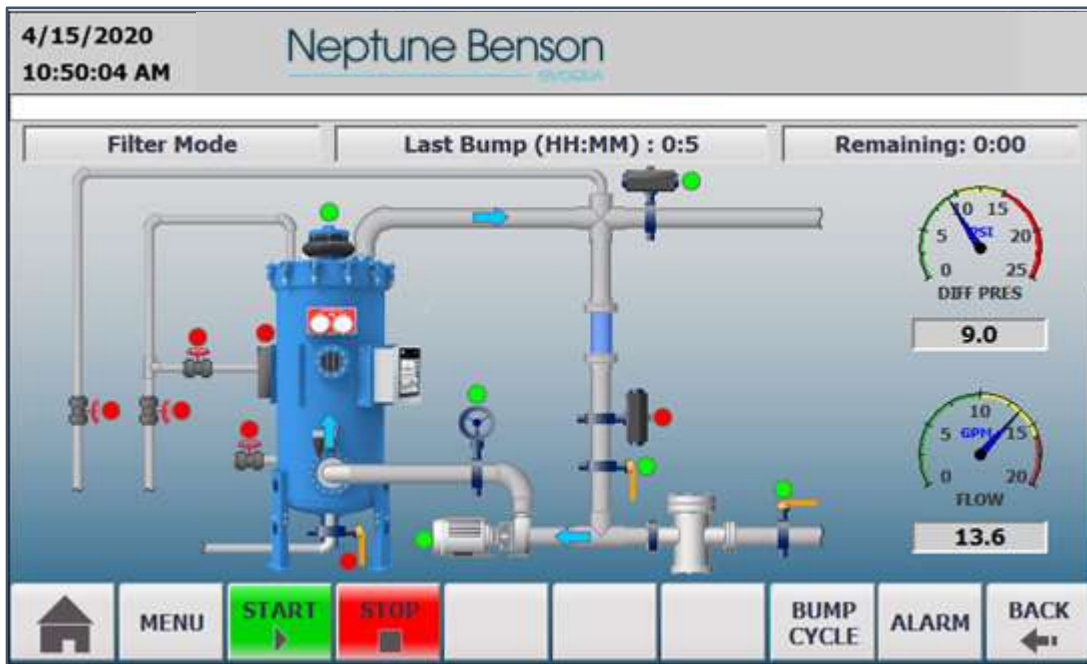


Figure 42: Filter Mode Screen

The D7 continues to run in **Filter Mode** until you press **BUMP CYCLE**, the pressure differential is reached, or as scheduled by the internal clock.

It is recommended that a bump be performed at least once every day. When a bump occurs, the pump stops, the effluent valve closes, and then the bump mechanism activates. The bump mechanism depressurizes, and then pressurizes (bumps) 10 times. This action separates media and dirt from the tubes. The D7 goes into the **Precoat/Regen** and **Filter Mode**, as described above.

Last Bump Time: The time is shown in hour and minutes.

Recharging Perlite (Drain/Rinse)

There are several indications that can indicate when it is time to recharge the perlite. Factors such as bather load, water chemistry, organics, indoor/outdoor pool, etc. influence the length of time between recharging. Perlite might require recharging in two weeks to three months.

Recharge media when:

- The pressure differential reaches 10–12 PSI shortly after bumping.
- The required system recirculation flow rate cannot be maintained.
- The media does not coat well (has the appearance of a melted candle) or does not readily release from the flex tubes and into the suspension.

Before pressing **STOP**, partially open the drain valve to clear any debris in the piping.

Press **STOP**. The pump stops, the effluent valve closes, and the **System Idle** screen displays.

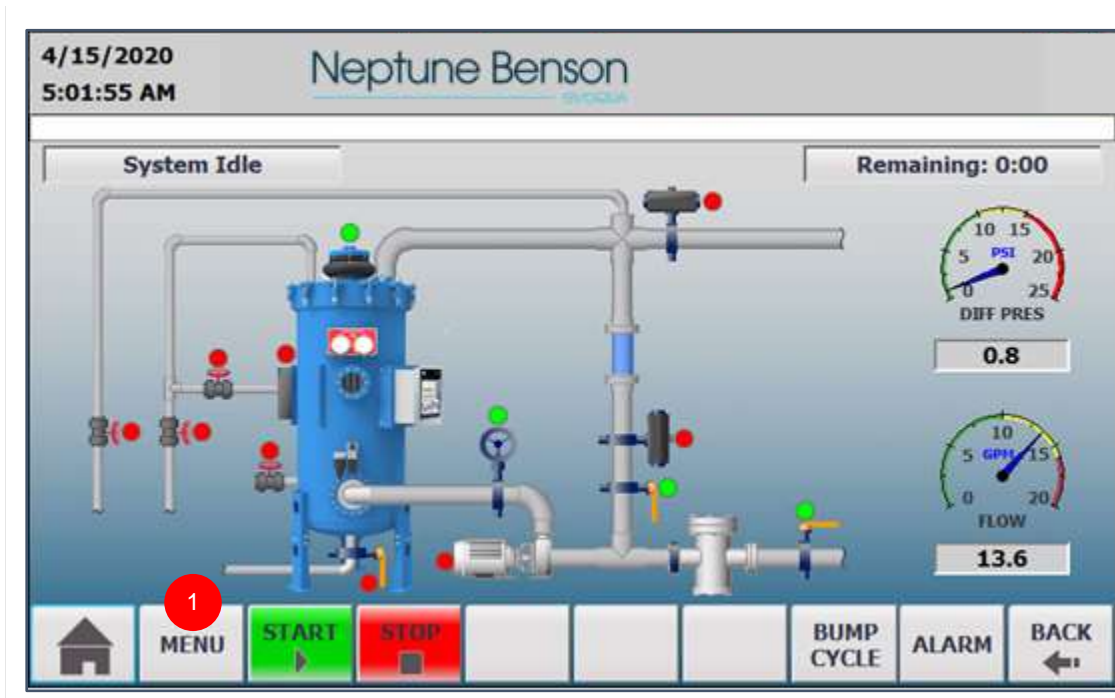


Figure 43: System Idle Screen

1. Press **MENU**.



Figure 44: Menu Screen

2. Press **DRAIN RINSE**.
3. Close Pump Discharge Valve.
4. Press **BUMP CYCLE**. The filter bumps for the preprogrammed number of times (10).
5. Open Drain Valve.
6. Open Vacuum Drain Valve.
7. Once the tank is completely empty, Close Drain Valve.
8. Open Pump Discharge Valve.

9. Fill Tank. Press **PUMP ON**, and then wait a couple of seconds after the water passes the viewing window.
10. Press **PUMP OFF**.
11. Press **REPEAT**.
12. Repeat Steps 3–7 to rinse the tank and remove any residual media and dirt.

NOTE:

Once the tank has been drained and rinsed satisfactorily, the D7 automatically prompts you to perform a **Vacuum Transfer** as instructed in *Loading Perlite/Vacuum Transfer* Steps 3–11 and *Fill Tank* Steps 1–3. If you stop the process for any reason, press **MENU**, press **VACUUM TRANSFER**, and perform Steps 3–11 above.

Recharging Perlite (Drain/Rinse) With Automatic Drain Valve Option (Parameter 18 is Set to **ON**)

Press **STOP**. The pump stops, the effluent valve closes, and the **System Idle** screen displays.

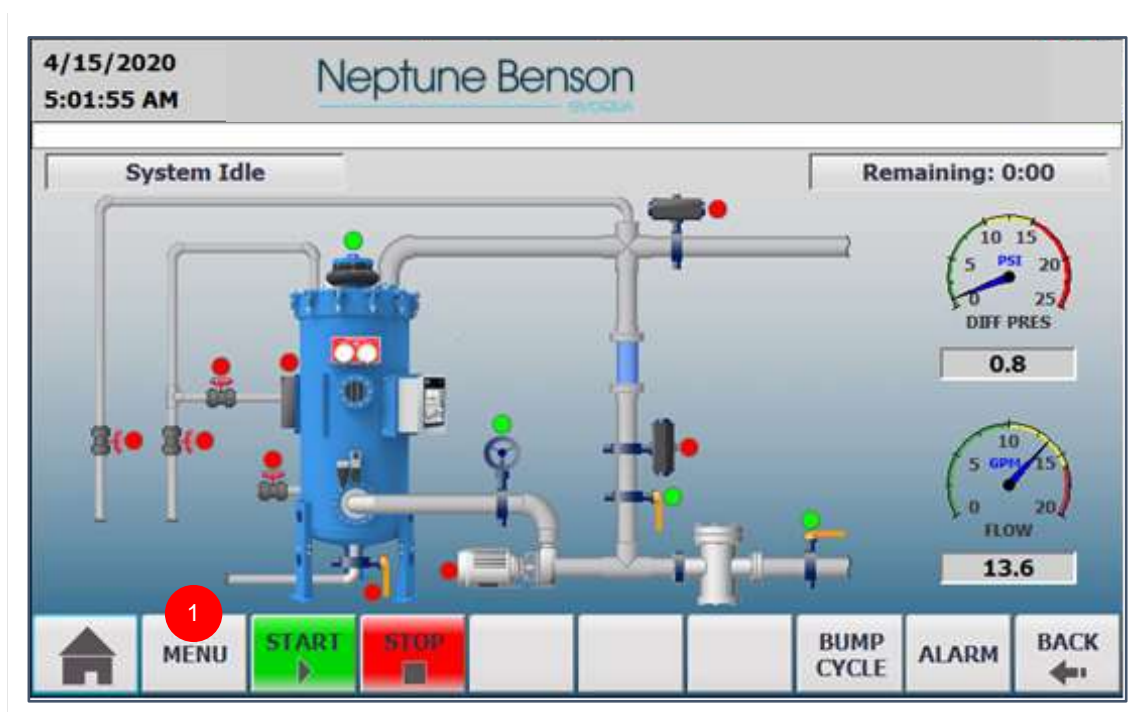


Figure 45: System Idle Screen

1. Press **MENU**.

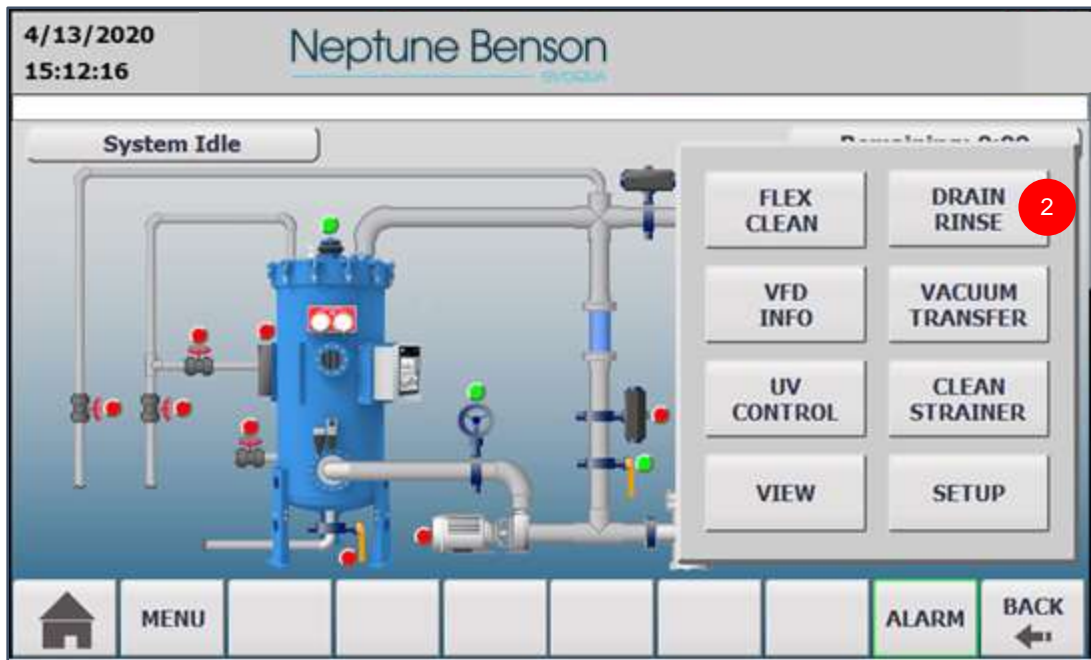


Figure 46: Menu Screen

2. Press **DRAIN RINSE**.
3. Close Pump Discharge Valve.
4. Open Drain Valve.
5. Open Vacuum Drain Valve.
6. Close Drain Valve.

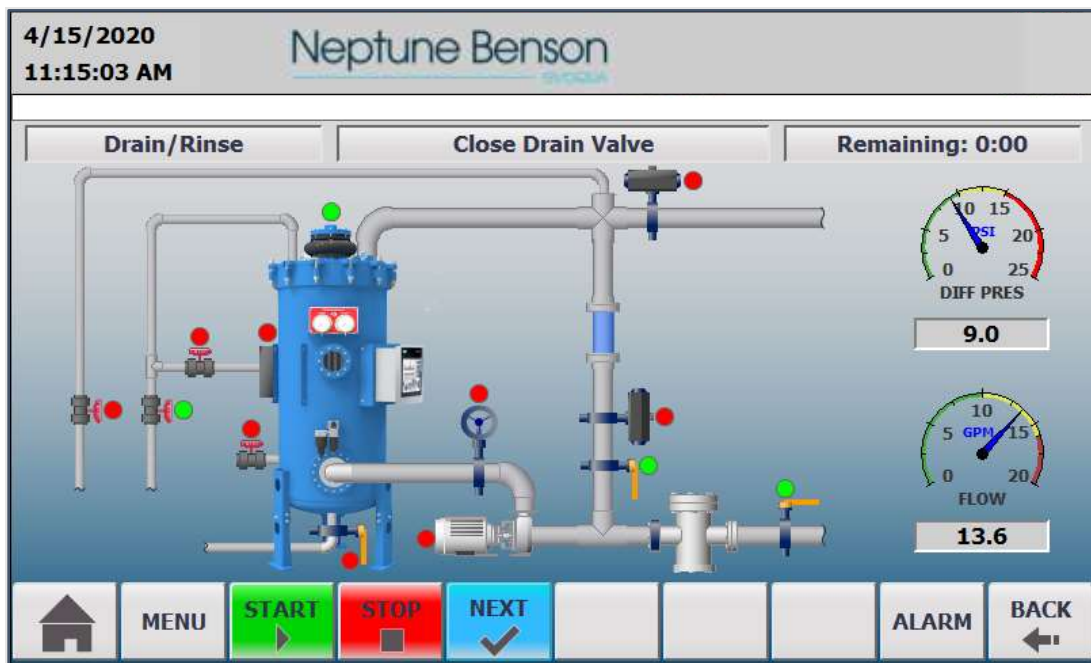


Figure 47: Close Drain Valve Screen

7. Open Vacuum Drain Valve.
8. Open Pump Discharge Valve.
9. Press **PUMP ON**. Wait a couple of seconds after the water passes the viewing window.

10. Press **PUMP OFF**.
11. Press **REPEAT**.
12. Repeat Steps 3–8 to rinse the tank and remove any residual media and dirt.

NOTE:

Once tank has been drained and rinsed satisfactorily, the *D7* automatically prompts you to perform a **Vacuum Transfer** as instructed in *Loading Perlite/Vacuum Transfer* Steps 3–11 and *Fill Tank* Steps 1–3. If you stop the process for any reason, press **MENU**, press **VACUUM TRANSFER**, and perform Steps 3–11 above.

Cleaning the Strainer

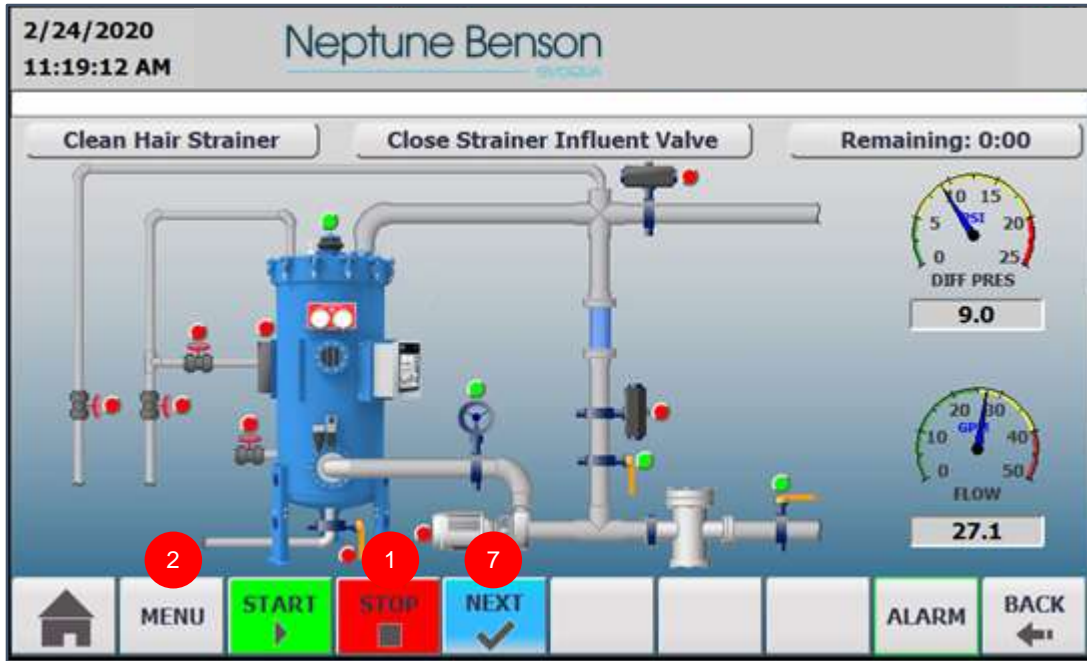


Figure 48: Close Strainer Influent Valve Screen

1. Press **STOP**.
2. Press **MENU**.
3. Clean Hair Strainer.
4. Close Strainer Influent Valve.
5. Remove Strainer Basket and spare basket. If you have no spare, clean the filter (strainer basket).
6. Open Strainer Influent Valve.
7. Press **NEXT** to start the bump.

*The filter bumps, and then goes into the **Precoat/Regen** and **Filter Mode**, as described above.*

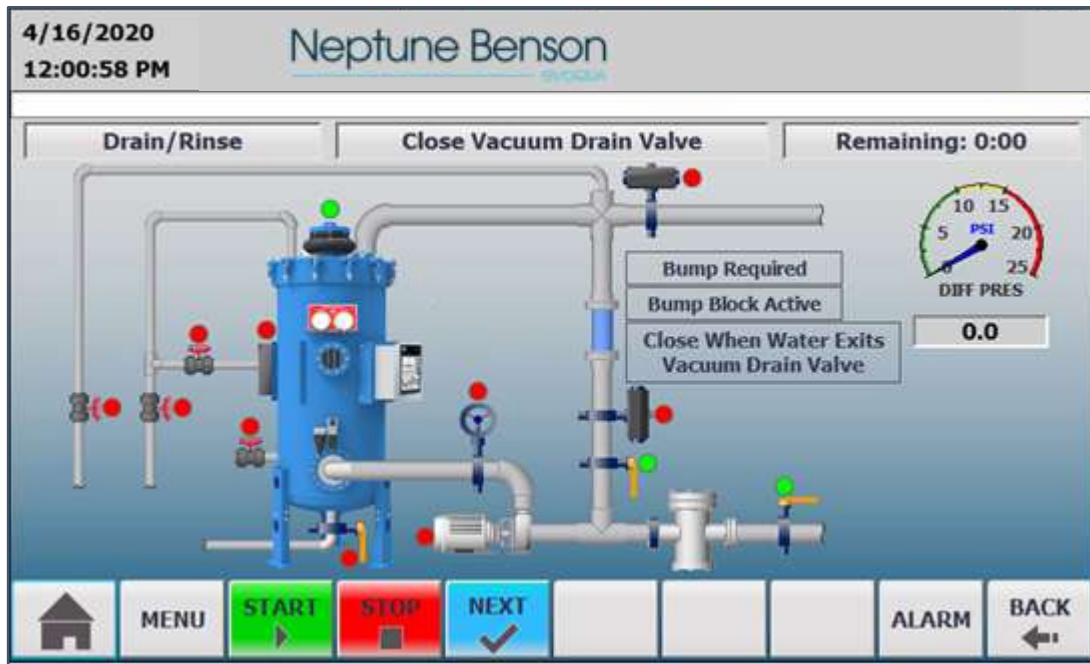


Figure 49: Close Vacuum Drain Valve Screen

Bump Required Status: This status displays when the bump is required automatically or planned manually but blocked by a scheduled bump block.

Bump Block Active: This status displays during a scheduled bump block.

Close when Water Exits Vacuum Drain Valve: This status displays while performing **DRAIN RINSE** or **VACUUM TRANSFER**, and during the Close Vacuum Drain Valve step to inform the operator to close the drain valve when the water exits the drain line.

Errors and Alarms

The D7 includes several onboard diagnostic tools that alert you to a situation that requires attention.

