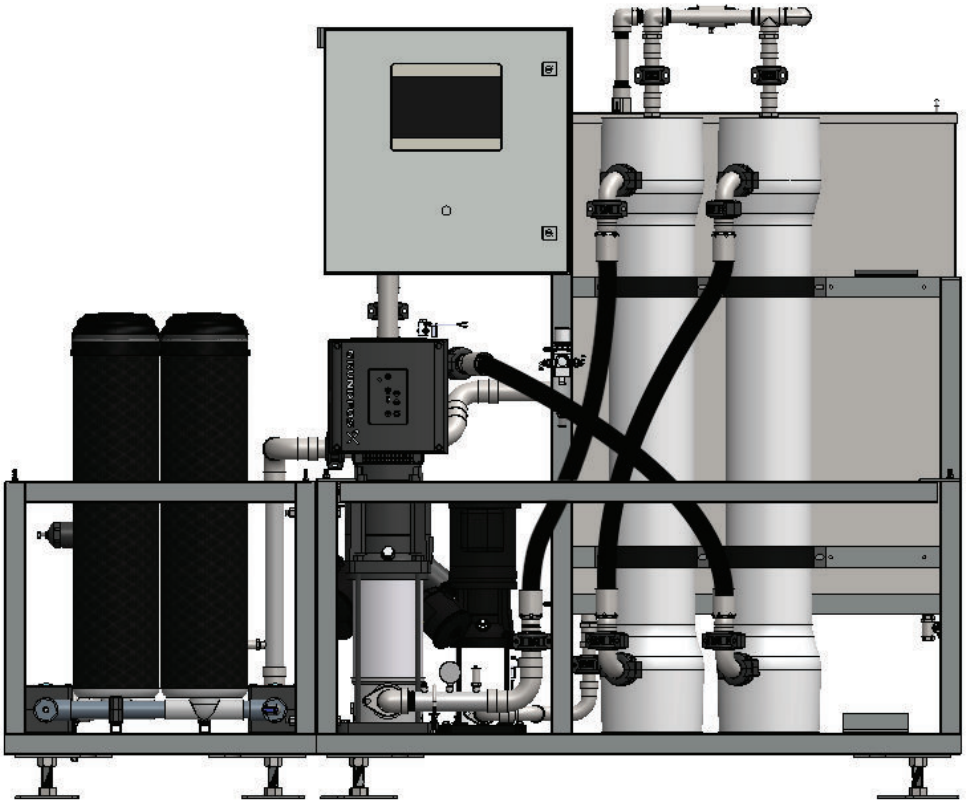
HOFFMAN INNOVATEIT

REVERSE OSMOSIS

S P O T - F R E E R I N S E S Y S T E M

Instruction Manual

REV3.00



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Introduction

1. Introduction

The manufacturer innovateIT Car Wash Equipment LLC is committed to the continuous improvement of its equipment construction quality and the safe operation of its equipment.

1.1 Warranty

This manual covers the installation, intended use, and maintenance of the Reverse Osmosis (RO) Spot-Free Rinse System. Misuse or improper operation of this device will void the manufacturer's warranty.

The RO Spot-Free Rinse System is covered by a 1-year limited warranty from the date of shipment. This warranty shall be void and of no effect if:

- Any installation defect that was apparent or ascertainable at the time of installation was completed but was not promptly reported to innovateIT Car Wash Equipment LLC.
- Damage occurs due to the customer's failure to observe any instructions from innovateIT Car Wash Equipment or an authorized distributor and/or requirements of the manufacturer with respect to the product.
- The breach results from misuse of the equipment as outlined in the instruction manual.

When purchasing through a distributor, please ask about their warranty coverage on the unit.

1.2 Safety Information

The instructions in this manual provide you with the information necessary to install and operate the RO System. Before starting installation, the instruction manual should be carefully read and understood. This relates to all RO System documents from innovateIT Car Wash Equipment.

The basic pre-requisite for safe working is compliance with all the safety and handling instructions stated in this manual. Furthermore, follow all local accident, hazard prevention regulations or general safety regulations when installing and operating the RO System.

The equipment's operation, maintenance, and troubleshooting must only be carried out by trained personnel. Personnel be able to interpret a wiring diagram, use a multimeter to read AC and DC power, and apply Lock Out Tag Out (LOTO) safety procedures specific to the equipment.

Eye protection should be worn at all times when operating the RO System, as the unit includes high pressure water lines and membrane housings which may leak if fittings loosen over time.

Electrical installation must adhere to local codes and the National Electrical Code, ANSI/NFPA 70 for electrical wiring. To avoid electrical shock hazards, do not operate this device when electrical enclosures are open and energized. Electrical power must be shut off and a lock-out procedure utilized to ensure all electrical power is disabled before performing maintenance to any portion of the system.

Plumbing installation must adhere to a local code and Uniform Plumbing Code (UPC), and plumbing connections and drains must adhere to local standards and facility codes.

Do not remove any Caution, Warning, or any other descriptive labels from the RO System. Do not operate this device in

an explosive environment or in the presence of flammable materials.

Movement or vibrations during shipment may cause connections to loosen. Check all connections before starting up a unit.

Do not operate this unit in an environment where water temperatures may be below 40°F or above 80° F.

This equipment is intended for installation in ordinary locations, by the National Electrical Code, ANSI/NFPA 70, where the ambient temperature does not exceed 104°F maximum.

innovateIT Car Wash Equipment LLC does not accept liability for accidents or damages due to negligence or disregard for the instructions in this manual. Also, the Company does not accept liability for damages due to improper use of the equipment.

This instruction manual should always be kept in a safe and easily accessible place near the equipment's site of installation and operation, and be available for the operator at the user site at any time.

If the manual is damaged, lost, or misplaced, you should immediately request a new copy from innovateIT Car Wash Equipment LLC.