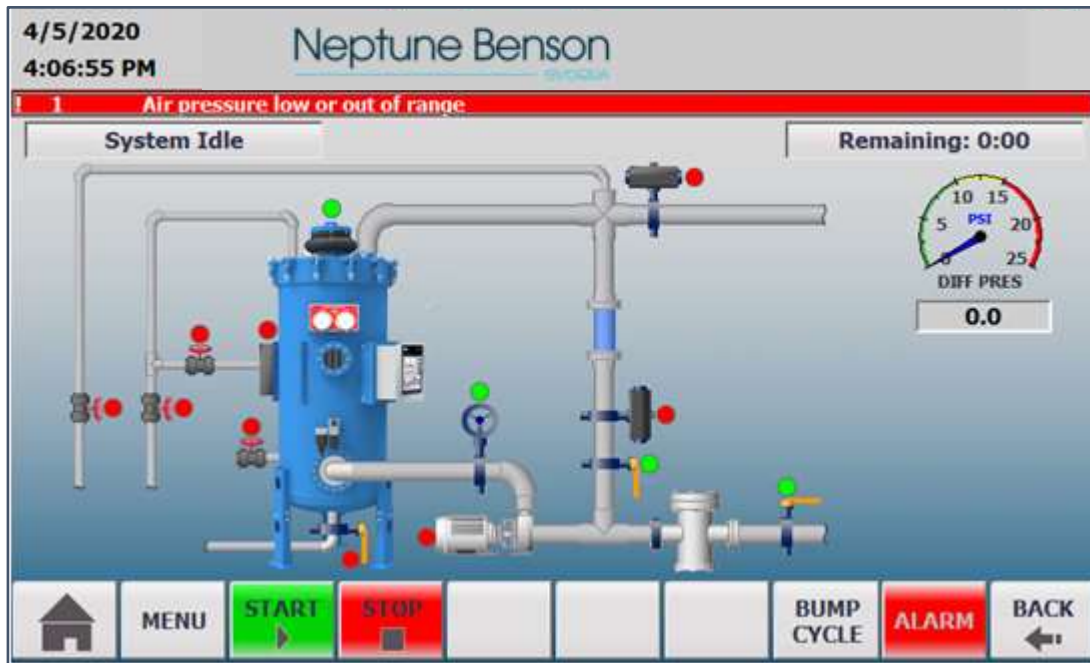


Figure 50: Alarm

When any predefined alarm condition occurs, it is indicated on the top alarm banner in the panel screen. The **ALARM** button blinks. Press **ALARM** to open the **Active Alarm** screen.

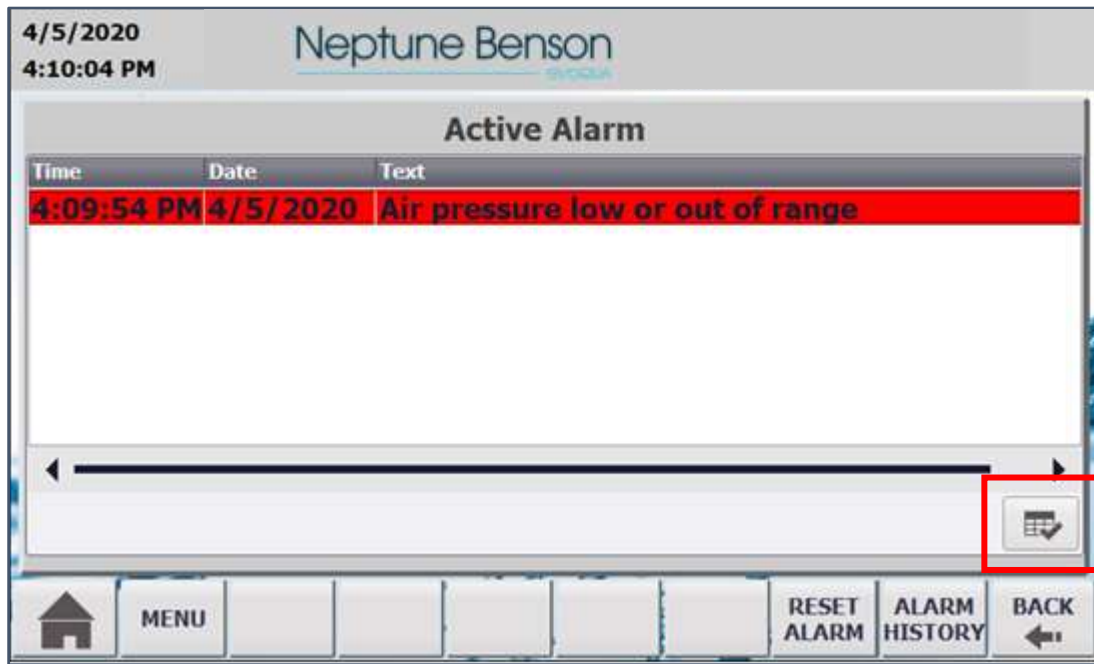


Figure 51: Active Alarm Screen

This **Active Alarm** screen example indicates a loss of air pressure. Press the acknowledge button (check mark icon) to acknowledge the current alarm. You might take one or more of the following actions to resolve this alarm:

1. Check the air compressor for pressure and operation. A minimum of 120 PSI should be available.
2. Check the filter/regulator on the filter. It should be set for a minimum of 90 PSI.
3. Check connections at the system panel to be sure the pressure transducer is connected.

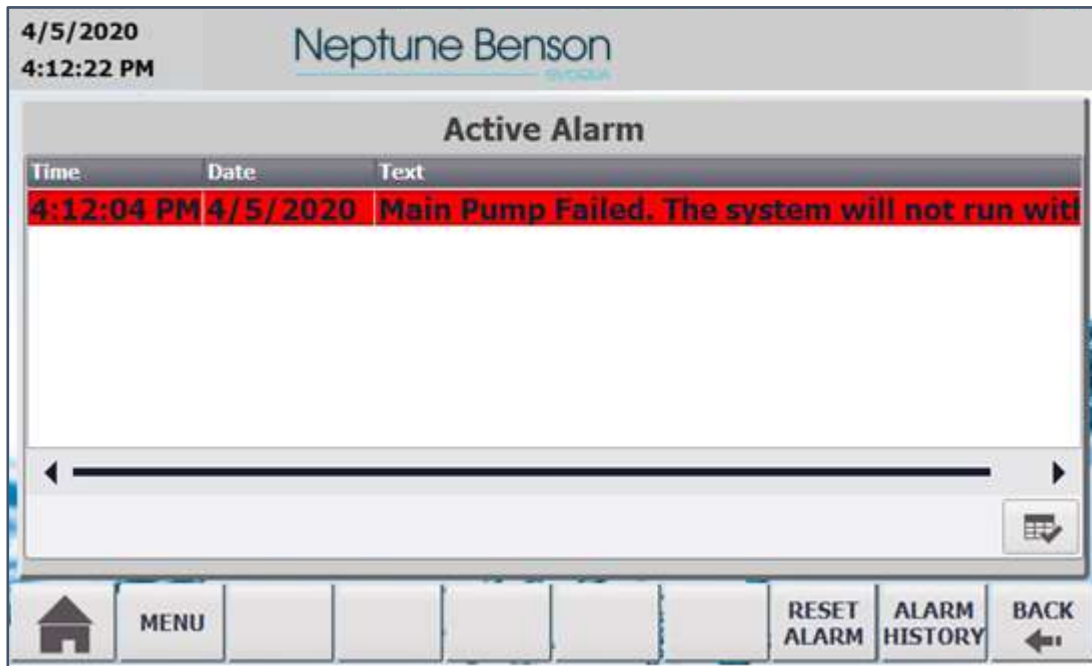


Figure 52: Active Alarm Screen

This **Active Alarm** screen example indicates that the D7 did not get the run confirm from the motor starter/VFD. Press the acknowledge button to acknowledge the current alarm. You might take the following actions to resolve this alarm: Check the wiring from the motor starter/ VFD to the D7 run confirm terminals.

RESET ALARM: Once the alarm condition is resolved, press this button to reset the alarm.

ALARM HISTORY: Opens the **Alarm History** screen which displays all the alarm and warning messages that have occurred in the system.

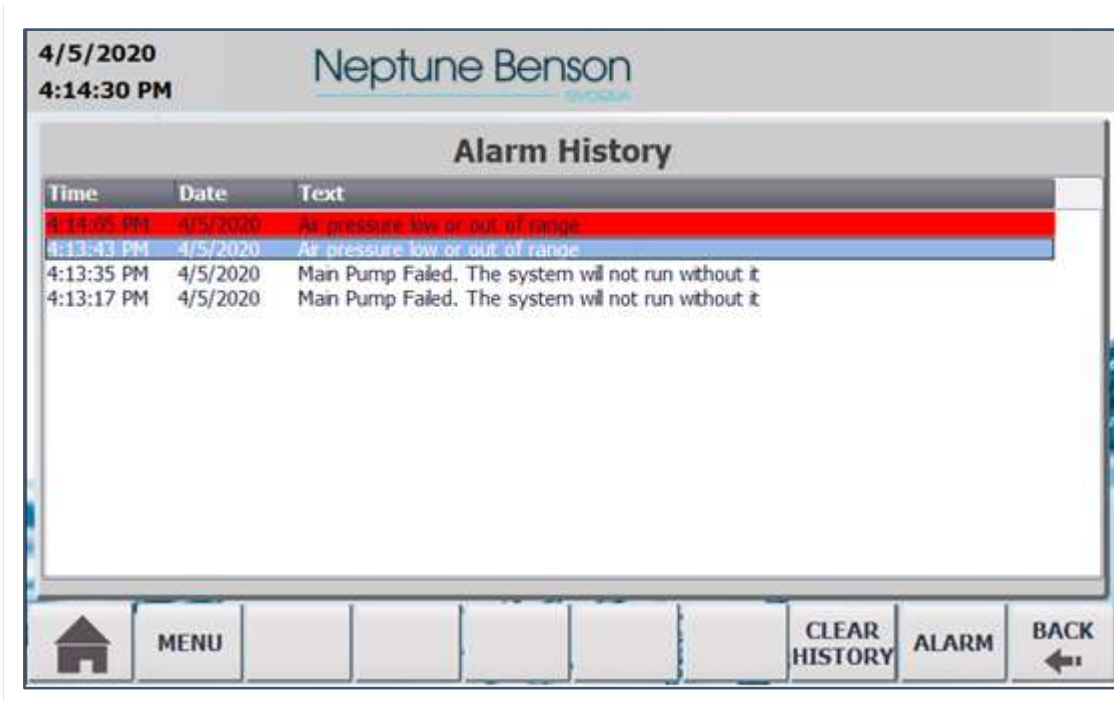


Figure 53: Alarm History Screen

CLEAR HISTORY: Clears all alarm and warning messages from the system.

View Information

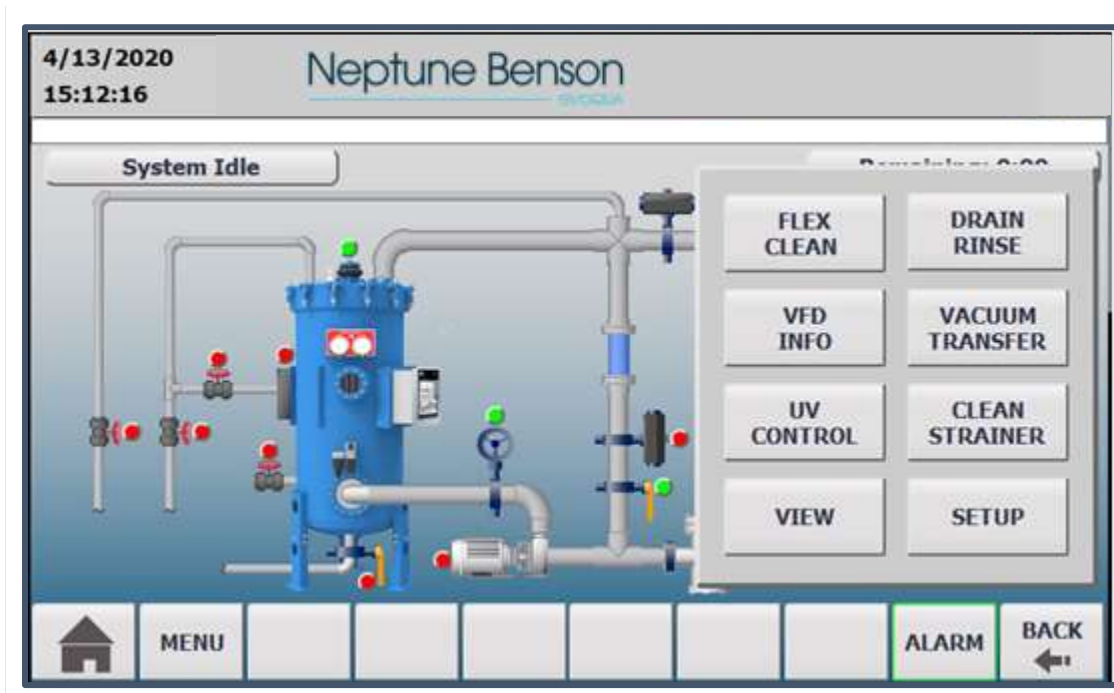


Figure 54: Menu Screen

From the **System Idle** screen, press **MENU**, and then **VIEW** to open the **VIEW INFORMATION** screen.

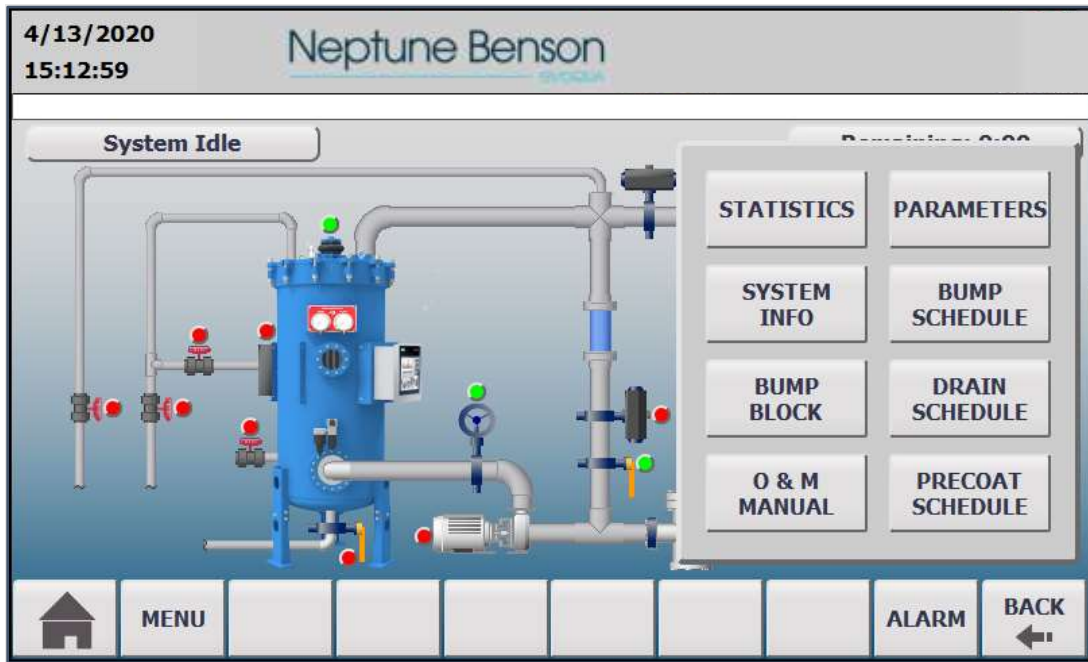


Figure 55: View Information Screen

This screen contains eight sub-menus:

- **STATISTICS**
- **SYSTEM INFO**
- **BUMP BLOCK**: View the bump block schedule.
- **O & M MANUAL**: View Operator and Maintenance manual.
- **PARAMETERS**: View parameter settings.
- **BUMP SCHEDULE**: View the bump schedule.
- **DRAIN SCHEDULE**: View the drain valve schedule.
- **PRECOAT SCHEDULE**: View the precoat vent valve schedule.

STATISTICS

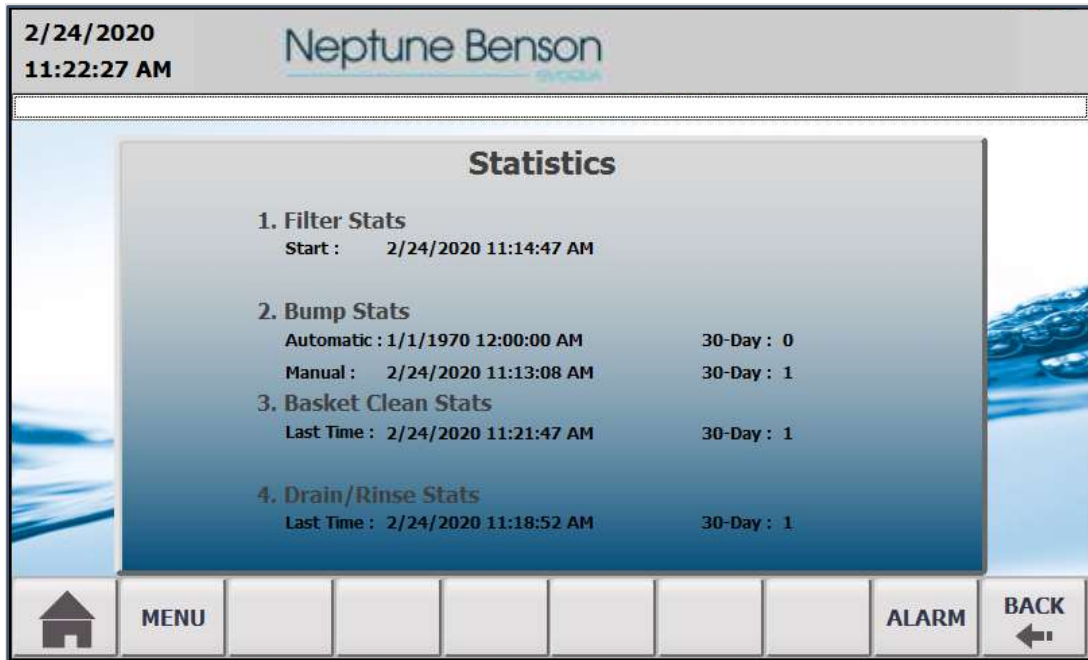


Figure 56: Statistics Screen

The **Statistics** screen displays a 30-day history of:

- 1. Filter Stats**
- 2. Bump Stats**
 - **Automatic:** By pressure differential or time schedule.
 - **Manual:** By pressing the **BUMP**.
- 3. Basket Clean Stats**
- 4. Drain/Rinse Stats**

SYSTEM INFO

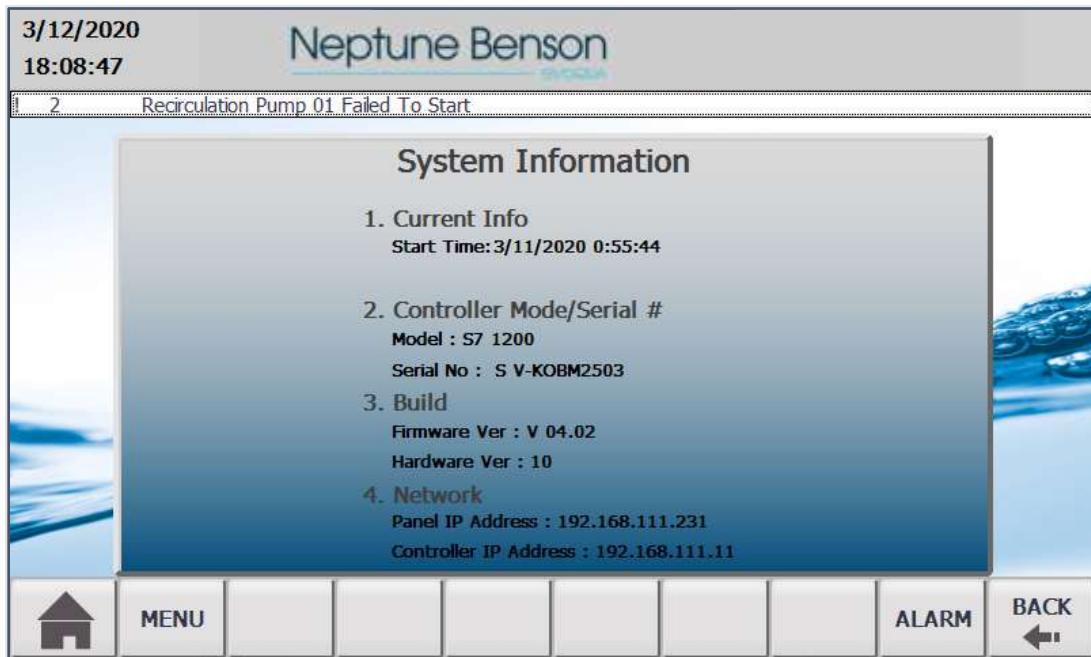


Figure 57: System Information Screen

The **System Information** screen contains the following information:

- 1. Current Info:** Controller last download date:
- 2. Controller Mode/Serial #:** The model and serial number of the filter.
- 3. Build:** Hardware and firmware versions.
- 4. Network:** IP addresses of the operator panel and controller.

Advanced Topics

Panel Setup

Configuration options such as Ethernet and e-mail are provided in the Panel Setup.

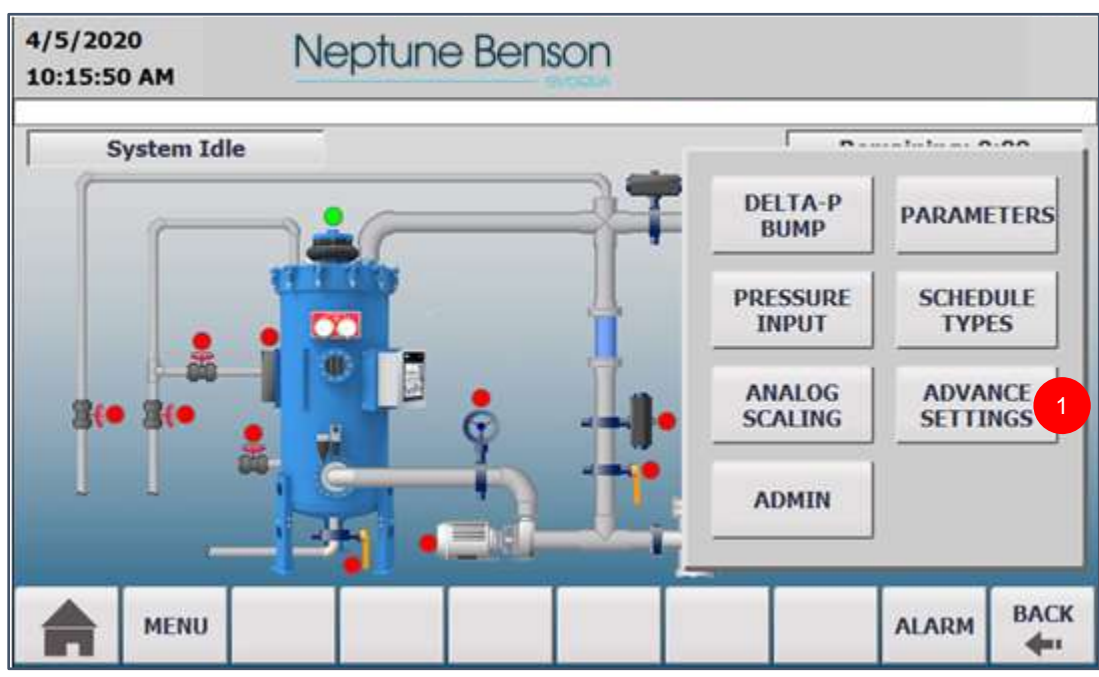


Figure 58: Setup Submenu Screen

1. From the **Setup** sub-menu, press **ADVANCE SETTINGS**.

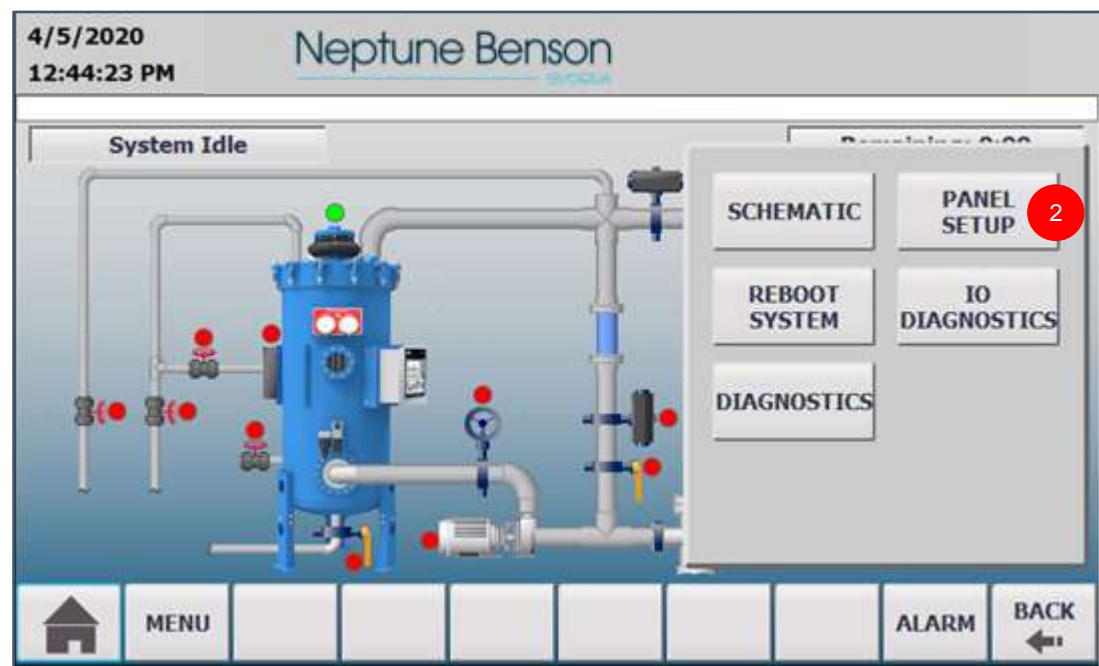


Figure 59: Advance Settings Submenu Screen

2. Select **PANEL SETUP**.

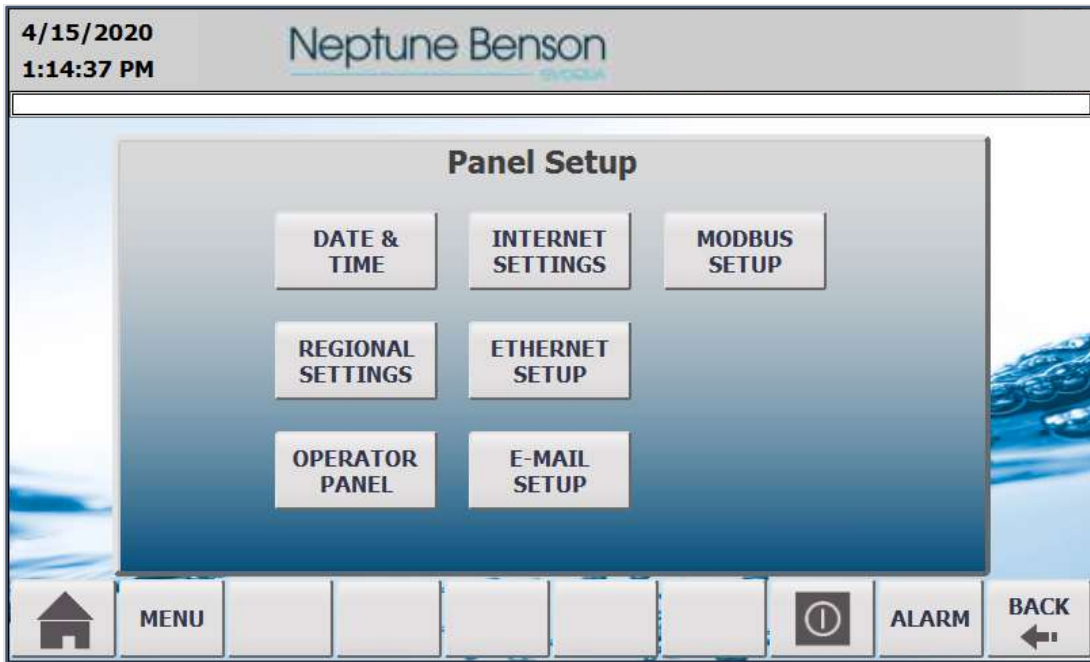


Figure 60: Panel Setup Screen

The Panel Setup screen contains seven options and requires the passcode (ewt) to access these options:

- **DATE & TIME:** Set the system date and time.
- **REGIONAL SETTINGS:** Set the date and time display format.
- **OPERATOR PANEL:** Display information about the operator panel and calibrate the touch screen.
- **INTERNET SETTINGS:** Display operator panel internet settings such as SMTP, web server, etc.
- **ETHERNET SETUP:** Set the IP addresses for the operator panel and controller.
- **E-MAIL SETUP:** Set the SMTP information to use when the system sends e-mail.
- **MODBUS SETUP:** Enable or disable the Modbus TCP slave communication.

DATE & TIME

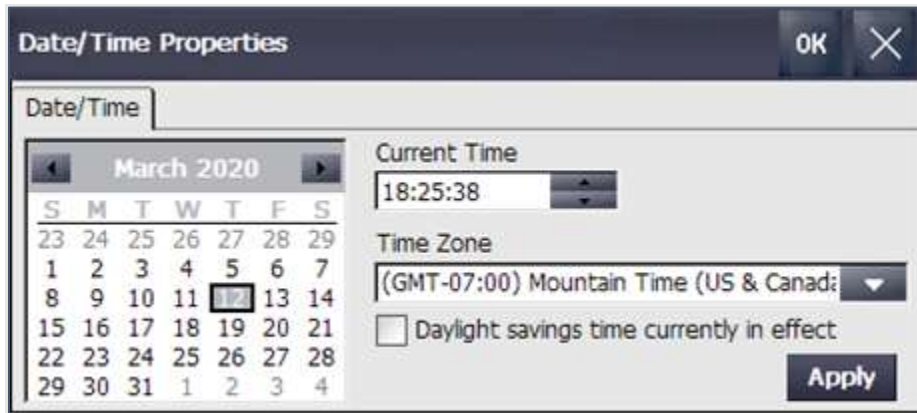


Figure 61: Date/Time Properties Dialog Box

Set the date, **Current Time**, **Time Zone**, and **Daylight savings time currently in effect** option. Click **Apply** to save your settings. The date, time, and time zone are important for proper logging.

REGIONAL SETTINGS



Figure 62: Regional and Language Settings Dialog Box, Regional Settings Tab

Select **English (United States)** from the dropdown under the regional settings.

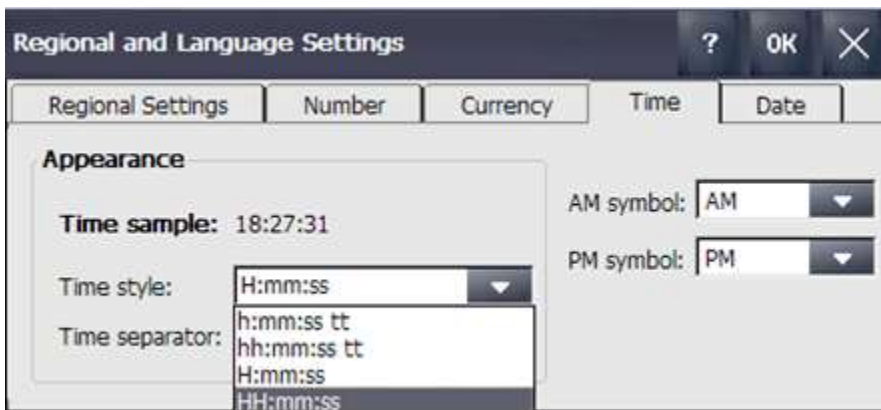


Figure 63: Regional and Language Settings Dialog Box, Time Tab

Select the **Time** tab. Select the required time display format from the **Time separator** drop-down list.

OPERATOR PANEL

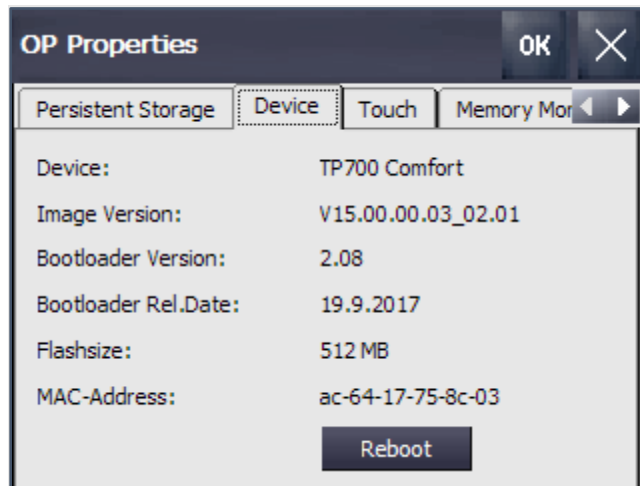


Figure 64: OP Properties Dialog Box, Device Tab

Select the **Device** tab to view the panel information or to reboot the panel.

To calibrate the touch screen, select the **Touch** tab. Press **Calibrate**, and then follow the onscreen instructions.

INTERNET SETTINGS

Most of these settings are already preconfigured and change only if needed.

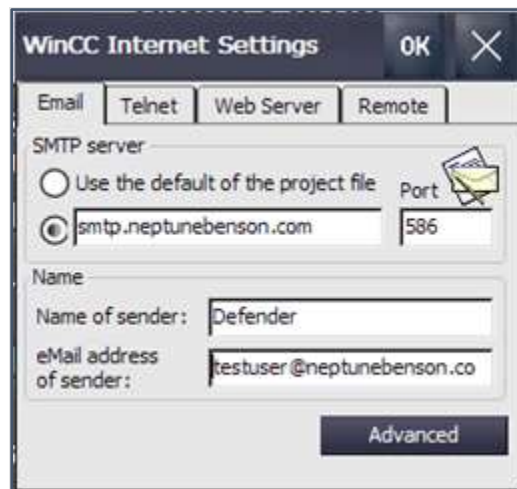


Figure 65: WinCC Internet Settings Dialog Box, Email Tab

Configuring E-Mail: Connect the operator panel to an e-mail server to enable the sending of e-mail messages when certain operational errors occur. The IT department of your company should provide the necessary information to configure the operator panel e-mail.

1. Select the **Email** tab.
2. Select the option for manually entering the server, below the **Use the default of the project file** option.
3. Specify the **SMTP server** address and port number.
4. Enter the name and e-mail address of the sender in their respective fields.
5. Press **Advanced** to make further settings for sending e-mail over SMTP server.

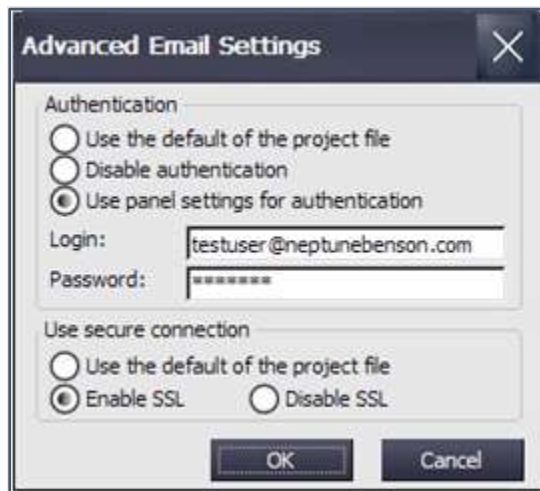


Figure 66: Advanced Email Settings Dialog Box

6. If authentication is required by the SMTP sever, select **Use panel settings for authentication**.
7. Enter the **Login** and **Password** for the SMTP connection.
8. Select **Enable SSL** or **Disable SSL** for the secure connection configuration.
9. Press **OK** to save your settings and close the dialog box.
10. From the **WinCC Internet Settings** dialog box, press **OK** to close the dialog box.
11. Restart the runtime for the changes to take effect.

Configuring the Web Server: Use this option to configure the operator panel as an HTTP server. You can then view the HTML pages of the operator panel using a web browser.

1. Select the **Web Server** tab.



Figure 67: WinCC Internet Settings Dialog Box, Web Server Tab

2. To edit the user settings, press **User Administrator**.
3. If prompted to do so, enter the **Administrator** password. The default password is **22222**.

*The **UserDatabase-Edit** dialog box opens.*

4. To create a new user, press **Add**.
5. Enter a username and specify a password. The user enters the associated password when accessing the web server.
6. Press **Apply** to save your settings.

7. Select the **Authorizations** tab.
8. Specify the web authorizations for the new user.
9. Press **Apply** to save your settings.
10. Press **OK** to close the dialog box.
11. From the **WinCC Internet Settings** dialog box, press **OK** to close the dialog box.
12. Restart the runtime for the changes to take effect.

Configuring Sm@rtServer: Use this option to configure the operator panel as a Sm@rtServer to access the operator panel over the network.

1. Select the **Remote** tab.



Figure 68: WinCC Internet Settings Dialog Box, Remote Tab

2. To edit the user settings, press **Change Settings**.
3. Assign passwords used for accessing the Sm@rtServer with corresponding monitor only or control settings.
4. Change the port addresses, if required. Default settings:
 - HTTP: 5800
 - Main/Sm@rtClient app: 5900
5. Press **Apply** to save your settings.
6. Press **Start** or **Stop** to start or close Sm@rtServer on the operator panel.
7. Press **OK** to close the dialog box.

Once the Sm@rtServer has started, you can access the operator panel using Internet Explorer, Sm@rtClient App, or other Java-based clients.

ETHERNET SETUP

The parameters for the fixed IP address must be provided by an IT or network group if the filter is connected to a plant network. Both the controller and operator panel should be in the same network to communicate with each other, and to other controllers in the plant. If the filter needs to be accessed from outside your company, it might require additional network configuration by your IT or network group.

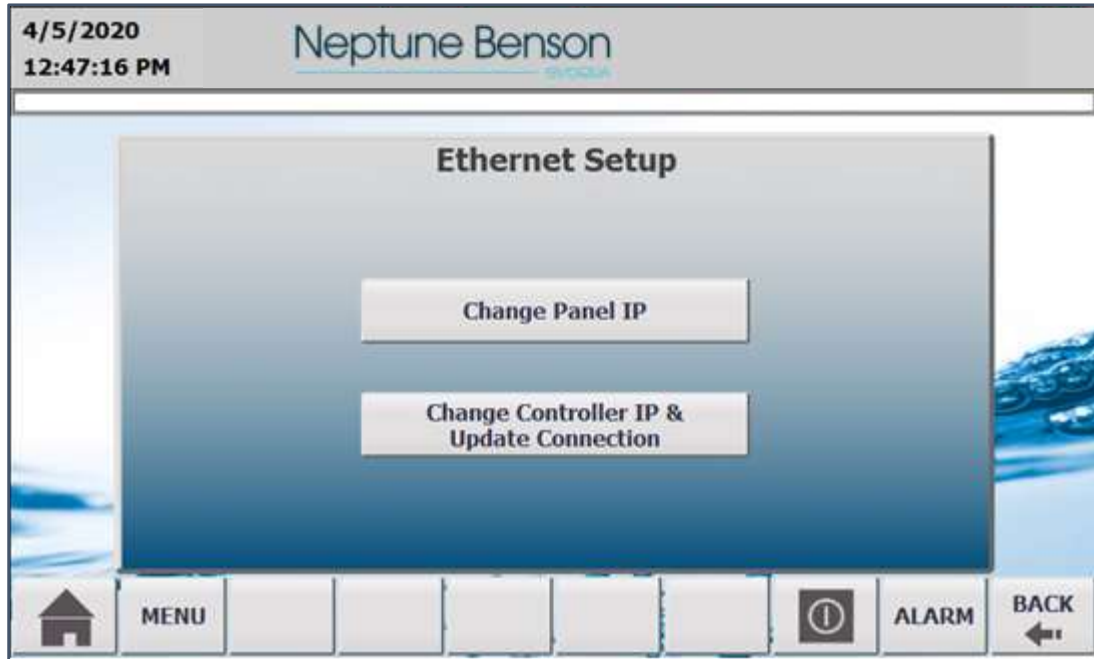


Figure 69: Ethernet Setup Screen

Change Controller IP and Update Connection: The controller needs a fixed IP for communication over the Ethernet.

1. Press **Change Controller IP & Update Connection**.



Figure 70: Service & Commissioning Dialog Box, IP Config Tab

2. From the **Service & Commissioning** dialog box, select the **IP Config** tab.
3. Press **Assign IP**.

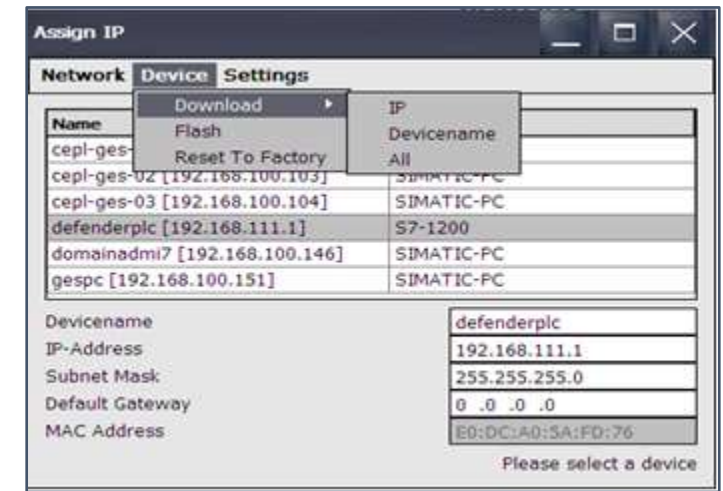


Figure 71: Assign IP Dialog Box

4. From the **Assign IP** dialog box, select **Network > Start Scan** to start the network scan.
5. Once the scan is complete (as shown at the bottom of the dialog box), select the **defenderplc** from the scan list, and then edit the **IP-Address**.
6. Select **Device > Download > IP** to download the changes.
7. From the **Service & Commissioning** dialog box, press **Set Connection**.

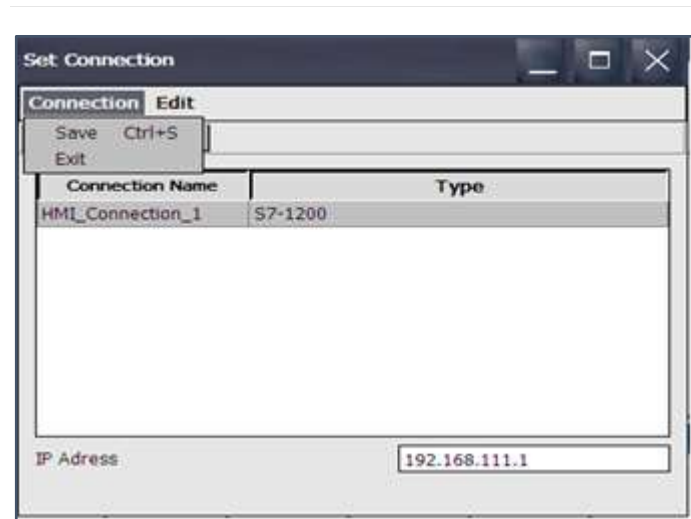


Figure 72: Set Connection Dialog Box

8. Change the **IP Address** to the new address assigned to the controller.
9. Select **Connection > Save** to save your settings.
10. Select **Connection > Exit** to close the **Service & Commissioning** dialog box.
11. Press the close button (**X**) to close the **Service & Commissioning** dialog box.
12. Restart the operator panel runtime for the changes to take effect.

NOTE:

If the IP address of the operator panel will be changed as well, then the operator panel runtime restart can be done after completing the operator panel setup.

Setting Operator Panel IP Address: Press **Change Operator Panel IP**, and then set up the new HMI IP settings.