1.2.1 Notifications & Symbols

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTE is used to address practices not related to physical injury.

2. System Overview

Reverse Osmosis Spot-Free Rinse Systems address the need for pure, mineral-free water to enhance the wash process's efficiency and effectiveness. This system directly contributes to maintaining consistent water quality, reducing maintenance needs, and optimizing operational costs by mitigating the adverse effects of hard water on both the vehicles being washed and the car wash equipment itself.

Municipal water contains a variety of dissolved minerals, such as calcium, magnesium, and sodium, which contribute to water hardness and can leave spots and residues on vehicles after drying. An RO System filters these minerals out, producing pure water (permeate) that results in a spot-free rinse.

The quality of municipal water can also vary significantly due to seasonal changes, local water treatment variations, and infrastructure quality. An RO system ensures that the rinse water quality is consistently high, irrespective of the incoming water's condition, by removing up to 99% of dissolved solids and impurities.

The use of this high-quality RO water can also reduce chemical usage and extend the life of car wash equipment. Since the water is purer, it is more effective at rinsing away soap and residues, which can lead to a reduction in chemical costs. Additionally, the pure water without minerals prevents the buildup of scale and corrosion in pipes and nozzles, reducing maintenance requirements and extending the operational lifespan of the equipment.

2.1 Features & Functions

innovateIT Car Wash Equipment LLC has developed a high-efficiency Reverse Osmosis Spot-Free Rinse System to provide spot-free rinse service for express car wash applications.

The system uses a 'Flow on Demand' control algorithm to adjust pressure on the membranes by varying pump speed, which automatically generates the required RO for the demand of the car wash. This allows the pump to operate at lower pressures for longer periods, increasing membrane life and reducing pump cycling. Additionally, it avoids short cycling the pump, ensuring the unit runs efficiently even during periods of low or intermittent car wash tunnel volume.

This approach produces high-quality spot-free rinse water with maximum operating efficiency. It also allows for the use of a reduced-size RO storage tank which is fully integrated into the RO stainless steel stand. The integrated system eliminates the cost of buying and installing large buffer storage tanks needed to meet the high-volume tunnel demand at busy washes.

The tank level sensor (pressure transducer) generates the request for the RO production flow rate, which varies based upon the RO storage tank level.

In addition, the Grundfos VFD pump allows the unit to produce a minimum flow of 10 GPM for Standard Flow units and 15 GPM for High Flow units at 40F feed water temperature to ensure consistent flow for the wash even in extremely cold winter climates. Figure 2.1 - 1 shows the range of permeate flow that the RO System produces over a range of feedwater temperature.

The RO System utilizes fixed orifices on the recirculation and reject lines to provide a 60/40 split of recirculation to reject flow, maximizing fresh water usage.

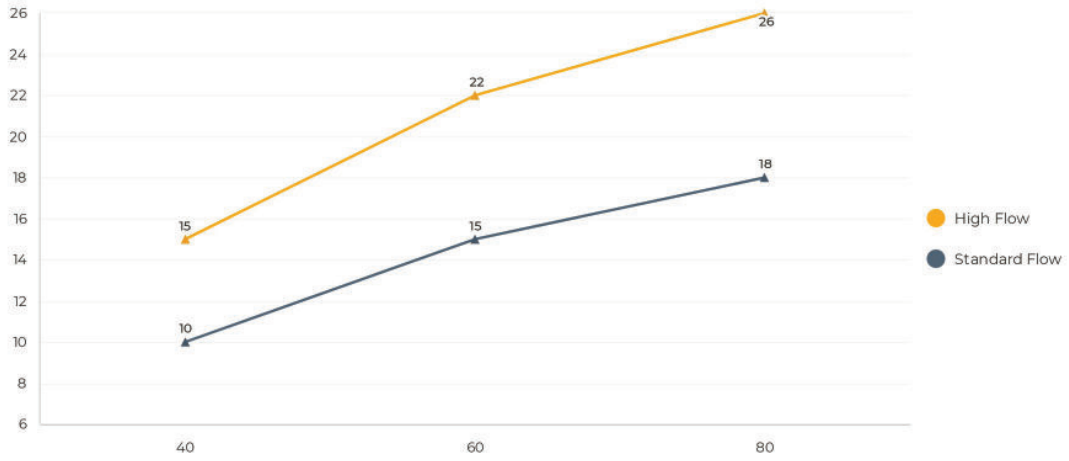


Fig. 2.1 - 1 *- Permeate flow based on feed temperature*

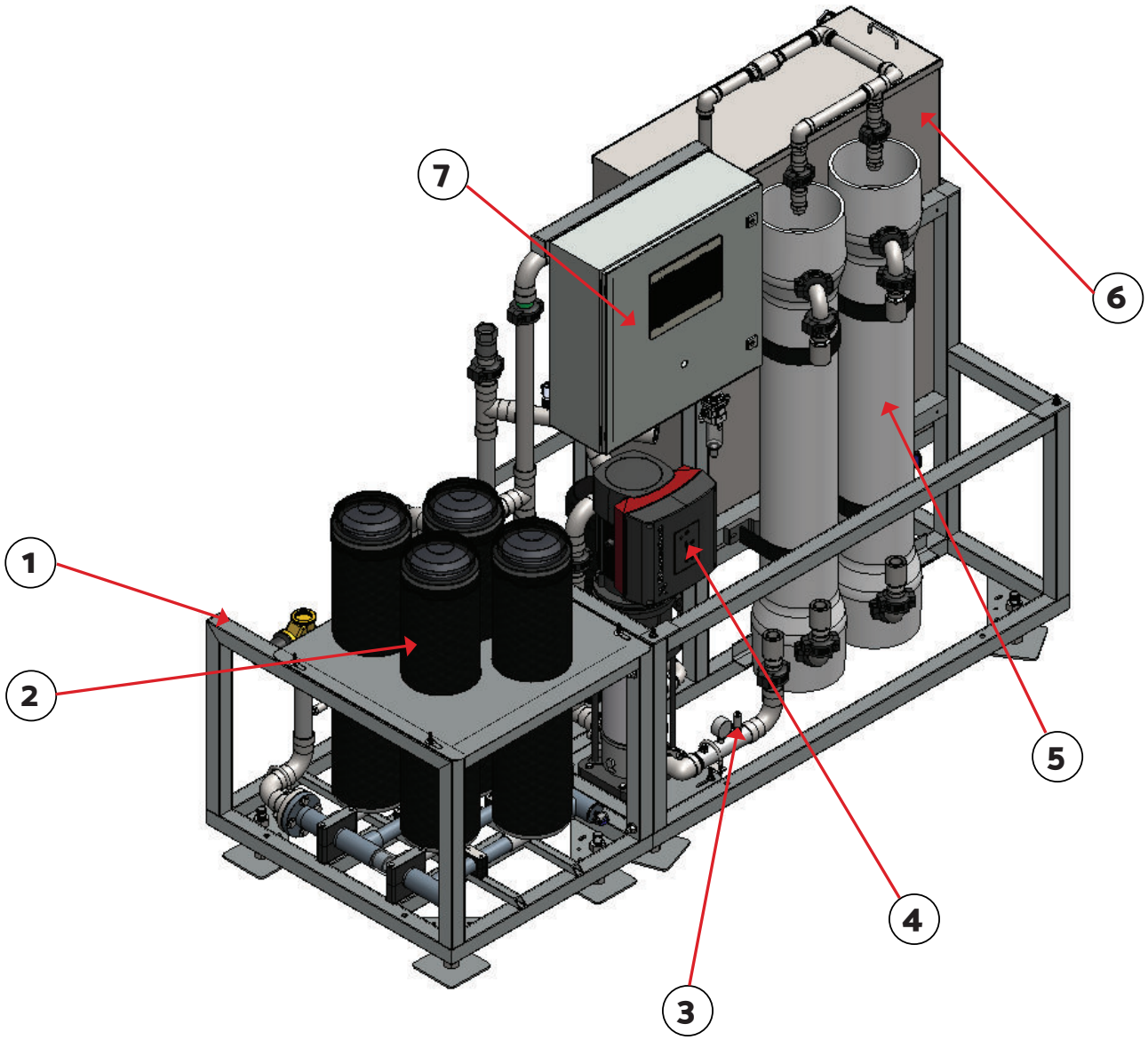


Fig. 2.1 - 2a *- RO System identification*

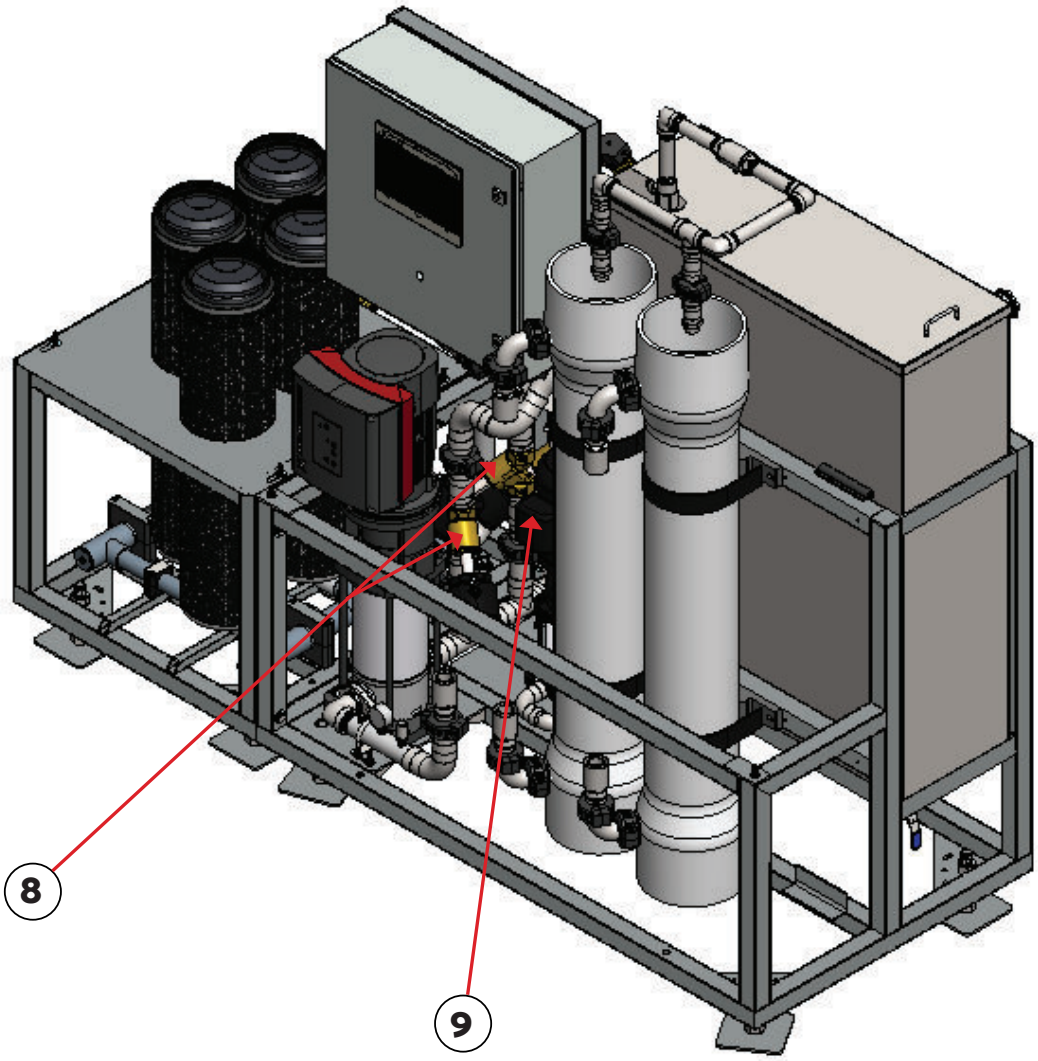


Fig. 2.1 - 2b *- RO System identification*

Table 2.1 - 1 *- RO System component features and functions*

#	Component	Features/Functions
1	Stainless Steel Frame	- Stainless steel construction maximizes durability and equipment longevity
2	Carbon Blocks	- Removes chlorine and chloramines from municipal water, which are the leading causes of premature fouling of membranes - Filters are designed to be serviced from the top, making them quick and easy to replace
3	Process Sensors	- A variety of sensors including flow switches, pressure transducers, and pressure switches are used within the 'Flow on Demand' algorithm to provide seamless operation and maximum process feedback
4	Production Pump	- A reliable 7.5HP Grundfos VFD pump allows the system to produce 'Flow On Demand' by varying pump speeds to match wash demand
5	Membranes	- Large capacity 8" membranes provide a larger filtration surface area than traditional 4" membranes and a reliable supply of permeate water across a range of feedwater temperatures - Simple series flow path allows for rapid troubleshooting
6	Buffer tank	- 100 gallon on-skid tank with pressure transducer for tank level indication - Eliminates the need for additional external storage
7	Electrical Enclosure	- Includes PLC, HMI, and mechanical disconnects from main power supply - Converts 480VAC 3PH power to 24 VDC power for the HMI, PLC, and air solenoids - Built-in HMI provides feedback on system operation - Allows for rapid troubleshooting and fine-tuning of system performance - PLC controller utilizes 'Flow on Demand' algorithm to match permeate production to the demand in the car wash
8	Process Valves	- Reliable angle valves for process automation
9	Transfer (Re-Pressurization Pump)	- Included on the system skid - Pulls RO water from the storage tank and delivers RO flow to the wash - Activated based on a request signal from the tunnel controller.

2.2 System Specifications

Table 2.2 - 1 - *RO System specifications*

	Standard Flow	High Flow
Production (GPD)*	25,920	37,440
Membranes (Qty)	2	3
Permeate Flow*	18 GPM	26 GPM
Reject Flow*	12	18
Production Pump Size	7.5HP	
Transfer (Re-Pressurization) Pump Size	1.5HP	
Inlet Size	1.5” FNPT	
Permeate Outlet	1.0” FNPT	
Reject Outlet	1.5” FNPT	
Water Temperature	40°F - 80°F	
Water Supply	30GPM @ 40-60PSI	45GPM @ 40-60PSI
Air Supply (Clean, Dry Air)	3 SCFM @ 80-100PSI	