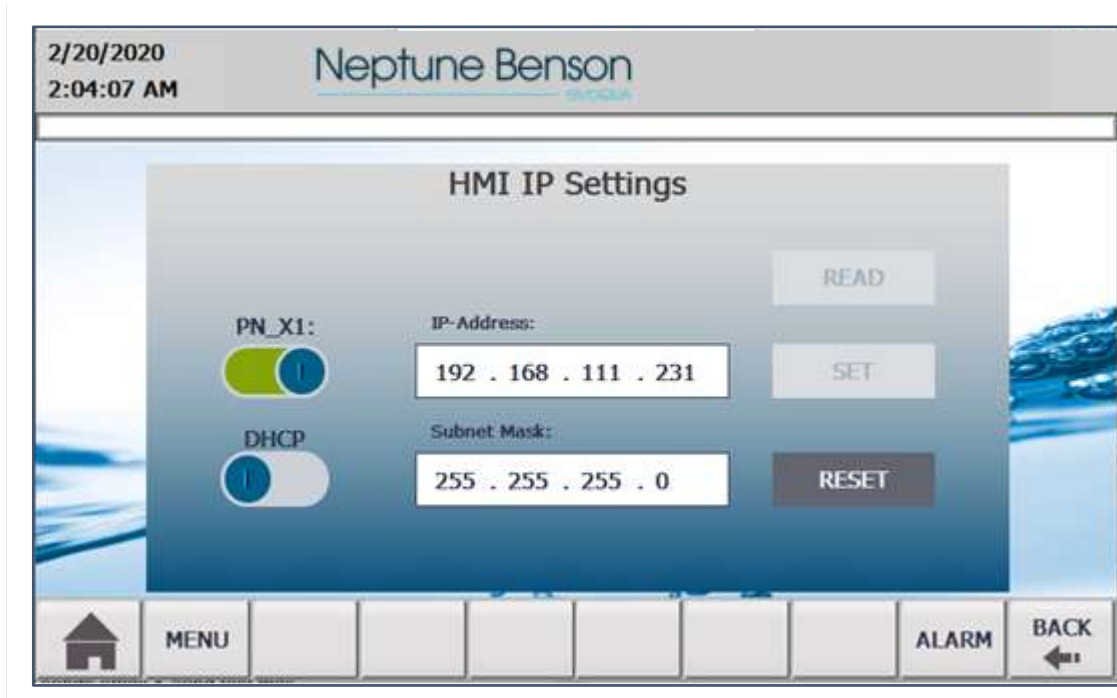


Figure 73: HMI IP Settings Screen

E-MAIL SETUP

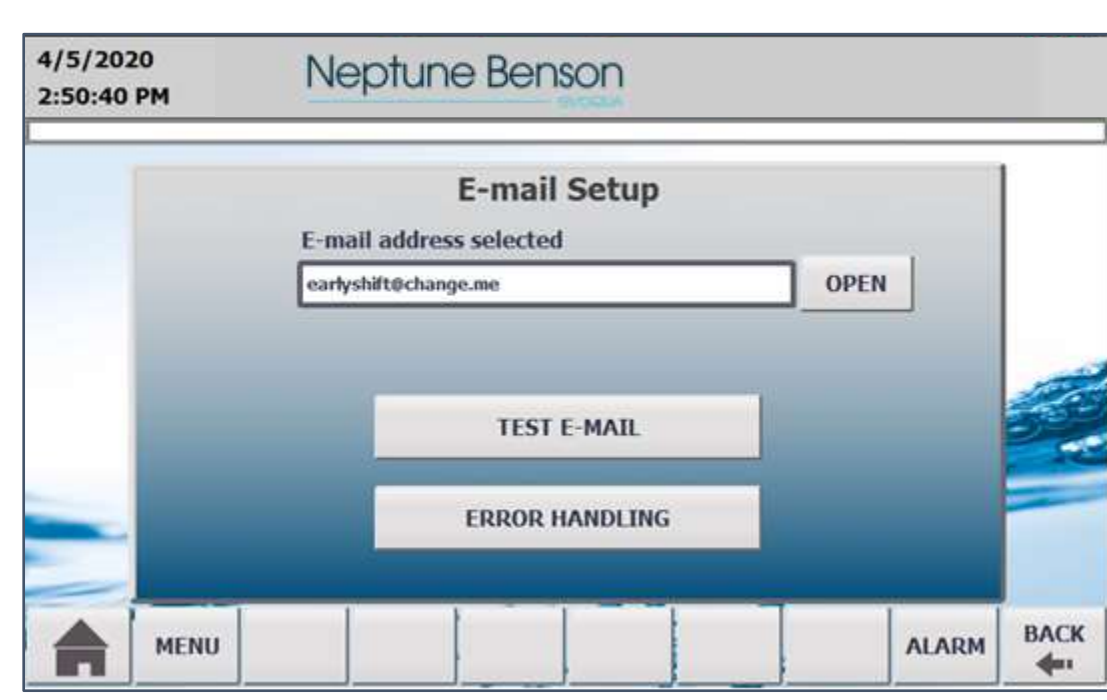


Figure 74: E-mail Setup Screen

Email Address Selected: Displays the recipient mail address for the error messages. Press **OPEN** to enter the e-mail address from the directory.

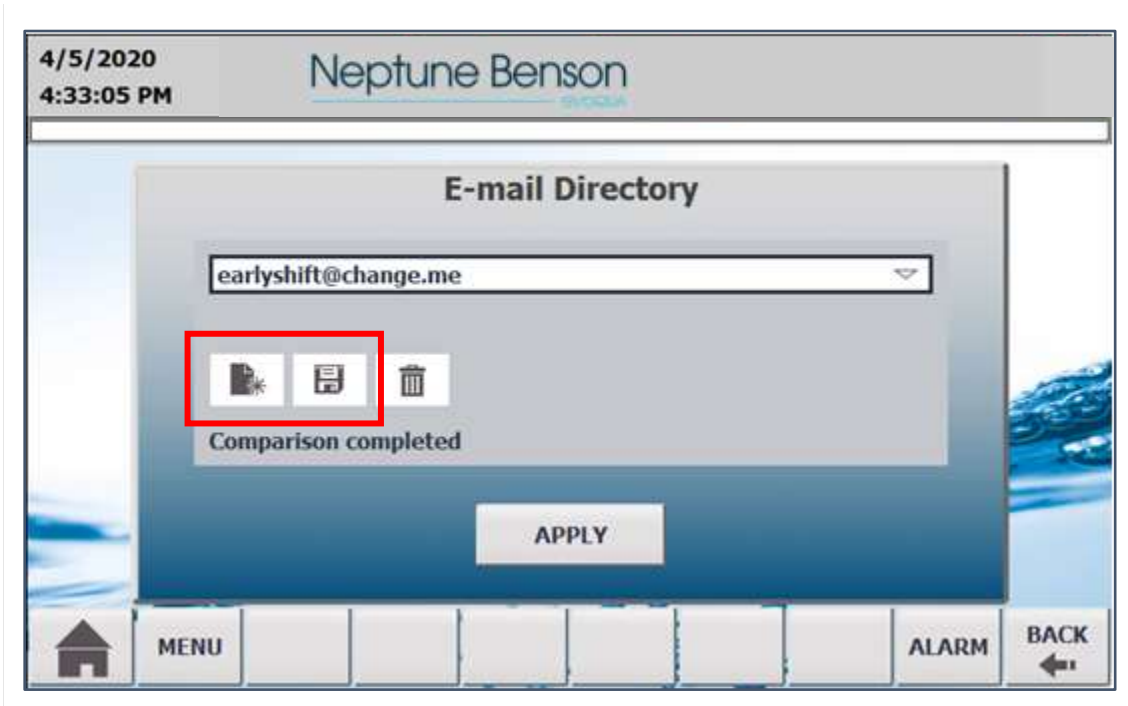


Figure 75: E-mail Directory Screen

Email Directory: You can either select an existing e-mail address or add a new e-mail address and save it in to the directory.

Test Mail: Helps to send test e-mails. You can select the e-mail address from directory by pressing **TO**.



Figure 76: Test E-mail Screen

Error Handling: Allows you to select the errors for which e-mail is sent.

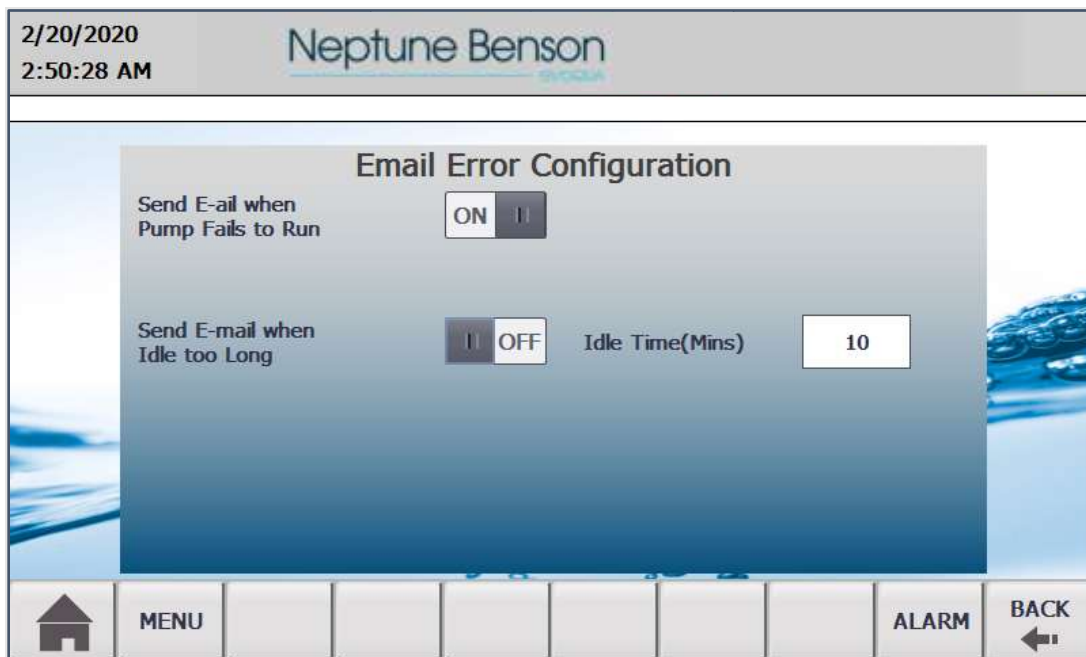


Figure 77: Email Error Configuration Screen

MODBUS SETUP

The filter has an internal Modbus slave that can be used to make status information available remotely over a TCP network. Configuration details of Modbus TCP is provided in a separate manual.

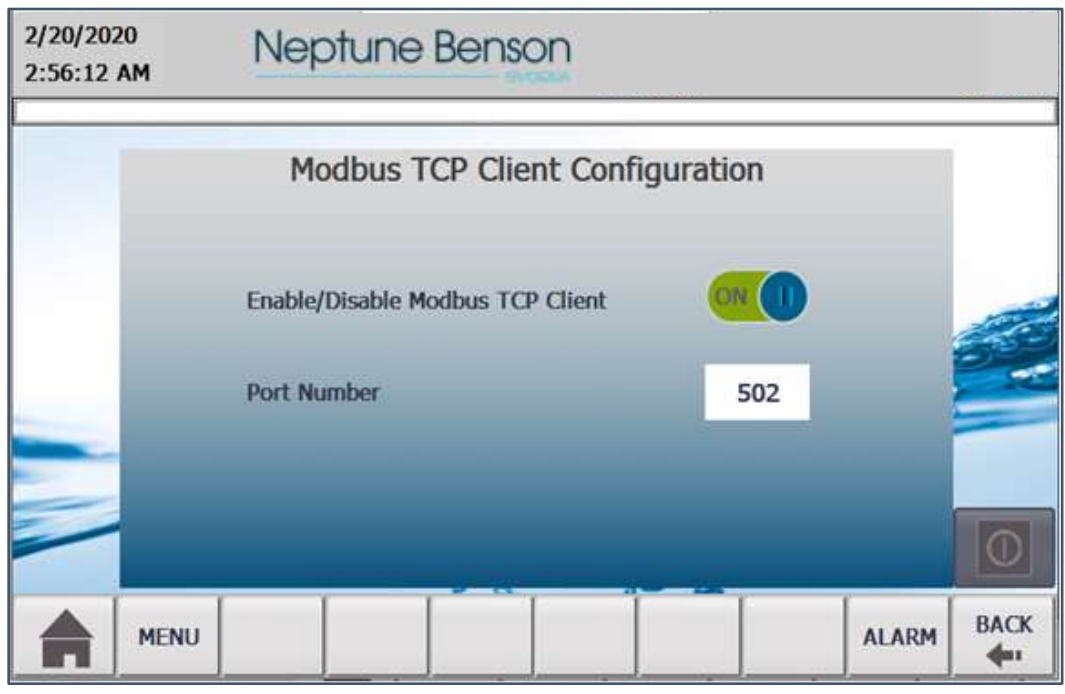


Figure 78: Modbus TCP Client Configuration Screen

Enable/Disable Modbus TCP Client: Set to **ON** to enable the filter to act as a Modbus TCP slave. It is set to **ON** by default.

Port Number: The local port number for Modbus request. The default port is 502.

Refer to *Defender Register Examples* for further details of the Modbus configuration and addresses.

Accessing the Defender Over the Network

The operator panel can be accessed remotely over the network using Microsoft Internet Explorer or Sm@rtClients. The user can access the operator panel's service pages to check the status or remotely download the log files for diagnostic purposes or can access the Sm@rtServer for remote control and monitoring. The filter must be connected to a network by inserting an Ethernet cable into the RJ-45 connector at the back of the operator panel with IP's in the same range.

The operator panel can be accessed using the IP address found on the **System Information** page.

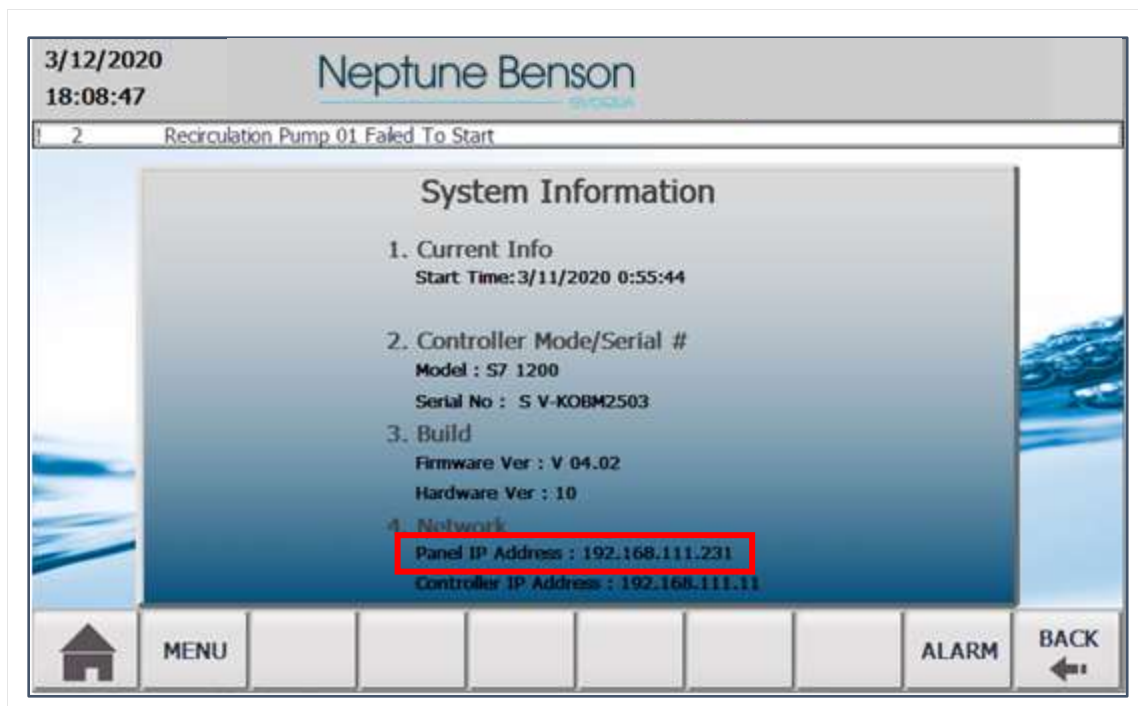


Figure 79: System Information Screen

Defender Service Pages

Open Microsoft Internet Explorer on a computer connected to the network and type in the IP address of the operator panel. In this example, it would be 192.168.111.231. The following operator panel service pages are available from the menu at the left of the screen.



Figure 80: SIMATIC HMI Miniweb Start Page

Start Page: View general information such as the operating system version of the operator panel.

Remote Control: Start the Sm@rtClient for remote monitoring and control of the operator panel. Refer to *Defender Remote Control (Sm@rtServer)* for further details of this functionality.

Control Functions: Start or stop the runtime of the operator panel with proper authorization.

System Diagnostics: View system diagnostic messages from the operator panel.

File Browser: Access the file system of the operator panel and download log files such as alarms and data logs. Refer to *Logs* below for further details.

Logs

The operator panel stores alarms and data log files in the CSV format and can be remotely accessed from the **File Browser** service page. The log files are stored in a USB storage medium, in the **Logs** folder. Clicking on one of the log names downloads it to your computer. Open the file in Excel. The file is in **.csv** format which is readable by most spreadsheet programs.

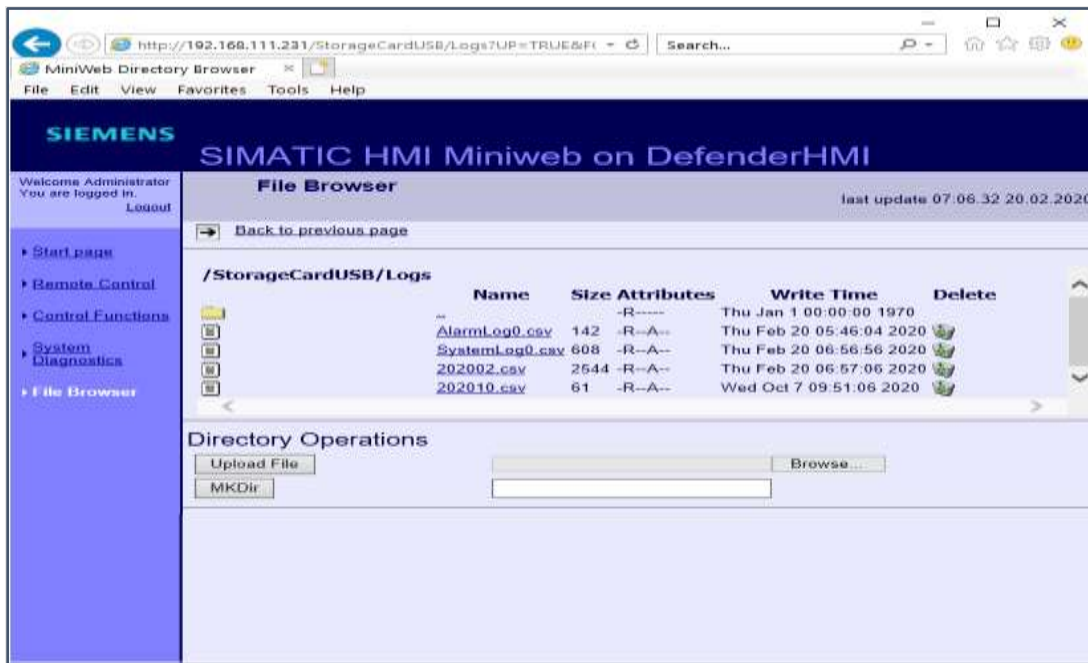


Figure 81: SIMATIC HMI Miniweb File Browser Page

Data Log: The data log files listed in this example are **202002**, which indicates that the log entries are from February 2020 (YYYYMM format).

Alarm Log: This system-generated log file contains alarm and warning messages.

System Logs: This system-generated log file contains diagnostic messages.

Defender Remote Control (Sm@rtServer)

The operator panel can be accessed over the network using Internet Explorer or Sm@rtClient app. The panel acts as a Sm@rtServer and provides its user interface for the Sm@rtClients. This option enables remote access to its full extent as if you were standing in front of the operator panel.

Open the Microsoft Internet Explorer on the network computer and go to **http://IP Address:5800** where **5800** is the HTTP port address. This can be also accessed from the **Remote Control** service page by clicking on the **Start Sm@rtClient** link. When you enter this, you might be prompted to install Java (required version 7.0.45) if your computer does not already have it installed. A password is requested as shown below.

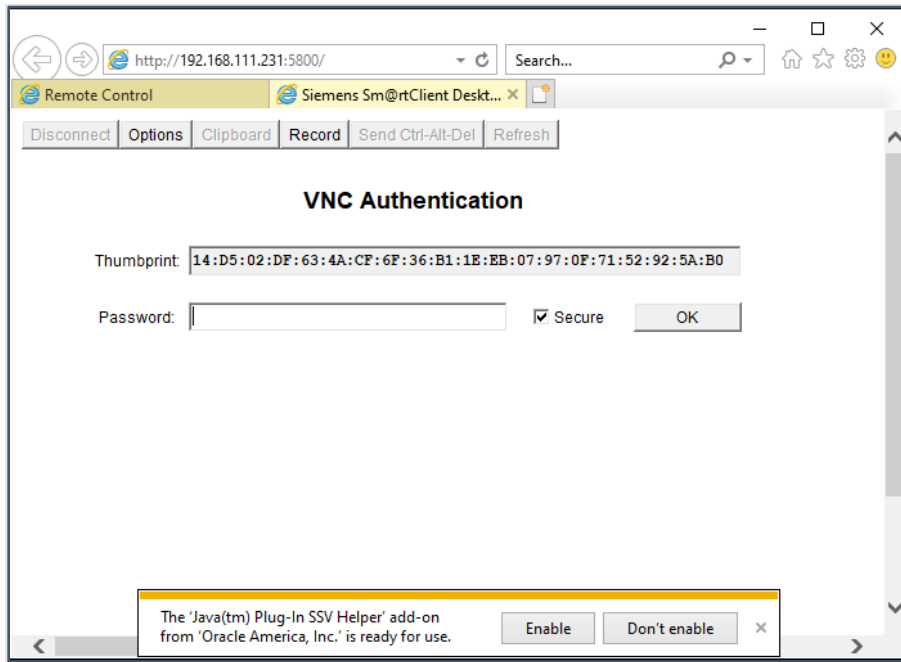


Figure 82: Siemens Sm@rt Client Desktop VNC Authentication Page

The default password is **22222**. After you have successfully authenticated, the current display from the operator panel is mirrored on your display with the same functionality as if you were standing in front of the operator panel.