Voltage**	480 VAC/3PH 24 VDC	
Max Current	20 A	
Dimensions	92” w x 70” h x 36.5” d	92” w x 70” h x 45” d

* *Production rates based upon the supply of 77F softened water*

** 480 VAC 3PH power with ground from the facility. Review the electrical schematic for required current ratings and integration of the system controller. The primary RO Production Pump is 7.5 HP, and the Transfer (Re-Pressurization) Pump is 1.5 HP. RO Power requirement is 20A, 3 Phase 480VAC fed by a trip class 10 or higher. Wiring and conduits as allowed by local code and NEC-70.

NOTE

Failure to properly pre-treat the water may result in reduced membrane life and premature membrane failure and is not covered under the limited warranty.

Table 2.2 - 2 - *Feed water limits and recommended pre-treatment approach*

Specification	Limit	Recommended Pre-Treatment
Water Hardness	< 1 grain	Ion-exchange Water Softener
Iron (Fe)	< 0.5 mg/L	Iron Filter
Iron Ferrite	0.05 mg/L	Iron Filter
Free Chlorine (Cl2)	< 0.1 mg/l 0.1 PPM	Activated Carbon
Turbidity (dirt) - (NTU)	< 0.2 NTU	Ultrafiltration (UF)/Microfiltration (MF)/Multimedia Filtration (MMF)
Manganese (Mn)	< 0.05 mg/L	Ion-exchange Water Softener
Hydrogen Sulfide (H2S)	> 0.0 mg.L	Oxidation, Aeration
Organics	> 0.0 mg/l	Activated Carbon
Total Dissolved Solids	1,000 mg/l (max)	Feed water must be below 1000 mg/l

3. Installation

Installation of the RO System must conform to local plumbing, electrical, and sanitation codes. The customer is responsible for obtaining all permits and ensuring the following conform to all state and local codes before installing the RO System.

3.1 Installation Preparation

- Locate where the equipment will be installed with your installer. The RO System should be located 4-6 inches from the back wall.
- Use 200 psi hose (Eaton BOSFLEX or equivalent) and heavy-duty stainless steel hose clamps on every connection to ensure reliable operation.
- Lines should be positioned to minimize bends and lines from tanks should hang in a manner to minimize loading on the stainless fittings. The municipal water line and the line out to the wash should be roughly 3 feet from the floor. The Reject line should be roughly 6 feet from the floor.
- If needed, install additional clamps or hose supports to RO frame to reduce movement of hoses during operation.
- All water drains and overflow lines must drain to the floor drain. The RO System plumbing is constructed to allow a visual indication of water flowing to the drain to help diagnose proper system operation. The RO tank has a 2 inch female overflow plug.

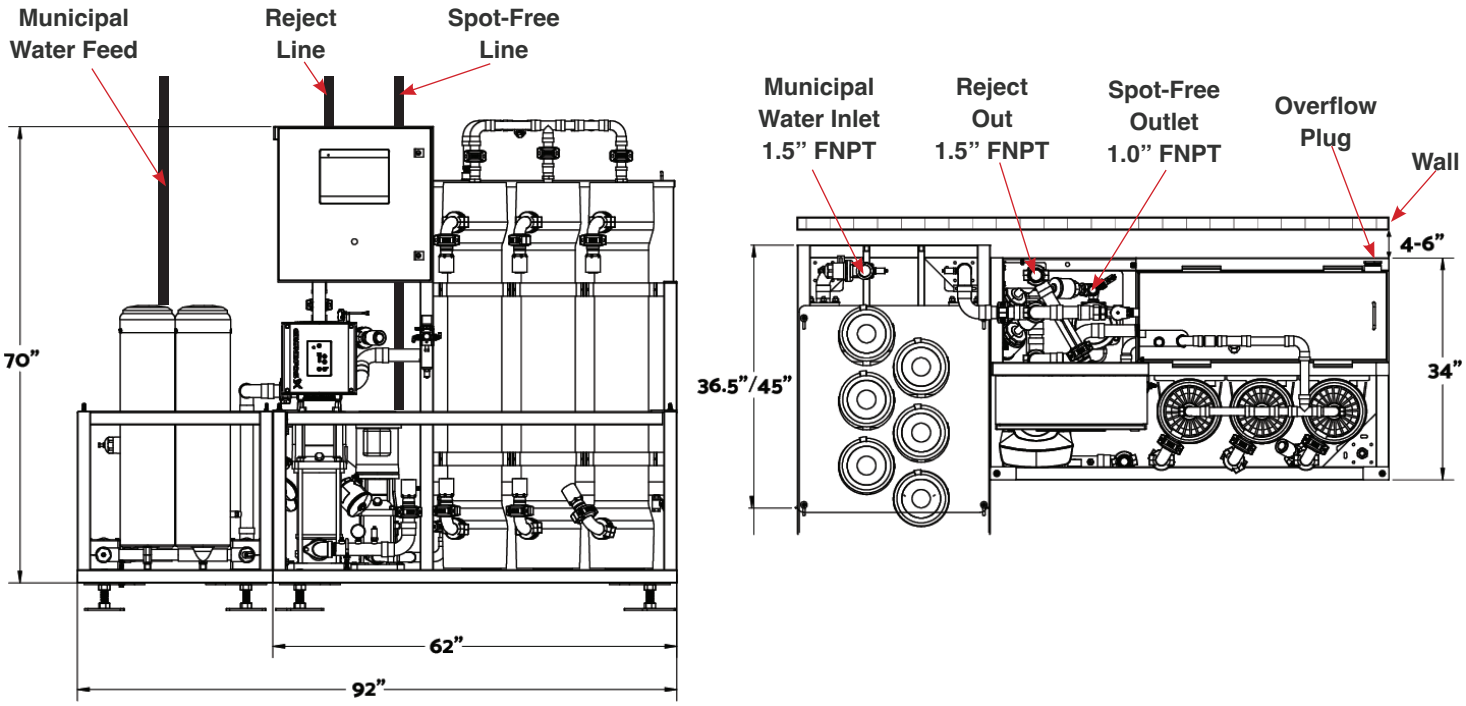


Fig. 3.1 - 1 - *RO System dimensions and connection locations (Standard Flow/High Flow)*

3.2 Mechanical Installation

⚠ WARNING!

Do not attempt to remove the carbon filter cover if the pressure in the housing is not zero. If the cap is removed while the unit is pressurized, the cap could cause serious injury or death.

3.2.1 Installing Carbon Block Skid

The carbon block skid is shipped separate from the main RO skid. Perform the following steps for locating and interfacing the carbon block skid to the main RO skid.

1. Line up the carbon block skid to the left of the main RO skid and use the leveling feet to ensure both the frames are level and at the same height.
2. Loosen the groove coupling.
3. Slide the carbon block groove nipple to the groove coupling and tighten back up (Fig. 3.2.1 - 1)
4. Bolt the carbon block skid to the RO skid using (4) 4-inch bolts.
5. Route the two cables with DIN connectors, located at the electrical enclosure and labeled “In” and “Out” to the inlet and outlet pressure transducers on the carbon block skid.