The Simatic WinCC Sm@rtClient app is provided for accessing the panel on Android and iOS devices. This app enables you to access the operator panel's Sm@rtServer from mobile devices such as tablets and smartphones. You can also download this app from PlayStore or the Apple Store into the mobile device.

Open the installed Sm@rtClient app on the mobile device and manually add a connection.

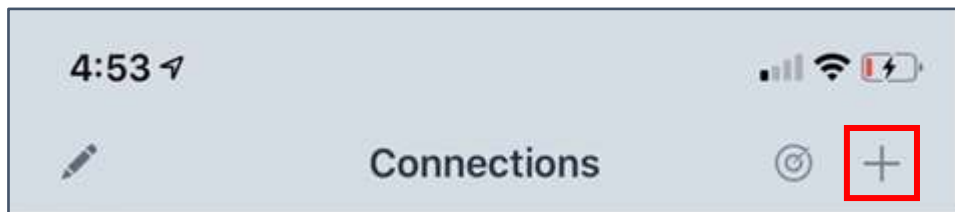


Figure 83: Siemens Sm@rt Client App, Connections Screen

Edit connection and enter operator panel's Sm@rtServer details such as IP address and port (default is 5900) and a password. Password protect both the device and the app to prevent unauthorized access to the Sm@rtServer.



Figure 84: Siemens Sm@rt Client App, Edit Server Screen

Once the connection is updated, save the settings, and return to the connection page.



Figure 85: Siemens Sm@rt Client App, Connections Screen with New Connection

Click on its connection from the app and enter the password to access the operator panel.

Defender Register Examples

1. Introduction

This manual explains how to physically establish and configure communication between the filter and a controller using the Modbus TCP protocol.

The instruction is intended to be used for both instruction and reference. It only briefly touches on the basics of the Modbus protocol whenever necessary to gain an understanding of the Modbus TCP interface. This instruction is also intended to serve as a guideline to specify and optimize the communication system.

1.1. Modbus TCP Overview

Controllers communicate using a master-slave technique in which only one device (the master) can initiate transactions (called queries). The other devices (slaves) respond by supplying the requested data to the master or by taking the action requested in the query.

The master can address individual slaves. Slaves return a message (called a response) to queries that are addressed to them individually. The Modbus TCP protocol establishes the format for the master's query by sending a request to the slave consisting of a function code, defining the requested action, any data to be sent, and an error-checking field. The slave's response message is also constructed using Modbus protocol. It contains fields confirming the action taken, any data to be returned and an error-checking field. If an error occurs in receipt of the message, or if the slave is unable to perform the requested action, the slave constructs an error message, and sends it in response, or a time-out error occurs.

1.2. Connecting to the Defender

The Defender must be connected to the network by inserting an Ethernet cable into the RJ-45 connector in the back of the controller for communication over an Ethernet connection. It also provides Modbus TCP connectivity over the same Ethernet connection.

Both the controller and operator panel should be assigned IP address to communicate to on the network as explained in the **ETHERNET SETUP** procedure. The assigned IP addresses for the controller and operator panel can be found on the **System Information** page. The **System Information** page is displayed from the front panel by accessing the following keys from the main menu: **MENU** (or **VIEW**) > **VIEW** > **SYSTEM INFO**.

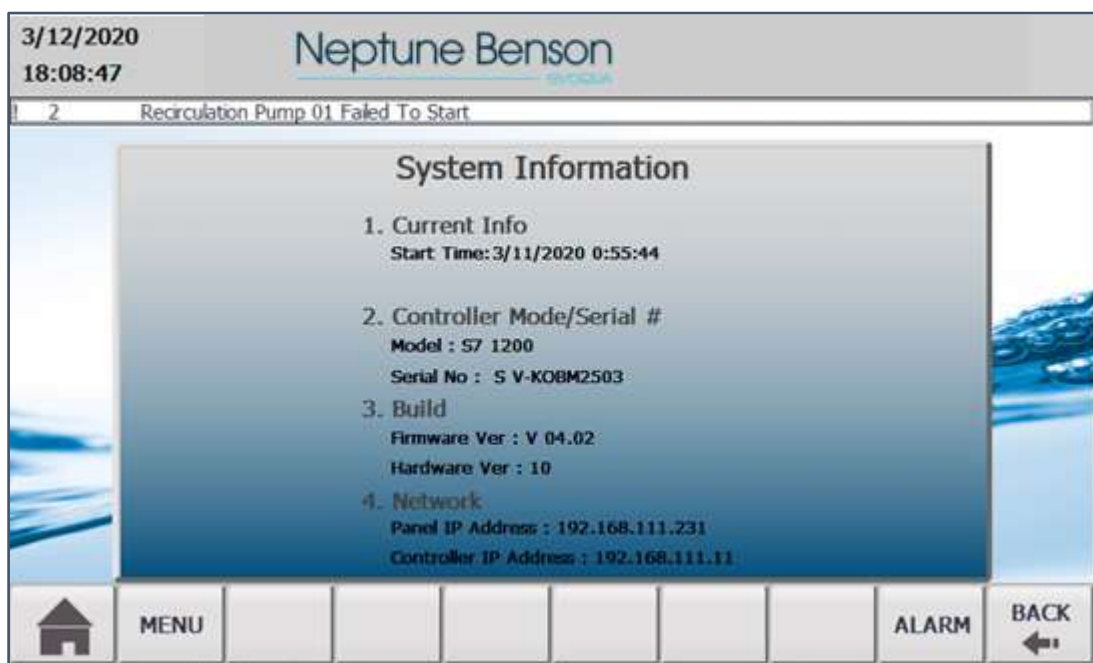


Figure 86: System Information Screen

The **Controller IP Address** is found in the **Network** section. This IP address is also used to communicate to the filter as a Modbus TCP slave on port 502.

2. Modbus TCP Messaging

2.1. Function Codes supported by Modbus TCP

Modbus TCP currently supports Read Holding Registers with the function code 03 hex in the function field of a message.

2.2. Parameter Values

One Modbus holding register is specified as a 16-bit register (i.e., the data range goes from 0 to 65535). Some parameters in the system have 32-bit data types so to be able to read or write to these parameters, two registers need to be accessed to have the correct data read or written.

In order to read and write the different supported data types, the following conversions must be used.

Uint_32 or Float Data Types: An unsigned integer, signed integer, or float data type of four bytes consisting of two registers with the following byte mapping.

| Register 1 | | Register 2 | |
|------------|--------|------------|--------|
| Byte 3 | Byte 2 | Byte 1 | Byte 0 |

Uint_16 Data Types: An unsigned or signed integer of two bytes consisting of one 16-bit register with the following byte mapping.

| Register 1 | |
|-------------------|--------|
| Byte 1 | Byte 0 |

2.3. Register Addresses

The data stored in the filter is arranged as a database, which is accessed for read using one or two 16-bit words arranged to give operation status data.

| Address | Description | Units | Type | Read/Write | Remark |
|---------|--|---------|---------|------------|---|
| 40020 | Delta-P trigger value | PSI | Float | Read | |
| 40022 | Analog air pressure trigger value | PSI | Float | Read | |
| 40036 | Influent Valve raw value | 4–20 mA | Float | Read | |
| 40038 | Effluent Valve raw value | 4–20 mA | Float | Read | |
| 40040 | Pressure Enable raw value | 4–20 mA | Float | Read | |
| 40042 | Influent Valve scaled value | PSI | Float | Read | |
| 40044 | Effluent Valve scaled value | 4–20 mA | Float | Read | |
| 40046 | Air Pressure Valve scaled value | 4–20 mA | Float | Read | |
| 40048 | Current Delta-P scaled value | 4–20 mA | Float | Read | |
| 40080 | Modes | | uint_16 | Read | 10 = System Idle 20 = Precoat/Regen 30 = Filter 40 = Drain/Rinse 50 = Bump 60 = Perlite/Vacuum Transfer 70 = Clean Hair Strainer 80 = Flex Clean |
| 40081 | Previous Modes | | uint_16 | Read | |
| 40110 | Precoat Cycle Time | 10 min | uint_16 | Read | |
| 40111 | Effluent Valve Close Delay | 0 sec | uint_16 | Read | |
| 40112 | Regen Valve Open to Precoat Time | 5 sec | uint_16 | Read | |
| 40113 | Pump Run Confirm Time | 5 sec | uint_16 | Read | |
| 40114 | Effluent Valve to Bump Start Time | 5 sec | uint_16 | Read | |
| 40115 | Regen Valve Close Delay | 15 sec | uint_16 | Read | |
| 40116 | Regen Valve Open Delay | 5 sec | uint_16 | Read | |
| 40117 | Fireman Off before Effluent Valve Open | 0 sec | uint_16 | Read | |
| 40118 | Fireman On To Effluent Valve Close Time | 0 sec | uint_16 | Read | |
| 40121 | Bump Auto/Man Off Time | 2 sec | uint_16 | Read | |
| 40122 | Bump Auto/Man On Time | 2 sec | uint_16 | Read | |
| 40123 | Flex Clean (Flexible Tube Chemical Cleaning) Loop Time | 120 sec | uint_16 | Read | |

| Address | Description | Units | Type | Read/Write | Remark |
|---------|---|--------------------------|---------|------------|--|
| 40124 | Flex Clean (Flexible Tube Chemical Cleaning) Loop Delay | 15 min | uint_16 | Read | |
| 40125 | Auto Bump Loops | 10 bumps | uint_16 | Read | |
| 40126 | Required Bump Passcode | Off | uint_16 | Read | |
| 40127 | Tank Drain Option | Off | uint_16 | Read | |
| 40128 | Tank Drain On Time | 5 sec | uint_16 | Read | |
| 40129 | Precoat Line Option | Off | uint_16 | Read | |
| 40130 | Precoat Line On Time | 5 sec | uint_16 | Read | |
| 40131 | UV Screen Cycle Option (Automatic UV Screen) | Off | uint_16 | Read | |
| 40132 | UV Screen Cycle Time | 0 hr | uint_16 | Read | |
| 40133 | Pool Water Level Enable | Off | uint_16 | Read | |
| 40134 | Pool Water Level Fill Delay | 0 sec | uint_16 | Read | |
| 40135 | Pool Level Stabilize Delay | 0 sec | uint_16 | Read | |
| 40136 | Pool Level Valve Maximum Open Time | 0 sec | uint_16 | Read | |
| 40137 | VFD Display Enable | Off | uint_16 | Read | |
| 40138 | VFD Units | (0- GPM, 1- LPM, 2-M3PH) | uint_16 | Read | |
| 40141 | Flow Rate Enable | | uint_16 | Read | |
| 40142 | Flow Units | (0- GPM, 1- LPM, 2-M3PH) | uint_16 | Read | |
| 40144 | Precoat Pump Enable | Off | uint_16 | Read | |
| 40145 | Main Pump On to Effluent Open Delay (Seconds) | 6 sec | uint_16 | Read | |
| 40146 | Precoat Pump Off after Regen Close Delay (seconds) | 5 sec | uint_16 | Read | |
| 40147 | Dual Mode Option | Off | uint_16 | Read | |
| 40148 | Main Drain Delay - Dual D4 (Seconds) | 0 sec | uint_16 | Read | |
| 40150 | Pressure Units | (0 PSI, 1 kPa, 2 BAR) | uint_16 | Read | |
| 40151 | Auto Restart after Power Fail | Off | uint_16 | Read | |
| 40152 | Remote On/Off Control | Off | uint_16 | Read | |
| 40153 | Alarm Relay Output | Off | uint_16 | Read | |
| 40154 | Optional Relay One Control | | uint_16 | Read | Optional Relay 1 Control 1 = open in idle mode and open in filter 2 = open in idle mode and open in precoat mode 3 = open in precoat mode and open in filter 4 = when level is below fill set point (Level option should enable) |
| 40155 | Start Pool Fill Level | % | uint_16 | Read | |

| Address | Description | Units | Type | Read/Write | Remark |
|---------|--|-------|---------|------------|--------|
| 40156 | Delta-P Trigger Enable | Off | uint_16 | Read | |
| 40157 | Time to wait before performing bump after crossing Trigger point for Delta P bumping | sec | uint_16 | Read | |

MAINTENANCE

General

Your Defender® Regenerative Media Filter is virtually maintenance-free. As with any steel tank, visually inspect the finish and touch up any blemishes. Inspect all tubing and connections for any signs of wear. Replace any worn tubing.

- Head bolts: Check every three months and retighten if necessary. Refer to *Tank Leg Anchor Installation*.
- Vacuum transfer unit: Refer to the vacuum transfer unit owner's manual.
- Filter/regulator: Refer to the filter/regulator manual.
- Airline filter element: Replace with SMC Corporation Part Number AF40P-060S.
- Flexible tubes: Clean the flexible tubes inside the filter based on the bather load.
 - The more oils and contaminants that are introduced into the filter, the more often it needs to be cleaned.
 - Flexible tube cleaning is required when the system influent pressure builds back up within approximately one hour after new media has been installed.
 - Refer to *Flexible Tube Element Wash Procedure* below.

Indoor Pools

- Water parks and multi-use community centers: Twice annually.
- Competition pools, lap pools, dive pools, etc.: Once annually.

Outdoor Pools

- Up to 4 months of operation: At the end of the season.
- Up to 9 months of operation: At the middle and end of season.
- Year-round operation: Three times at convenient intervals.

Flexible Tube Element Wash Procedure

Perform this procedure to get the optimum performance of your filter.

1. Drain and rinse. Refer to *Recharging Perlite (Drain/Rinse)*.
2. At the upper right-hand corner of the control enclosure, shut the breaker off.
3. Remove the viewing window.
4. Using a power washer set to the fan pattern or a garden hose with a straight nozzle, thoroughly rinse the flexible tube elements that are accessible through the viewing window.
5. Reach into the viewing window, grasp several tubes with your hand, and pull radially **from left to right** to rotate the tube sheet and allow access to additional flexible tube elements. Continue until all flexible tube elements are rinsed.
6. Reinstall the viewing window, turn on the breaker, and then recharge the media. Refer to *Recharging Perlite (Drain/Rinse)*.

Head Removal

This procedure applies to the head gasket replacement, inspection of bump assembly, flexible tube element removal, and any kind of maintenance or repair of the tube sheet assembly.

Most filters are supplied with the davit head removal system. Domed-headed filters and the SP-18 and SP-29 systems do not have this feature. This is a tank-mounted jack that is attached to a structural steel brace that is welded to the tank head. Due to the infrequent use of the davit, the lubricating grease for the davit must be applied before each operation.

Be sure to have a new head gasket on hand before performing this procedure.

1. Press **CYCLE STOP**.
2. If the filter is located below pool water level, close the pump discharge throttling valve.
3. Turn the bump selector switch to **BUMP SET**.
4. Press **BUMP START** 5–10 times.
5. Open the drain valve.
6. Open the vacuum drain valve.
7. Drain the tank completely.
8. Close the drain valve.
9. Turn the vacuum transfer switch to **ON**, and then **OFF** within 1–2 seconds.
10. Turn the bump selector switch to **MANUAL**, and then open the pump discharge throttling valve.
11. Press **CYCLE START**. When the water fills past the viewing window, wait 4–5 seconds, and then press **CYCLE STOP**.
12. Repeat Steps 2–7.
13. Shut off the air supply, and then drain the air out via the filter regulator.
14. Remove the pneumatic tubing from the bump mechanism.
15. Disconnect the effluent and vacuum piping that are bolted to the head.
16. Disconnect the tubing from the gauge panel, and then remove the gauge panel bracket by removing the nuts.
17. Remove the hex bolt that has a lock and flat washers threaded into the top of the lift shaft.
18. Assemble the bump jig.

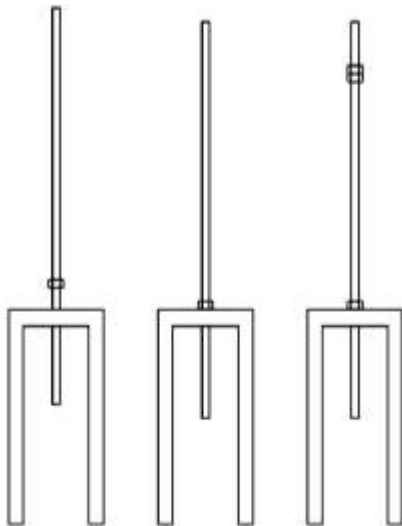


Figure 87: Bump Jig Assembly

- a. Thread one of the four supplied nuts onto the threaded rod, and then insert the shaft through the center hole of the bump jig.
- b. Thread the rod into the lift shaft, and then, when the rod bottoms out, tighten the nut to the top of the jig.
- c. Thread two of the supplied nuts, and then tighten them against each other to hold the threaded rod.

19. Unthread the hex nut from the top of the bump assembly.
20. Lower the tube sheet by holding the nut on the bump jig while turning the double nut counterclockwise until the tube sheet is sitting on the internal rests.
21. Unthread the threaded rod from the lift shaft, and then remove the bump jig assembly.
22. Remove the nuts and washers from the mounting flange to head, and then remove the bump assembly.
23. Remove the rest of the nuts, bolts, and washers that hold head in place.

24. Using the supplied jack handle, insert it into the mounted jack, and then jack up the head until the head clears the lift shaft.
25. After the head is clear of the lift shaft, swing it clear of the filter to perform the next step.

NOTE

The SP-18, SP-29, and all other domed-headed filters have lifting lugs (older domed-headed filters), pad eye lugs (SP-18 and SP-24 without the davit option) or eye nuts (SP-29) that are used with a hoist.

If you are moving the head from an SP-29 with eye nuts, perform the following after Step 21:

22. Remove the four nuts and washers, and then remove the mounting flange.
23. Thread the eye nuts onto two of the studs, making sure that the studs are threaded completely into the head (eye nuts for removing the head with a hoist).
24. Remove the rest of the nuts, and washers holding the head in place.
25. Attach the hoist to the eye nuts and remove the head.

Head torque sequence is listed on next page. For filters other than the SP-29 domed head sequence, use a standard bolt pattern and torque recommendations for the specific bolt sizes.

Head Gasket

Replace the head gasket after every upper head removal to ensure that the gasket always provides a proper seal.