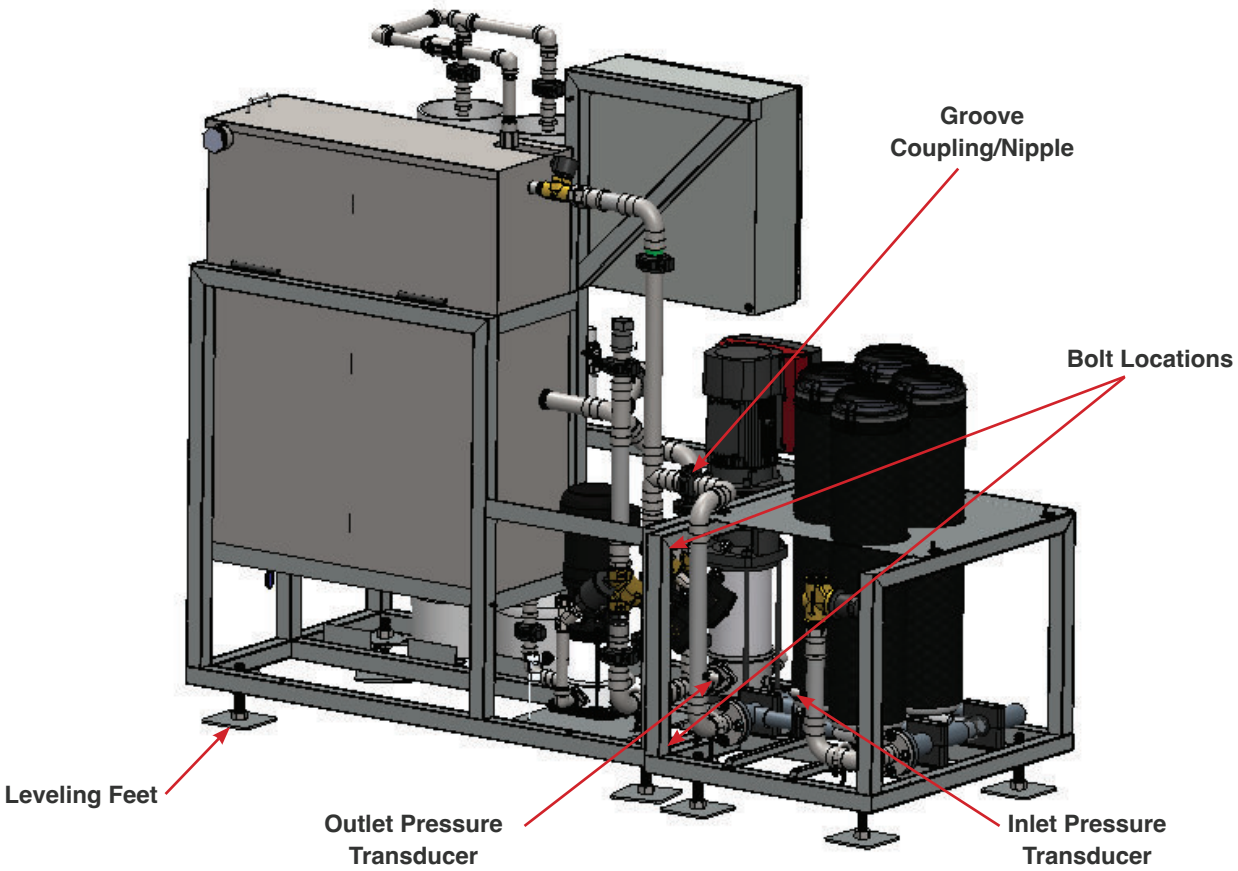


Fig. 3.2.1 - 1 - *Carbon Block skid installation*

3.2.2 Installing Air Supply

1. Install an air supply to the ¼” push connector air regulator. Verify air supply can supply 3CFM at 80-100 psi, and adjust the air regulator to 80-100 psi (Fig. 3.2.2 - 1).

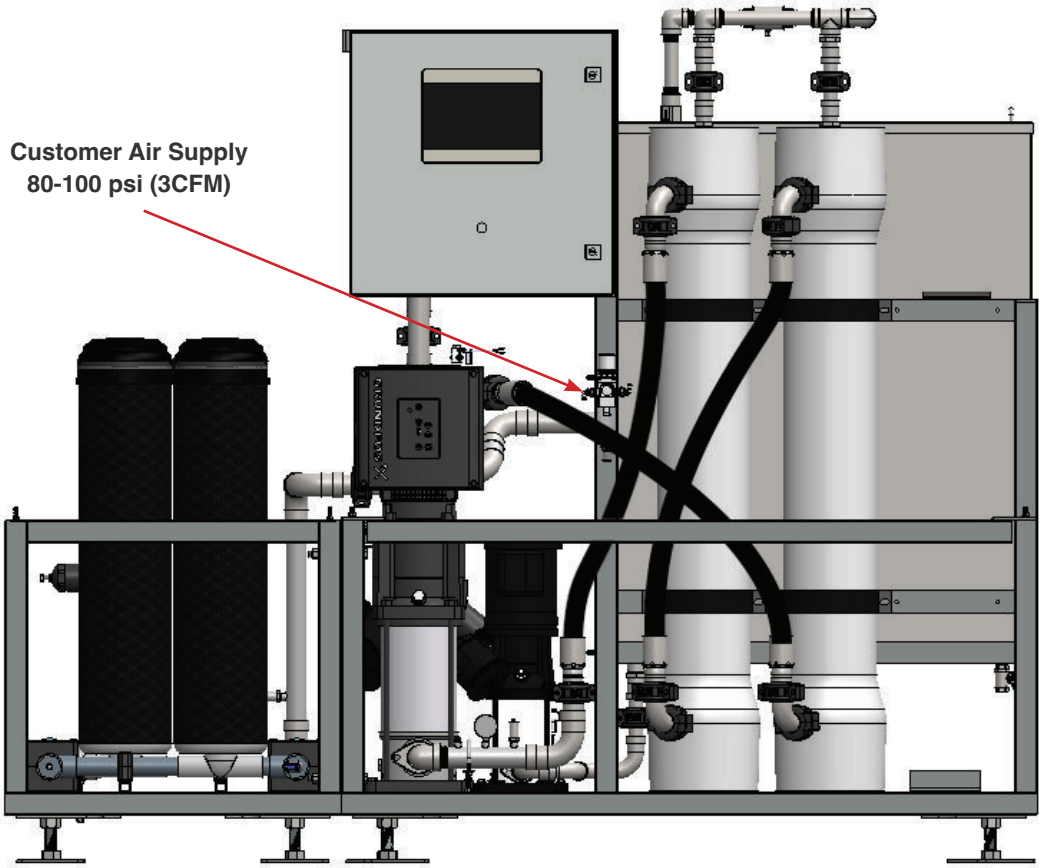


Fig. 3.2.2- 1 - *Air regulator supply line connection*

3.2.3 Installing Water Lines

1. Connect a 1.5” MNPT hose to the municipal water inlet (Fig. 3.2.3 - 1). Verify municipal water can supply 40GPM @ 40-60 psi (see Table 2.2 - 1).
2. Connect a 1.5” MNPT hose to the Reject Outlet (Fig. 3.2.3 - 1). Reject water should be plumbed to either a reject tank, high-pressure pump stand, or drain.
3. Connect a 1” MNPT hose to the Spot-Free Outlet (Fig. 3.2.3 - 1). The Spot-Free Outlet can be plumbed directly to a single applicator in the wash or to a solenoid bank that supplies spot-free water to multiple applicators.
4. (Optional) Connect a 2” MNPT hose to the Drain Port (Fig. 3.2.3 - 1).