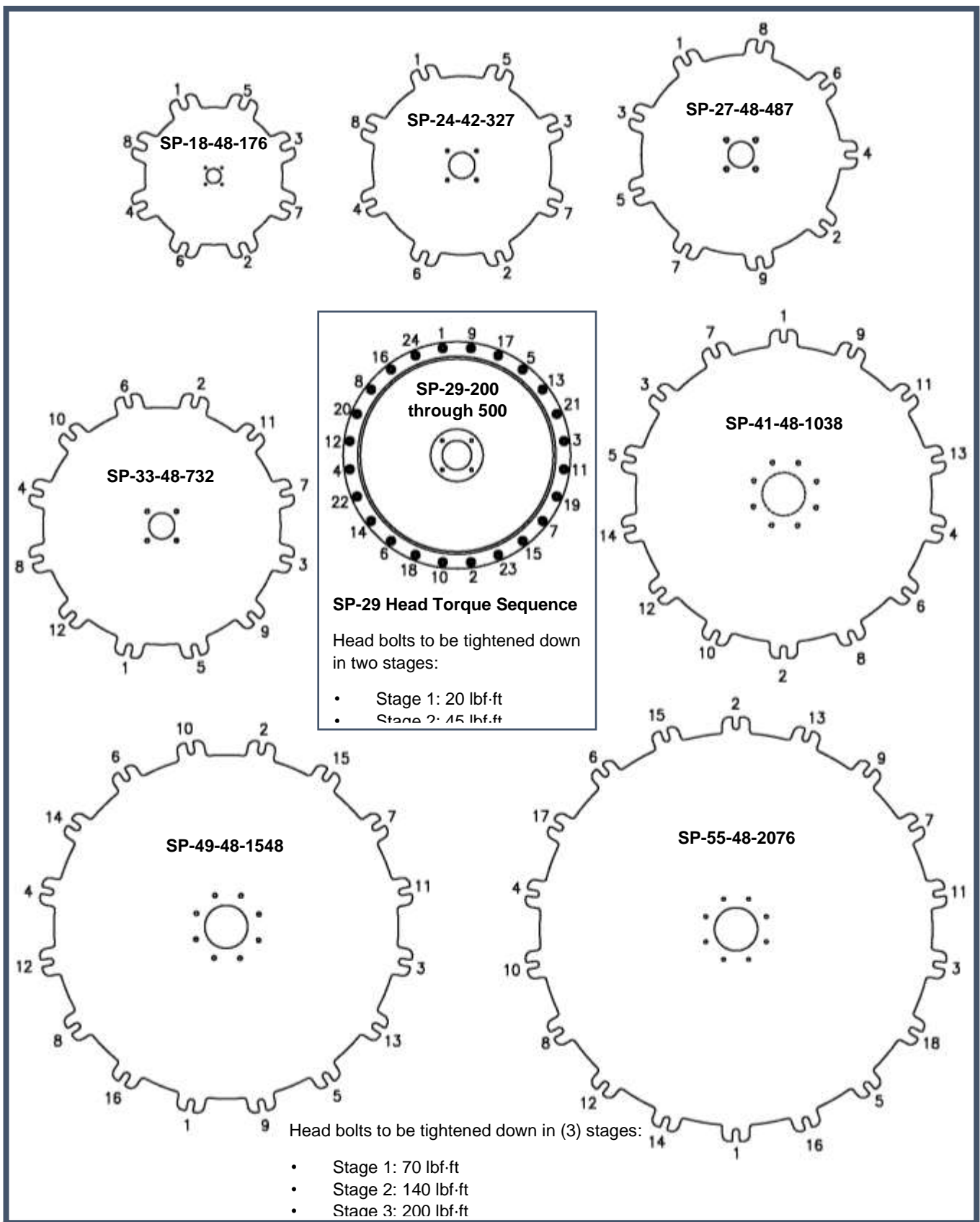


Figure 88: Head Torque

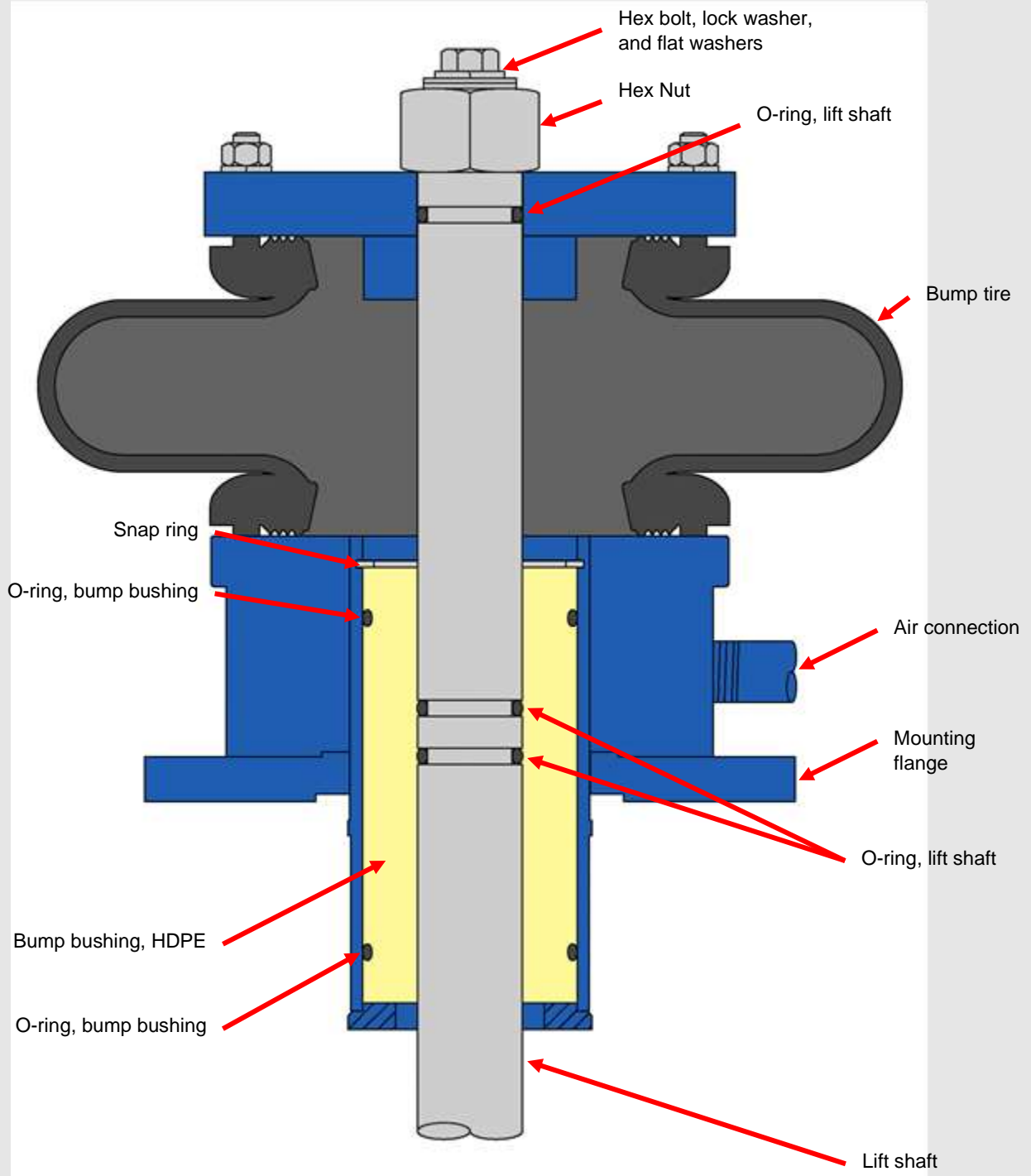


Figure 89: Bump Assembly

Five-Year Maintenance

After every five years of operation, inspect the bump assembly components to ensure proper performance.

- Inspect one bump mechanism tire.
- Inspect two bump bushing O-rings.
- Inspect three lift shaft O-rings.
- Inspect one bump bushing snap ring.
- Check the bump bushing for wear. Replace if necessary.

Contact Neptune-Benson for the instructions and tools required for this maintenance.

Ten-Year Maintenance

After every ten years of operation, inspect the tube elements to ensure proper performance.

Contact Neptune-Benson for the instructions and tools required for this maintenance.

Filter Cleaner

Chem-Clean Express™ is a multi-purpose granular formulation that cleans and unclogs filters from grease, oils, and scale. It is great for use on all types of swimming pool filters.

Features:

- Generates oxygen to assist with the cleaning function.
- Is a multi-purpose, granular formulation that cleans many types of filters (regenerative media, sand, cartridge, and DE filters).

Instructions for Use:

1. Remove the viewing window, and then manually wash off tube elements. Refer to *Flexible Tube Element Wash Procedure*
2. Reinstall the viewing window.
3. Vacuum the suggested amount of chemical cleaner into the tank. See the chart below.
4. Fill the tank with water.
5. Precoat for two minutes.
6. Open the precoat vent line to dissipate pressure build up.
7. Press **MENU**.
8. Press **Flex-tube Clean**. The filter automatically bumps 10 times every 15 minutes.
9. Soak for 1–5 hours.
10. Drain and fill the tank twice to remove all cleaner residue.
11. Recharge with perlite. Refer to *Recharging Perlite (Drain/Rinse)*.

NOTE

Parameter 14: Flex Clean Loop Time must be set to 0 seconds.



Figure 90: Chem-Clean Express

Size: 25-lb pail (Part Number 13250) and 55-lb pail (Part Number 13251).

Flexible Tube Element Chemical Cleaning

Refer to *Indoor Pools* and *Outdoor Pools* for the recommended cleaning frequency.

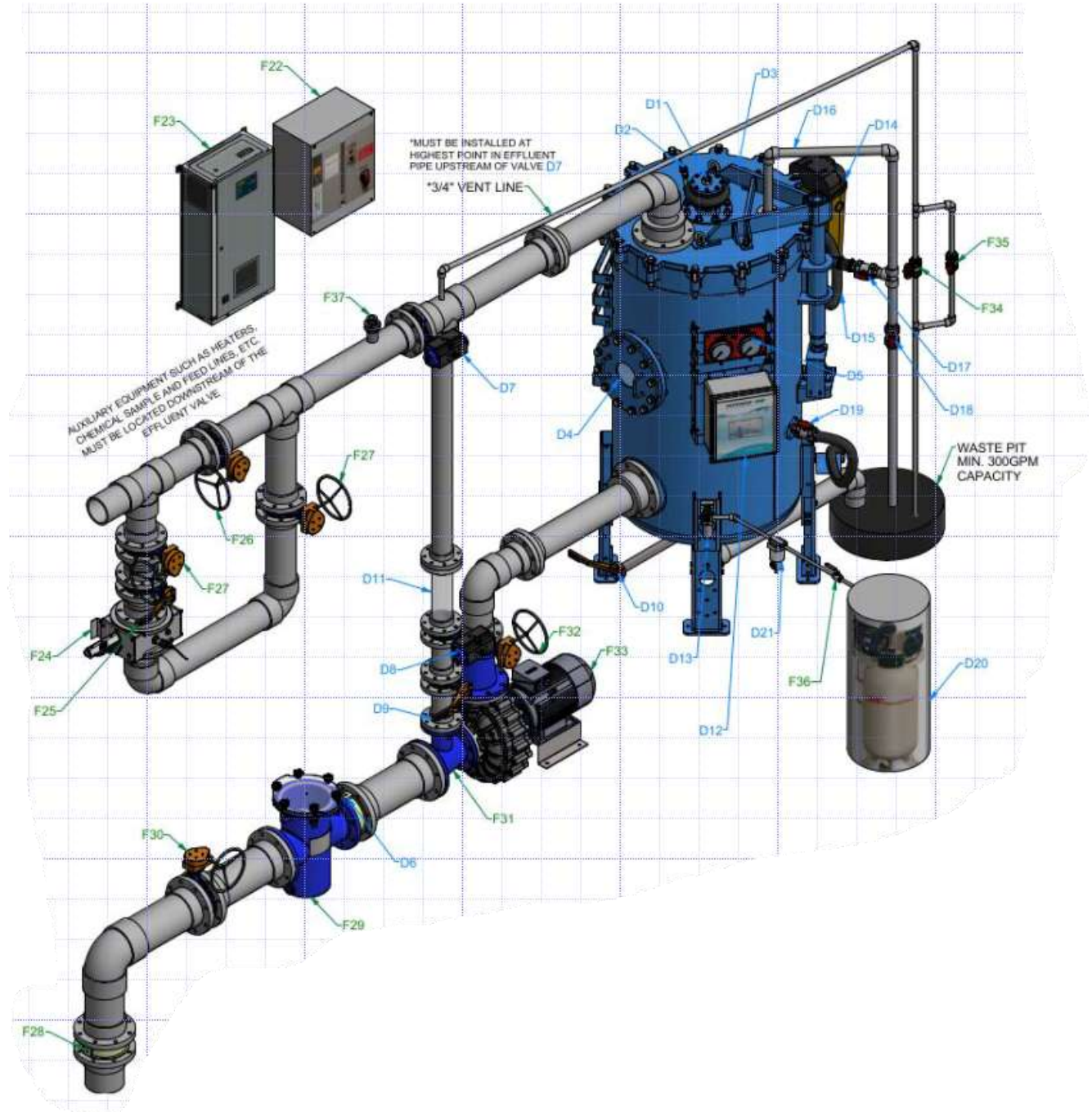
| Defender Model # | Volume (gal) | Volume (M ³) | Suggested Pounds (lbs) of Cleaner | Suggested Kilograms (kg) of Cleaner |
|--------------------------------------|--------------|--------------------------|-----------------------------------|-------------------------------------|
| SP-27-48-487 | 159 | .60 | 22 | 10 |
| SP-29-36-200 through SP-29-36-500 | 181 | .70 | 25 | 11 |
| SP-33-48-732 | 250 | .95 | 34 | 15 |
| SP-41-48-1038 | 441 | 1.70 | 61 | 28 |
| SP-49-48-1548 | 615 | 2.33 | 85 | 39 |
| SP-55-48-2076 | 841 | 3.20 | 116 | 53 |

TROUBLESHOOTING

| Component | Problem | Correction |
|----------------------|---|--|
| Vacuum transfer unit | 1. No vacuum at the vacuum hose. | <ol style="list-style-type: none"> Confirm the drain and vacuum transfer valves are closed. Remove the pneumatic actuators from the system valves to confirm that they are closed. |
| | 2. The motor does not turn on. | <ol style="list-style-type: none"> Confirm that the unit is plugged in to the receptacle. Confirm that the switch on the vacuum is in the ON position located on the top of the vacuum. Confirm all wiring connections. |
| Pneumatic Actuators | 1. The valve actuators are not operating. | <ol style="list-style-type: none"> Check the air pressure. Confirm that the filter/regulator is set to 90 PSI. Verify that the air line tubing is attached correctly. Check for leaks in the air lines. If an air line leaks at its connections, remove the tubing and re-cut it. Verify that the flow control valves on the actuators are open at least 1.5 turns. Open further if the valve does not move. |
| | 2. The valve actuators moving too quickly. | <ol style="list-style-type: none"> Shut off the air. Disconnect the air line from the actuator, and then connect the line from the right-side port into the single port on the air switch (included with the tool kit). Connect 1/4 inch OD tubing into the dual ports of the air switch, and then connect them to the actuator ports. Moving the switch back and forth operates the actuator. Adjust the flow control valves as necessary to regulate the valve speed for smooth opening and closing. |
| | 3. The valve disc is momentarily sticking in the closed position. | <ol style="list-style-type: none"> Adjust the flow control valves. Refer to Step 2 above. Adjust the limits stops for closing to angle seat the disc. Angle seating is defined as the closed position in which the disc does not leak but less is than 100% closed. Refer to the directions for limit stop adjustment using the supplied tool kit. Verify that the pressure regulator is set to 90 PSI. |
| Filter Tank | 1. The tank is draining slowly. | <ol style="list-style-type: none"> With the system filtering, open the drain valve to send pressurized water to the drain line. Open the vacuum drain valve. |

Appendices

Defender® RMF Schematic and Parts List



NOTES

Equipment is shown for schematic purposes only. Refer to the project proposal and submittals for a list of equipment supplied by Neptune-Benson™.

Pneumatic tubing or wiring not shown for clarity.

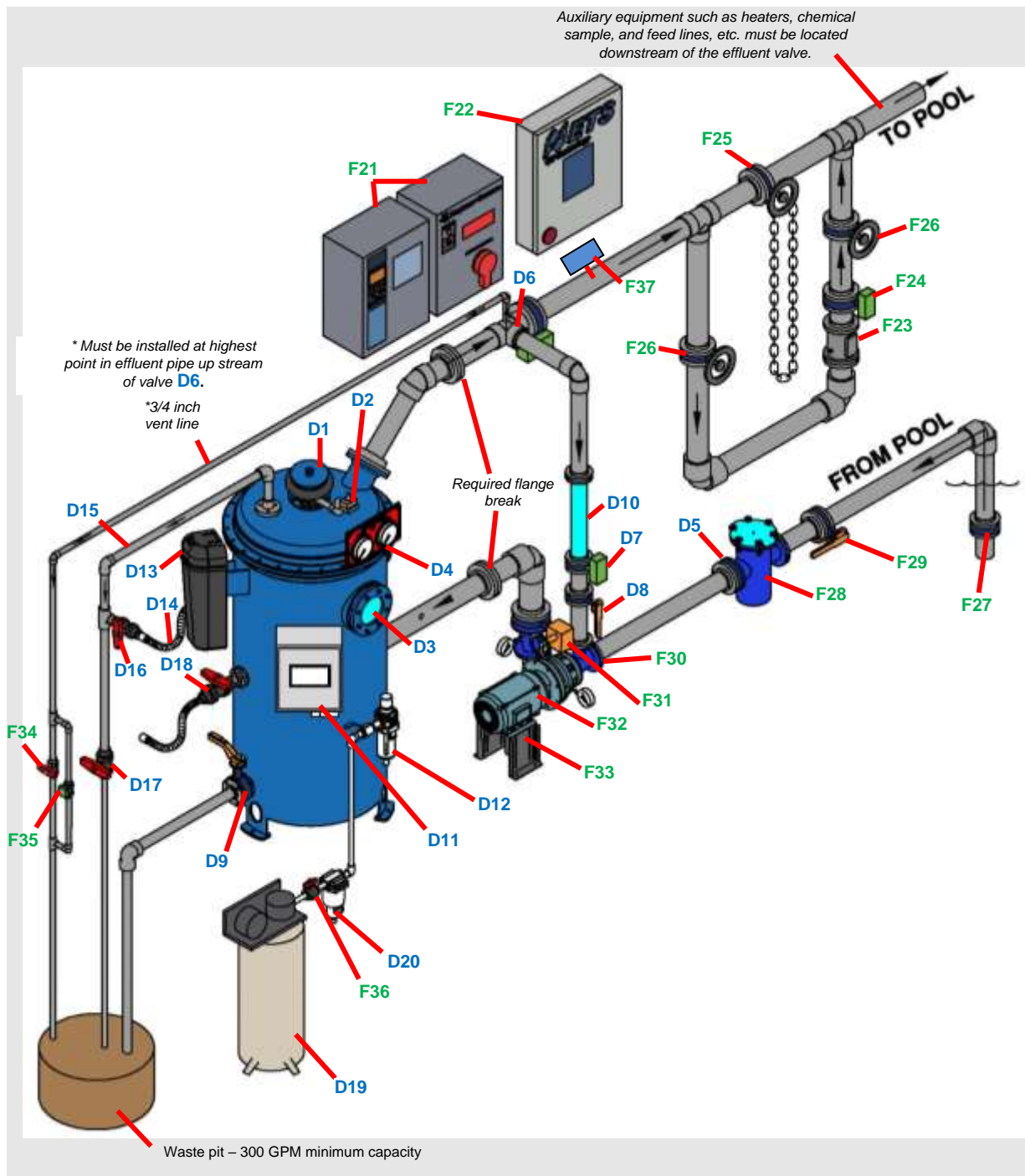
Filter Components – Included in Package

| Mark | Reference | Notes |
|------|-------------------------------------|---|
| D1 | Pneumatic bumping assembly | |
| D2 | Quick exhaust valve | |
| D3 | Lifting davit | |
| D4 | Viewing window | |
| D5 | Gauge panel | |
| D6 | Influent check valve | |
| D7 | Effluent valve | Air-operated butterfly valve, normally open. Install the effluent valve directly on the precoat tee. Locate the actuator where the valve position can be viewed from the floor. |
| D8 | Precoat valve | Air-operated butterfly valve, normally closed. Install the precoat valve as close as possible to the pump suction piping. Precoat the line two pipe diameters smaller than effluent pipe diameter. (No less than 2 inches). |
| D9 | System fill | Manually-operated butterfly valve, normally open. |
| D10 | Drain valve | Manually-operated butterfly valve, normally closed, with extension. Bolted directly to the tank bottom (media dump/rinse). Drain line must be plumbed independently to waste. (Automated option available). |
| D11 | In-line sight glass | Install in-line sight glass on the precoat line so that it can be viewed while standing at the filter control panel. |
| D12 | Control enclosure | |
| D13 | Filter regulator | |
| D14 | Vacuum transfer unit | |
| D15 | Vacuum transfer hose | |
| D16 | Vacuum transfer piping and fittings | SCH 80 PVC fittings and pipe, 1 1/2 inch. |
| D17 | Vacuum transfer valve | Ball valve, 1 1/2 inch, true union, normally closed. |
| D18 | Vacuum vent valve | Ball valve, 1 1/2 inch, true union, normally closed. The vacuum drain line must be plumbed independently to waste. |
| D19 | Vacuum hose valve with hose | Ball valve, 1 1/2 inch, true union, normally closed. |
| D20 | Air compressor | Optional. |
| D21 | Water separator | |

Filter Accessory Components – Available Upon Request

| Mark | Reference | Notes |
|------|------------------------------------|--|
| F22 | Green drive VFD | With by-pass. |
| F23 | ETS UV treatment system controller | This is a package. |
| F24 | ETS UV chamber | |
| F25 | ETS UV EZ strainer | Shown with automated option. |
| F26 | ETS UV bypass | Gear-operated butterfly valve, normally closed. |
| F27 | ETS UV isolation | Gear- or lever-operated butterfly valve, normally open. Two required. |
| F28 | Check valve | For self-priming pumps, the check valve must be installed on the suction pipe below the water level. |
| F29 | Guardian™ strainer | Hair and lint strainer. |
| F30 | Strainer isolation | Lever- or gear-operated butterfly valve, normally open. |
| F31 | Precoat reducing tee | None. |
| F32 | Pump throttle valve | Gear-operated butterfly valve, normally open. |
| F33 | Recirculating pump | |
| F34 | Pump base | |
| F35 | 3/4 inch precoat line vent valve | Normally closed, precoat line must be plumbed independently to waste. |
| F36 | 3/4 inch precoat line vent valve | Shown with automated option. |
| F37 | 3/4 inch shut off valve | |
| F38 | Flow meter | 4–20 MA output. |

Defender® Assero Schematic and Parts List



NOTES

Equipment is shown for schematic purposes only. Refer to the project proposal and submittals for a list of equipment supplied by Neptune-Benson™.

Pneumatic tubing or wiring not shown for clarity.

Filter Components – Included in Package

| Mark | Reference | Notes |
|------|-------------------------------------|---|
| D1 | Pneumatic bumping assembly | |
| D2 | Quick exhaust valve | |
| D3 | Viewing window | |
| D4 | Gauge panel | |
| D5 | Influent check valve | |
| D6 | Effluent valve | Air-operated butterfly valve, normally open. Install the effluent valve directly on the precoat tee. Locate the actuator where the valve position can be viewed from the floor. |
| D7 | Precoat valve | Air-operated butterfly valve, normally closed. Install the precoat valve as close as possible to the pump suction piping. Precoat the line two pipe diameters smaller than effluent pipe diameter. (No less than 2 inches). |
| D8 | System fill | Manually-operated butterfly valve, normally open. |
| D9 | Drain valve | Manually-operated butterfly valve, normally closed, with extension. Bolted directly to the tank bottom (media dump/rinse). Drain line must be plumbed independently to waste. (Automated option available). |
| D10 | In-line sight glass | Install in-line sight glass on the precoat line so that it can be viewed while standing at the filter control panel. |
| D11 | Control enclosure | |
| D12 | Filter regulator | |
| D13 | Vacuum transfer unit | |
| D14 | Vacuum transfer hose | |
| D15 | Vacuum transfer piping and fittings | SCH 80 PVC fittings and pipe, 1 1/2 inch. |
| D16 | Vacuum transfer valve | Ball valve, 1 1/2 inch, true union, normally closed. |
| D17 | Vacuum vent valve | Ball valve, 1 1/2 inch, true union, normally closed. The vacuum drain line must be plumbed independently to waste. |
| D18 | Vacuum hose valve with hose | Ball valve, 1 1/2 inch, true union, normally closed. |
| D19 | Air compressor | Optional. |
| D20 | Water separator | |

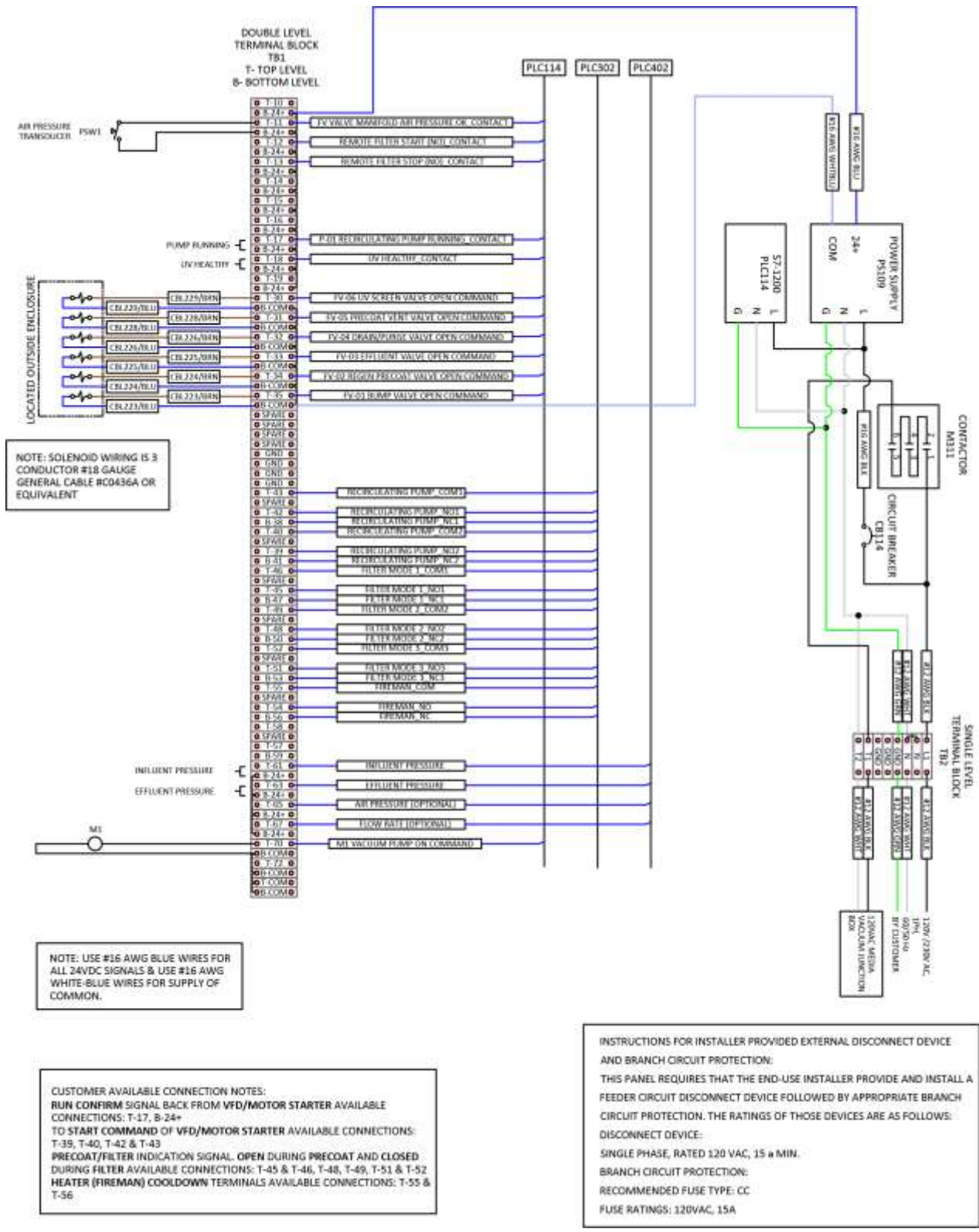
Filter Accessory Components – Available Upon Request

| Mark | Reference | Notes |
|------|------------------------------------|--|
| F21 | Green drive VFD | With by-pass. |
| F22 | ETS UV treatment system controller | This is a package. |
| F23 | ETS UV treatment system | |
| F24 | ETS UV EZ strainer | Shown with automated option. |
| F25 | ETS UV bypass | Gear-operated butterfly valve, normally closed. |
| F26 | ETS UV isolation | Gear- or lever-operated butterfly valve, normally open. Two required. |
| F27 | Check valve | For self-priming pumps, the check valve must be installed on the suction pipe below the water level. |
| F28 | Guardian™ strainer | Hair and lint strainer. |
| F29 | Strainer isolation | Lever- or gear-operated butterfly valve, normally open. |
| F30 | Precoat reducing tee | None. |
| F31 | Pump throttle valve | Gear-operated butterfly valve, normally open. |
| F32 | Recirculating pump | |
| F33 | Pump base | |
| F34 | 3/4 inch precoat line vent valve | Normally closed, precoat line must be plumbed independently to waste. |
| F35 | 3/4 inch precoat line vent valve | Shown with automated option. |
| F36 | 1/2 inch shut off valve | |
| F37 | Flow meter | 4–20 MA output. |

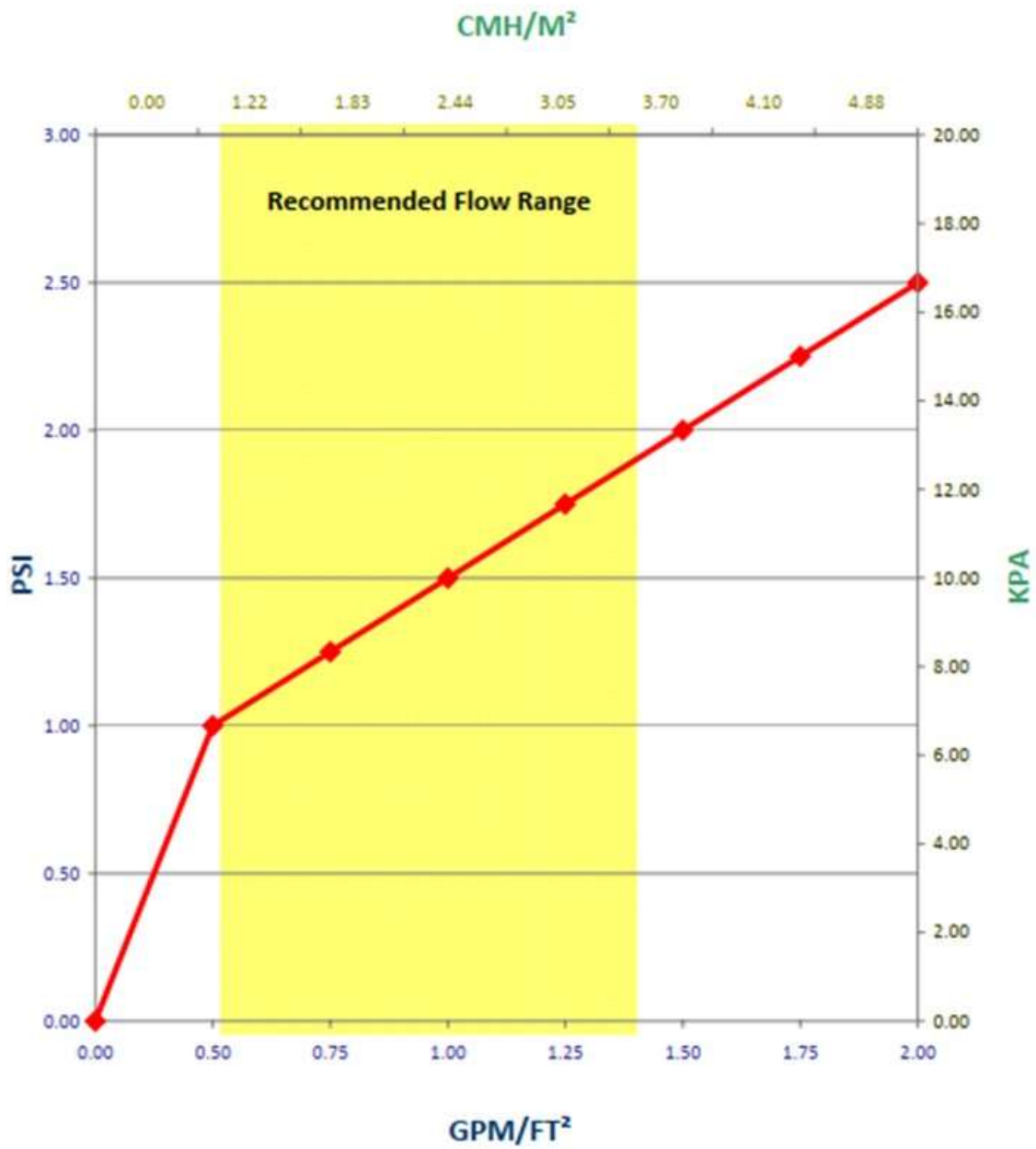
CAUTION

Do not store or install filter piping or internals in locations that are subject to temperatures beyond the specified limits of their composite materials. For outdoor installations, temperatures inside the filter can vary widely from the outside temperature. Do not expose the filter tanks to direct sunlight or heat beyond ambient temperatures during storage or when the system is shut down for extended periods. Contact Neptune-Benson™ for questions regarding the storage or installation procedures for tanks and piping.

Electrical Schematic

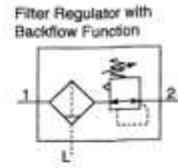
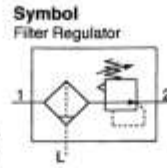


Head Loss Curve



Filter/Regulator

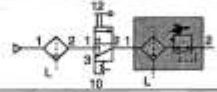
Filter Regulator AW20-B to AW60-B Filter Regulator with Backflow Function AW20K-B to AW60K-B



- Integrated filter and regulator units save space and require less piping.
- With the backflow function it incorporates a mechanism to exhaust the air pressure in the outlet side reliably and quickly.

Example)

When the air supply is cut off and releasing the inlet pressure to the atmosphere, the residual pressure release of the outlet side can be ensured for a safety purpose.



How to Order

Refer to page 85 for size 10.

AW **30** **K** - **03** **BE** - **10** - **B**

1 2 3 4 5 6

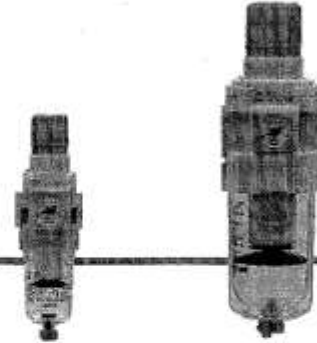
- Option/Semi-standard: Select one each for a to i.
- Option/Semi-standard symbol: When more than one specification is required, indicate in alphanumeric order.
Example) AW30K-03BE-1N-B

| | | Symbol | Description | 1 | | | | |
|----|----------------------------------|--|---|---|----|------------|------------|------------|
| | | | | Body size | | | | |
| | | | | 20 | 30 | 40 | 60 | |
| 2 | With backflow function | Nil | Without backflow function | ● | ● | ● | ● | |
| | | K ^{Note 1)} | With backflow function | ● | ● | ● | ● | |
| 3 | Pipe thread type | Nil | Rc | ● | ● | ● | ● | |
| | | N ^{Note 2)} | NPT | ● | ● | ● | ● | |
| | | F ^{Note 3)} | G | ● | ● | ● | ● | |
| 4 | Port size | 01 | 1/8 | ● | — | — | — | |
| | | 02 | 1/4 | ● | ● | ● | — | |
| | | 03 | 3/8 | — | ● | ● | — | |
| | | 04 | 1/2 | — | — | ● | — | |
| | | 06 | 3/4 | — | — | ● | ● | |
| | | 10 | 1 | — | — | — | ● | |
| 5 | a | Mounting | Nil | Without mounting option | ● | ● | ● | ● |
| | | | B ^{Note 5)} | With bracket | ● | ● | ● | ● |
| | | | H | With set nut (for panel mount) | ● | ● | ● | — |
| | b | Float type auto drain | Nil | Without auto drain | ● | ● | ● | ● |
| | | | C ^{Note 6)} | N.C. (Normally closed) Drain port is closed when pressure is not applied. | ● | ● | ● | ● |
| | | | D ^{Note 7)} | N.O. (Normally open) Drain port is open when pressure is not applied. | — | ● | ● | ● |
| | c | Pressure gauge ^{Note 8)} | Nil | Without pressure gauge | ● | ● | ● | ● |
| | | | E | Square embedded type pressure gauge (with limit indicator) | ● | ● | ● | ● |
| | | | G | Round type pressure gauge (with limit indicator) | ● | ● | ● | ● |
| | | Digital pressure switch ^{Note 9)} | M | Round type pressure gauge (with color zone) | ● | ● | ● | ● |
| | | | E1 | Output: NPN output / Electrical entry: Wiring bottom entry | ● | ● | ● | ● |
| | E2 | Output: NPN output / Electrical entry: Wiring top entry | ● | ● | ● | ● | | |
| E3 | | Output: PNP output / Electrical entry: Wiring bottom entry | ● | ● | ● | ● | | |
| E4 | | Output: PNP output / Electrical entry: Wiring top entry | ● | ● | ● | ● | | |
| d | Set pressure ^{Note 10)} | Nil | 7.3 to 123 psi (0.05 to 0.85 MPa) setting | ● | ● | ● | ● | |
| | | 1 | 2.9 to 29 psi (0.02 to 0.2 MPa) setting | ● | ● | ● | ● | |
| 6 | e | Bowl ^{Note 11)} | Nil | Polycarbonate bowl | ● | ● | ● | ● |
| | | | 2 | Metal bowl | ● | ● | ● | ● |
| | | | 6 | Nylon bowl | ● | ● | ● | ● |
| | | | 8 | Metal bowl with level gauge | — | ● | ● | ● |
| | | | C | With bowl guard | ● | — Note 12) | — Note 12) | — Note 12) |
| | | | 6C | Nylon bowl with bowl guard | ● | — Note 13) | — Note 13) | — Note 13) |
| f | Drain port ^{Note 14)} | Nil | With drain cock | ● | ● | ● | ● | |
| | | J ^{Note 15)} | Drain guide 1/8 | ● | — | — | — | |
| | | — | Drain guide 1/4 | — | ● | ● | ● | |
| | | W ^{Note 16)} | Drain cock with barb fitting | — | ● | ● | ● | |



Filter Regulator *Series AW20-B to AW60-B*

Filter Regulator with Backflow Function *Series AW20K-B to AW60K-B*



AW20-B, AW20K-B AW40-B, AW40K-B

| | | Symbol | Description | ① Body size | | | | |
|--------------------|---------------|------------------------|---|-------------------------------|-----------------------|-----------------------|-----------------------|---|
| | | | | 20 | 30 | 40 | 60 | |
| 6 Semi-standard | g | Exhaust mechanism | Nil | Relieving type | ● | ● | ● | ● |
| | | | N | Non-relieving type | ● | ● | ● | ● |
| | + | | | | | | | |
| | h | Flow direction | Nil | Flow direction: Left to right | ● | ● | ● | ● |
| | | | R | Flow direction: Right to left | ● | ● | ● | ● |
| | + | | | | | | | |
| i | Pressure unit | Nil | Name plate, caution plate for bowl, and pressure gauge in imperial units: MPa | ● | ● | ● | ● | |
| | | Z ^{Note 17)} | Name plate, caution plate for bowl, and pressure gauge in imperial units: psi, °F | ○ ^{Note 19)} | ○ ^{Note 19)} | ○ ^{Note 19)} | ○ ^{Note 19)} | |
| | | ZA ^{Note 18)} | Digital pressure switch: With unit conversion function | △ ^{Note 20)} | △ ^{Note 20)} | △ ^{Note 20)} | △ ^{Note 20)} | |

- Note 1) Set the inlet pressure to at least 7.3 psi (0.05 MPa) higher than the set pressure.
- Note 2) Drain guide is NPT1/8 (applicable to the AW20(K)-B) and NPT1/4 (applicable to the AW30(K)-B to AW60(K)-B). The auto drain port comes with a 3/8" One-touch fitting (applicable to the AW30(K)-B to AW60(K)-B).
- Note 3) Drain guide is G1/8 (applicable to the AW20(K)-B) and G1/4 (applicable to the AW30(K)-B to AW60(K)-B).
- Note 4) Option B, G, H, M are not assembled and supplied loose at the time of shipment.
- Note 5) Assembly of a bracket and set nuts (applicable to the AW20(K)-B to AW40(K)-B). Including 2 mounting screws for the AW60(K)-B.
- Note 6) When pressure is not applied, condensate which does not start the auto drain mechanism will be left in the bowl. Releasing the residual condensate before ending operations for the day is recommended.

- Note 7) If the compressor is small (0.75 kW, discharge flow is less than 3.5 scfm (100 L/min(ANR))), air leakage from the drain cock may occur during start of operations. N.C. type is recommended.
- Note 8) When the pressure gauge is attached, a 145 psi (1.0 MPa) pressure gauge will be fitted for standard (123 psi (0.85 MPa)) type. 58 psi (0.4 MPa) pressure gauge for 2.9 psi (0.2 MPa) type.
- Note 9) When choosing with H (panel mount), the installation space for lead wires will not be secured. In this case, select "wiring top entry" for the electrical entry. (Select "wiring bottom entry" when the semi-standard Y is chosen simultaneously.)
- Note 10) Pressure can be set higher than the specification pressure in some cases, but use pressure within the specification range.
- Note 11) Refer to Chemical data on page 90 for chemical resistance of the bowl.
- Note 12) A bowl guard is provided as standard equipment (polycarbonate).
- Note 13) A bowl guard is provided as standard equipment (nylon).

- Note 14) The combination of float type auto drain: C and D is not available.
- Note 15) Without a valve function.
- Note 16) The combination of metal bowl: 2 and 8 is not available.
- Note 17) For pipe thread type: NPT. This product is for overseas use only according to the new Measurement Law. (The SI unit type is provided for use in Japan.) Cannot be used with M: Round pressure gauge (with color zone). Available by request for special. The digital pressure switch will be equipped with the unit conversion function, setting to psi initially.
- Note 18) For options: E1, E2, E3, E4. This product is for overseas use only according to the new Measurement Law. (The SI unit is provided for use in Japan.)
- Note 19) ○: For pipe thread type: NPT only
- Note 20) △: Select with options: E1, E2, E3, E4.

Standard Specifications

| Model | AW20-B | AW30-B | AW40-B | AW40-06-B | AW60-B |
|---|---|----------|--------------------------|-----------|--------|
| Port size | 1/8, 1/4 | 1/4, 3/8 | 1/4, 3/8, 1/2 | 3/4 | 3/4, 1 |
| Pressure gauge port size ^{Note 1)} | 1/8 | | | | |
| Fluid | Air | | | | |
| Ambient and fluid temperature ^{Note 2)} | 23 to 140°F (-5 to 50°C) (with no freezing) | | | | |
| Proof pressure | 218 psi (1.5 MPa) | | | | |
| Maximum operating pressure | 145 psi (1.0 MPa) | | | | |
| Set pressure range | 7.3 to 123 psi (0.05 to 0.85 MPa) | | | | |
| Nominal filtration rating | 5 μm | | | | |
| Drain capacity (cm³) | 8 | 25 | 45 | | |
| Bowl material | Polycarbonate | | | | |
| Bowl guard | Semi-standard (Steel) | | Standard (Polycarbonate) | | |
| Construction | Relieving type | | | | |
| Weight (kg) | 0.20 | 0.36 | 0.66 | 0.72 | 2.05 |

Note 1) Pressure gauge connection threads are not available for F.R.L. unit with a square embedded type pressure gauge or with a digital pressure switch.

Note 2) 23 to 122°F (-5 to 50°C) for the products with the digital pressure switch



Series AW20-B to AW60-B Series AW20K-B to AW60K-B

Options/Part No.

| Optional specifications | | Model | | | | |
|--|---|---|--|-------------|--------------|----------------------|
| | | AW20(K)-B | AW30(K)-B | AW40(K)-B | AW40(K)-06-B | AW60(K)-B |
| Bracket assembly ^{Note 1)} | | AW23P-270AS | AR33P-270AS | AR43P-270AS | | AW62P-270AS |
| Set nut | | AR23P-260S | AR33P-260S | AR43P-260S | | — ^{Note 2)} |
| Pressure gauge | Round type ^{Note 3)} | Standard | G36-10-□01 | | G46-10-□01 | |
| | | 2.9 to 29 psi (0.02 to 0.2 MPa) setting | G36-4-□01 | | G46-4-□01 | |
| | Round type (with color zone) ^{Note 3)} | Standard | G36-10-□01-L | | G46-10-□01-L | |
| | | 2.9 to 29 psi (0.02 to 0.2 MPa) setting | G36-4-□01-L | | G46-4-□01-L | |
| Square embedded type ^{Note 4)} | Standard | GC3-10AS [GC3P-010AS (Pressure gauge cover only)] | | | | |
| | 2.9 to 29 psi (0.02 to 0.2 MPa) setting | GC3-4AS [GC3P-010AS (Pressure gauge cover only)] | | | | |
| Digital pressure switch ^{Note 5)} | NPN output: Wiring bottom entry | | ISE35-N-25-MLA [ISE35-N-25-M (Switch body only)] | | | |
| | NPN output: Wiring top entry | | ISE35-R-25-MLA [ISE35-R-25-M (Switch body only)] | | | |
| | PNP output: Wiring bottom entry | | ISE35-N-65-MLA [ISE35-N-65-M (Switch body only)] | | | |
| | PNP output: Wiring top entry | | ISE35-R-65-MLA [ISE35-R-65-M (Switch body only)] | | | |

Note 1) Assembly of a bracket and set nuts. Including 2 mounting screws for the AW60(K)-B

Note 2) Please consult with SMC regarding the set nuts for the AW60(K)-B.

Note 3) □ in part numbers for a round pressure gauge indicates a pipe thread type.

No indication is necessary for F; however, indicate N for NPT.

Please contact SMC regarding the pressure gauge supply for psi unit specifications.

Note 4) Including one O-ring and 2 mounting screws.