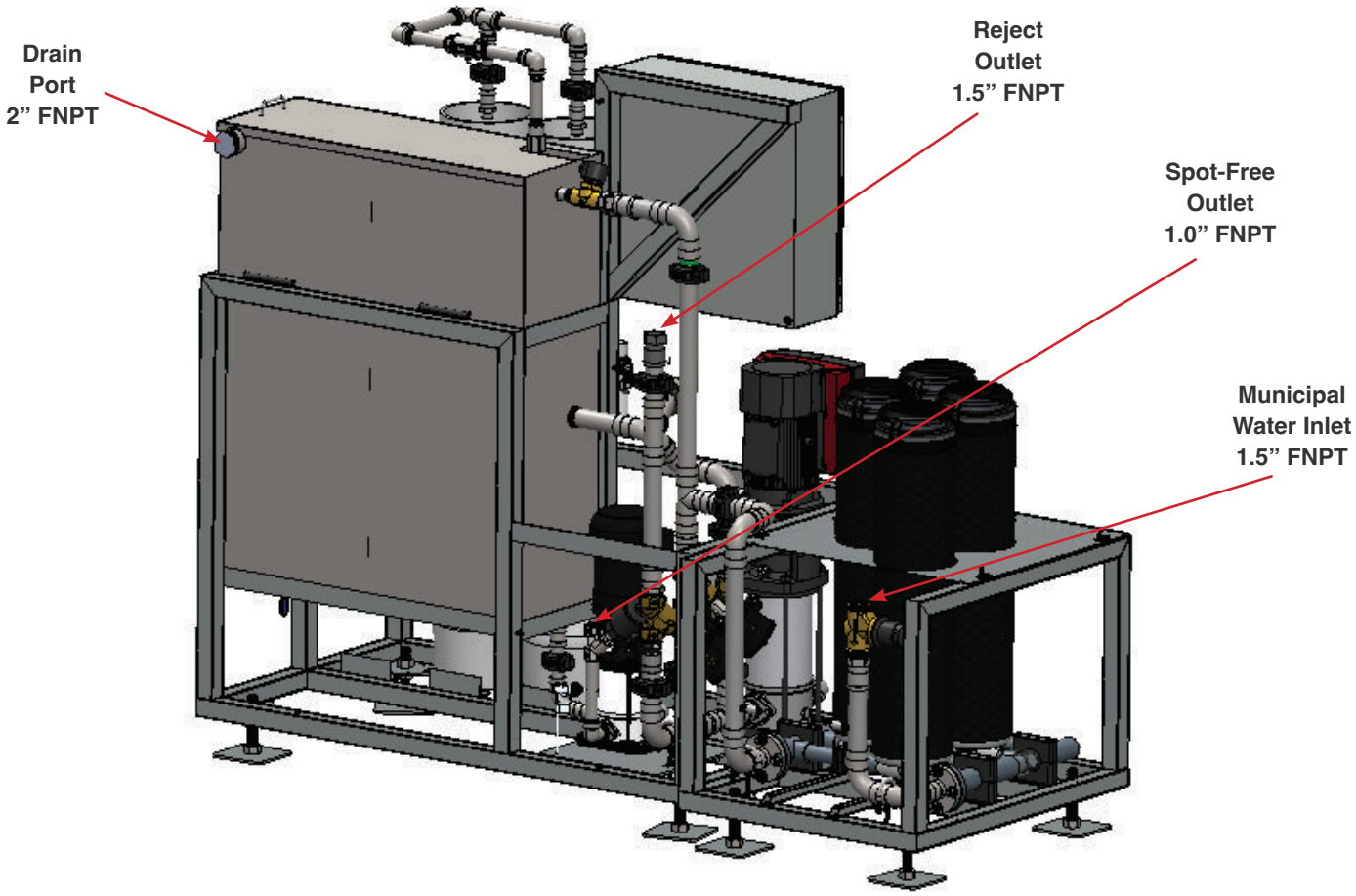


Fig. 3.2.3 - 1 - *Water line connections*

3.3 Electrical Installation

⚠ WARNING!

Electrical installation to be performed by a qualified electrician.
Follow all local codes.

The electrical schematics and connection points in the controller are designated in **Appendix 2**. The Main Control Disconnect (**DS1**) is used to disconnect all power to the unit. All penetrations should be made through the bottom of the enclosure.

NOTE

Each electrical enclosure has a serial number located inside the controller on the lower left side of the enclosure door. This number should be referenced when requesting support on the RO System, as this number links to both the controller software and hardware.

⚠ WARNING!

The Main Disconnect power must be turned off at the disconnect switch on the front of the enclosure before opening the RO System controller for maintenance.

1. Locate customer network interface (Fig. 3.3 - 1) and connect RJ-45 network cable. This will provide innovateIT Car Wash equipment with VPN remote access to the system.