[]: Pressure gauge cover only

Note 5) In addition to the pressure switch body, lead wire with connector (2 m), adapter, lock pin, O-ring (1 pc.), mounting screw (2 pcs.) are attached.

[]: Switch body only. (Regarding how to order the digital pressure switch, refer to the WEB catalog or the Best Pneumatics No.6.)

A pressure switch can be mounted on the AW60(K)-B, with a special mounting adapter (Pressure switch adapter assembly: AW63P-310AS) and mounting screws (M3 x 0.5 x 14) which are delivered with the mounting adapter.

Bowl Assembly/Part No.

| Bowl material | Drain discharge mechanism | Drain port | Other | Model | | | | |
|--------------------|---|---|---|-------------|------------|--------|------------|--------|
| | | | | AW20-B | AW30-B | AW40-B | AW40-06-B | AW60-B |
| Polycarbonate bowl | Manual discharge | With drain cock | — | C2SF-A | — | — | — | — |
| | | | With bowl guard | C2SF-C-A | C3SF-A | — | C4SF-A | |
| | | Drain cock with barb fitting | With bowl guard | — | C3SF-W-A | — | C4SF-W-A | |
| | Automatic discharge ^{Note)} (Auto drain) | Normally closed (N.C.) | With drain guide (without valve function) | — | C2SF□-J-A | — | — | — |
| | | | With bowl guard | C2SF□-CJ-A | C3SF□-J-A | — | C4SF□-J-A | |
| | | Normally open (N.O.) | — | AD27-A | — | — | | |
| Nylon bowl | Manual discharge | With drain cock | — | C2SF-6-A | — | — | — | |
| | | | With bowl guard | C2SF-6C-A | C3SF-6-A | — | C4SF-6-A | |
| | | Drain cock with barb fitting | With bowl guard | — | C3SF-6W-A | — | C4SF-6W-A | |
| | Automatic discharge ^{Note)} (Auto drain) | Normally closed (N.C.) | With drain guide (without valve function) | — | C2SF□-6J-A | — | — | — |
| | | | With bowl guard | C2SF□-6CJ-A | C3SF□-6J-A | — | C4SF□-6J-A | |
| | | Normally open (N.O.) | — | AD27-6-A | — | — | | |
| Metal bowl | Manual discharge | With drain cock | — | C2SF-2-A | C3SF-2-A | — | C4SF-2-A | |
| | | | With level gauge | — | C3LF-8-A | — | C4LF-8-A | |
| | | With drain guide (without valve function) | — | C2SF□-2J-A | C3SF□-2J-A | — | C4SF□-2J-A | |
| | Automatic discharge ^{Note)} (Auto drain) | Normally closed (N.C.) | With level gauge | — | C3LF□-8J-A | — | C4LF□-8J-A | |
| | | | — | AD27-2-A | AD37□-2-A | — | AD47□-2-A | |
| | | Normally open (N.O.) | With level gauge | — | AD37□-8-A | — | AD47□-8-A | |
| — | — | AD38□-2-A | — | AD48□-2-A | | | | |
| With level gauge | — | AD38□-8-A | — | AD48□-8-A | | | | |

Note) Minimum operating pressure: N.O. type—15 psi (0.1 MPa) (AD38-A, AD48-A); N.C. type—15 psi (0.1 MPa) (AD27-A) and 22 psi (0.15 MPa) (AD37-A, AD47-A).

Bowl assembly comes with a bowl seal.

□ in bowl assembly part numbers indicates a pipe thread type (applicable tubing for auto drain).

No indication is necessary for Rc thread; however, indicate N for NPT thread, and F for G thread. (For auto drain, Ni: ø10, N: ø3/8")

Please consult with SMC separately for psi and °F unit display specifications.



Water Separator

The AMG series water separator is installed on the air pressure line to remove water drops in the compressed air. It is suitable for use in cases where "water must be removed, but the air does not have to be as dry as when an air dryer is used" or "an air dryer cannot be used because an electric power supply is not available".

Through the adoption of an element that is used exclusively for removing water drops and the provision of ample housing interior space, a 99%* water removal rate** has been achieved.

Caution

Water separator can remove water droplets, but it cannot remove moisture.

- *Condition of inlet air
Pressure: 0.7 MPa
Temperature: 25 °C
Relative humidity: 100%
- Liquid water content (Water droplet content): 1.5 g/m³ (ANR)
- Compressed air flow; Rated flow of each model
- **Removed rate of water (%) = $\frac{\text{Removed water (Water droplet) (g)}}{\text{Inflowing water (Water droplet) (g)}} \times 100$

Various equipment for drain discharge



Made to Order Made to Order Specifications (For details, refer to page 14-20-55.)

Caution

Be sure to read before handling. Refer to pages 14-21-3 to 4 for Safety Instructions and Common Precautions on the products mentioned in this catalog, pages 14-14-6 to 8 for Precautions on every series, and pages 14-20-62 to 64 for more detailed precautions on every series.

Model

| Model | AMG150 | AMG250 | AMG350 | AMG450 | AMG550 | AMG650 | AMG850 |
|----------------------------|---------------|---------------|---------------|-------------|--------|----------|----------|
| Rated flow (ℓ/min (ANR)) | 300 | 750 | 1500 | 2200 | 3500 | 6000 | 12000 |
| Port size (Nominal size B) | 1/8, 1/4, 3/8 | 1/4, 3/8, 1/2 | 3/8, 1/2, 3/4 | 1/2, 3/4, 1 | 3/4, 1 | 1, 1 1/2 | 1 1/2, 2 |
| Weight (kg) | 0.38 | 0.55 | 0.9 | 1.4 | 2.1 | 4.2 | 10.5 |

Note) Max. flow capacity at a pressure of 0.7 MPa. Max. flow varies depending on operating pressure. Refer to page 14-20-4 for flow rate and page 14-20-4 for the max. flow line graph.

Specifications

| | |
|-------------------------------|---|
| Fluid | Compressed air |
| Max. operating pressure | 1.0 MPa |
| Min. operating pressure * | 0.05 MPa |
| Proof pressure | 1.5 MPa |
| Ambient and fluid temperature | 5 to 60°C |
| Removed rate of water | 99% |
| Element life | 2 years or when pressure drop reaches 0.1 MPa |

* 0.1 MPa (N.C. type) or 0.15 MPa (N.C. type) in the case of types with auto-drain.

Refer to "Made to Order Specifications" on page 14-20-55.

Accessory (Option)

| Applicable model | AMG150 | AMG250 | AMG350 | AMG450 | AMG550 | AMG650 | AMG850 |
|--|--------|--------|--------|--------|--------|--------|--------|
| Bracket assembly (With cap bolt and spring washer) | BM51 | BM52 | BM53 | BM54 | BM55 | BM56 | BM57 |

How to Order

AMG 250 03 B J

Body size

| | |
|-----|----------------|
| 150 | 1/8 Standard |
| 250 | 1/4 Standard |
| 350 | 3/8 Standard |
| 450 | 1/2 Standard |
| 550 | 3/4 Standard |
| 650 | 1 Standard |
| 850 | 1 1/2 Standard |

Thread type

| | |
|-----|-----|
| Nil | Rc |
| F | G |
| N | NPT |

Port size

| | | | |
|----|------------------|----|--------------------|
| 01 | 1/8 ^B | 06 | 3/4 ^B |
| 02 | 1/4 ^B | 10 | 1 ^B |
| 03 | 3/8 ^B | 14 | 1 1/2 ^B |
| 04 | 1/2 ^B | 20 | 2 ^B |

Option *

| | |
|---|--------------------------------|
| J | Drain guide 1/4" female thread |
| R | IN-OUT reversal direction |

Note) Element service indicator (symbol T) is not available as an option because water deposits inside the indicator will lead to malfunctions.

Accessory (Option) *

| Symbol | Description |
|--------|-----------------|
| Nil | — |
| B | Bracket |
| C | N.C. auto-drain |
| D | N.O. auto-drain |

* Refer to the table below for accessory/Option combinations.

Note) Refer to "How to Order Bowl Assembly" on page 14-20-59.

Accessory/Option Combinations

○ Available □ Not available ○ Depends on model

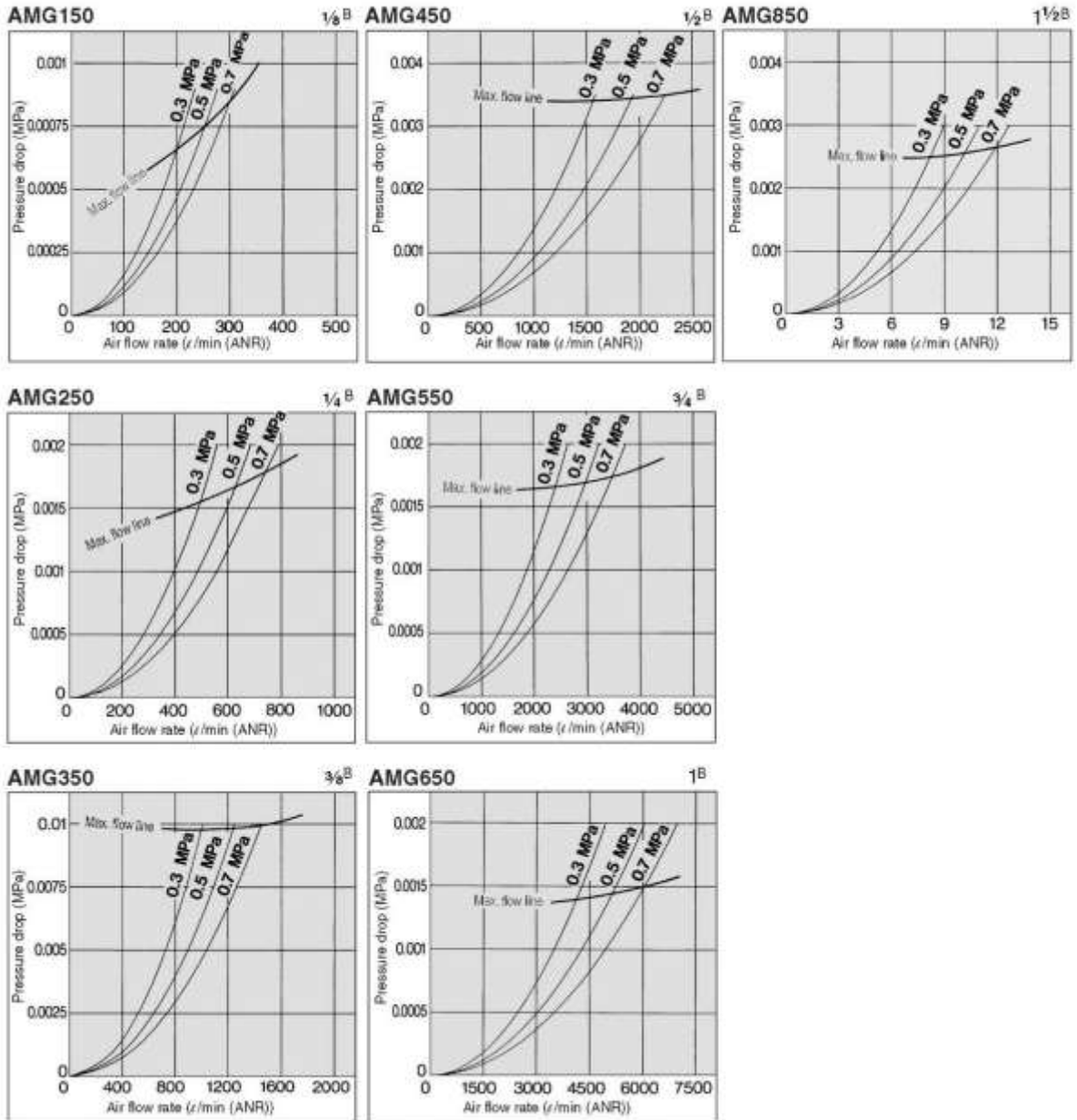
| Accessory (Option) | Accessory (Option) | | | | Applicable model | | | | | | | |
|---------------------------|--------------------|---|---|---|------------------|--------|--------|--------|--------|--------|--------|--|
| | C | D | J | R | AMG150 | AMG250 | AMG350 | AMG450 | AMG550 | AMG650 | AMG850 | |
| Accessory | | | | | | | | | | | | |
| N.C. auto-drain | C | | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |
| N.O. auto-drain | D | | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |
| Option | | | | | | | | | | | | |
| Drain guide 1/4 B | J | | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |
| IN-OUT reversal direction | R | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |

Flow Characteristics

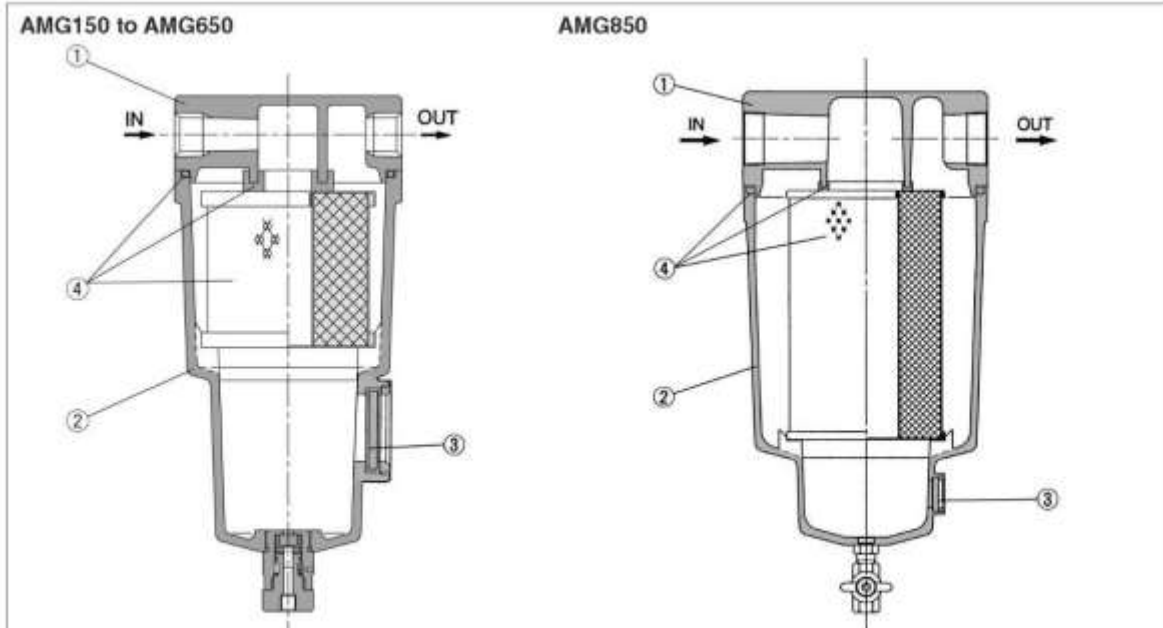
Element initial condition



Note) Compressed air over max. flow line in the table below may not meet the specifications of the product. It may cause damage to the element.



Construction



Component Parts

| No. | Description | Material | Note |
|-----|-------------|----------------------|--------------------------------|
| ① | Body | Aluminum die-casted | Chrome treated |
| ② | Housing | Aluminum die-casted* | Epoxy coating on inner surface |
| ③ | Sight glass | Tempered glass | |

* AMG850 is aluminum casted.



Note) Refer to page 14-20-59 for 'How to Order Bowl Assembly'.



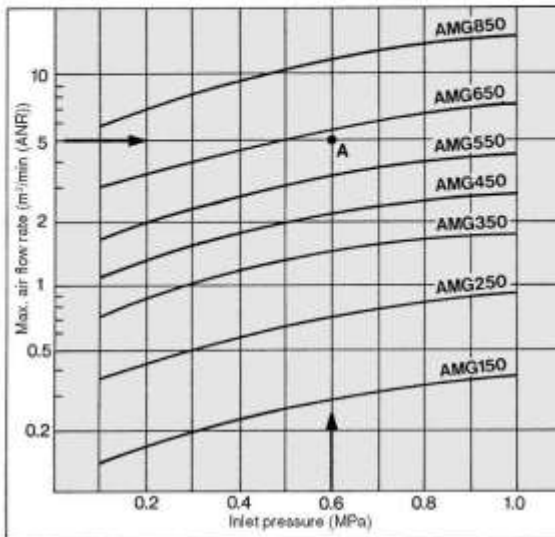
Note) Sight glass is indicated in the figure above for easy understanding of parts, however mounting position is different. Refer to dimensions on pages 14-20-6 to 7 for details.

Replacement Parts

| No. | Description | Material | Model | | | | | | |
|-----|------------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | | AMG150 | AMG250 | AMG350 | AMG450 | AMG550 | AMG650 | AMG850 |
| ④ | Element assembly | Resin Others | AMG-EL150 | AMG-EL250 | AMG-EL350 | AMG-EL450 | AMG-EL550 | AMG-EL650 | AMG-EL850 |

* Element assembly: With gasket and O-ring

Max. Air Flow



Model Selection

Select the model in accordance with the following procedure taking the inlet pressure and max. air flow into consideration.

(Example) Inlet pressure: 0.6 MPa

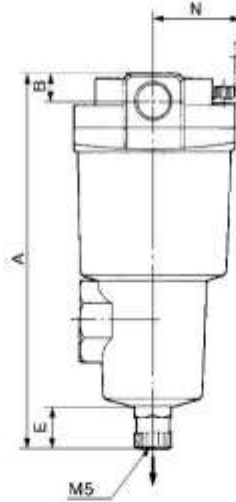
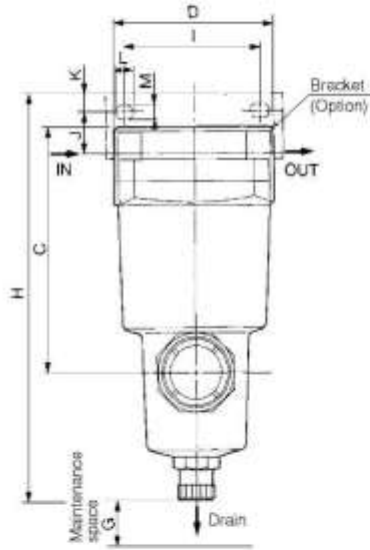
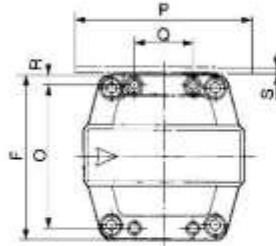
Maximum air flow rate: 5 m³/min (ANR)

1. Select the point of contact A of inlet pressure and max. air capacity in the graph.
2. AMG650 is obtained when the max. flow line is above the point of intersection A in the graph.



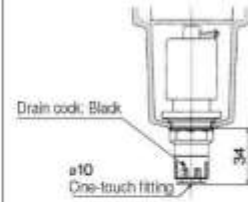
Note) Make sure to select a model that has the maximum flow rate line above the obtained intersecting point. With a model that has the maximum flow rate line below the obtained intersecting point, the flow rate will be exceeded, thus leading to a problem such as being unable to satisfy the specifications.

AMG150 to AMG650 Dimensions

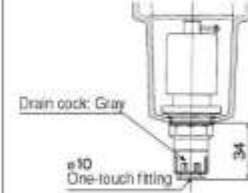


Accessory

D: With auto-drain (N.O.)



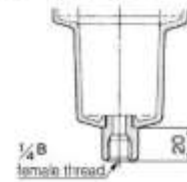
C: With auto-drain (N.C.)



* N.C. auto-drain not available for AMG650

Option

J: With drain guide



| Model | Port size (Nominal size B) | A | B | C | D | E | F | G | Dimensions with mounting bracket | | | | | | | | | | | |
|--------|-------------------------------|-----|----|-----|-----|----|-----|----|----------------------------------|-----|----|----|----|-----|----|-----|-----|----|-----|-----|
| | | | | | | | | | H | I | J | K | L | M | N | O | P | Q | R | S |
| AMG150 | 1/8, 1/4, 3/8 | 159 | 13 | 100 | 63 | 20 | 63 | 10 | 166 | 56 | 15 | 5 | 9 | 5.5 | 35 | 54 | 70 | 26 | 4.5 | 1.6 |
| | 1/4, 3/8 | 172 | 13 | 113 | 76 | 20 | 76 | 10 | 187 | 66 | 20 | 8 | 12 | 6 | 40 | 66 | 84 | 28 | 5 | 2.0 |
| | 1/2 | 178 | 16 | 119 | 76 | 20 | 76 | 10 | 187 | 66 | 17 | 8 | 12 | 6 | 40 | 66 | 84 | 28 | 5 | 2.0 |
| AMG350 | 3/8, 1/2 | 204 | 16 | 145 | 90 | 20 | 90 | 10 | 218 | 80 | 22 | 8 | 14 | 7 | 50 | 80 | 100 | 34 | 5 | 2.3 |
| | 3/4 | 210 | 19 | 151 | 90 | 20 | 90 | 10 | 218 | 80 | 19 | 8 | 14 | 7 | 50 | 80 | 100 | 34 | 5 | 2.3 |
| AMG450 | 1/2, 3/4 | 225 | 19 | 168 | 106 | 20 | 106 | 10 | 241 | 90 | 25 | 10 | 14 | 9 | 55 | 88 | 110 | 50 | 9 | 3.2 |
| | 1 | 232 | 22 | 173 | 106 | 20 | 106 | 10 | 241 | 90 | 21 | 10 | 14 | 9 | 55 | 88 | 110 | 50 | 9 | 3.2 |
| AMG550 | 3/4, 1 | 259 | 22 | 200 | 122 | 20 | 122 | 10 | 277 | 100 | 30 | 10 | 16 | 9 | 65 | 102 | 130 | 60 | 10 | 4.5 |
| AMG650 | 1, 1 1/2 | 311 | 32 | 253 | 160 | 20 | 160 | 10 | 334 | 150 | 40 | 15 | 20 | 11 | 85 | 136 | 180 | 76 | 12 | 4.5 |