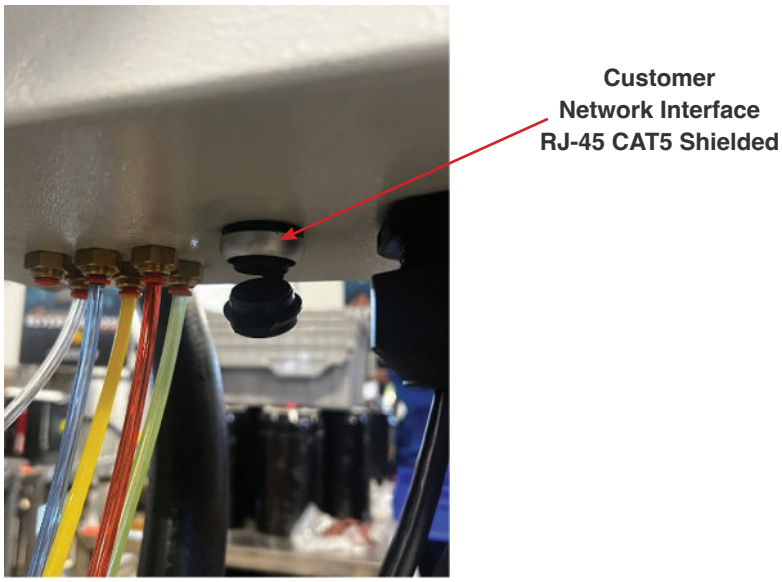


Fig. 3.3 - 1 - *Customer network interface location*

2. Connect wires from the tunnel controller to command the RO unit to supply water to terminals 1003A and 1003C (Fig. 3.3 - 2).

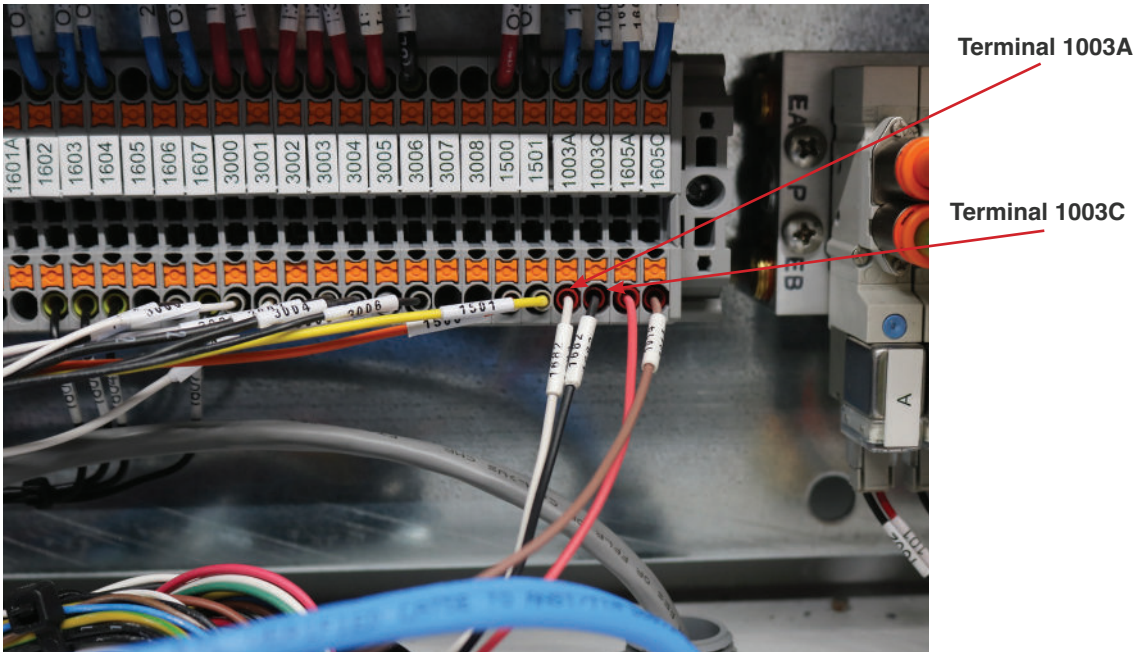


Fig. 3.3 - 2 - *Location for terminals 1003A and 1003C*

3. Land 1003A on the common terminal of a relay. Land 1003C on the normally open terminal relay in the tunnel controller. (Fig. 3.3 - 3).

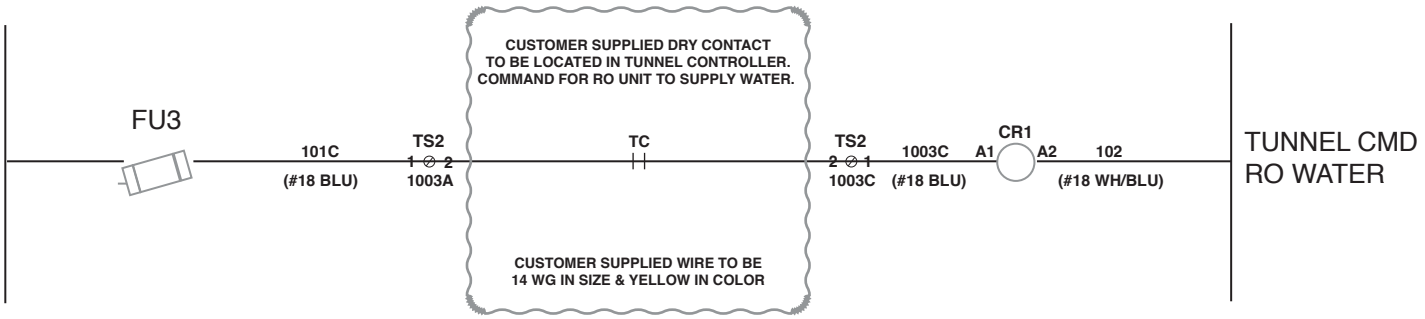


Fig. 3.3 - 3 - *Wiring schematic for terminals 1003A and 1003C*

4. Locate power supply knockout location (lower left). Drill and install a cable gland for 480VAC 3PH power supply.
5. Run customer supplied power (480VAC/3PH) to DS1 according to the system schematic (Fig. 3.3 - 5).

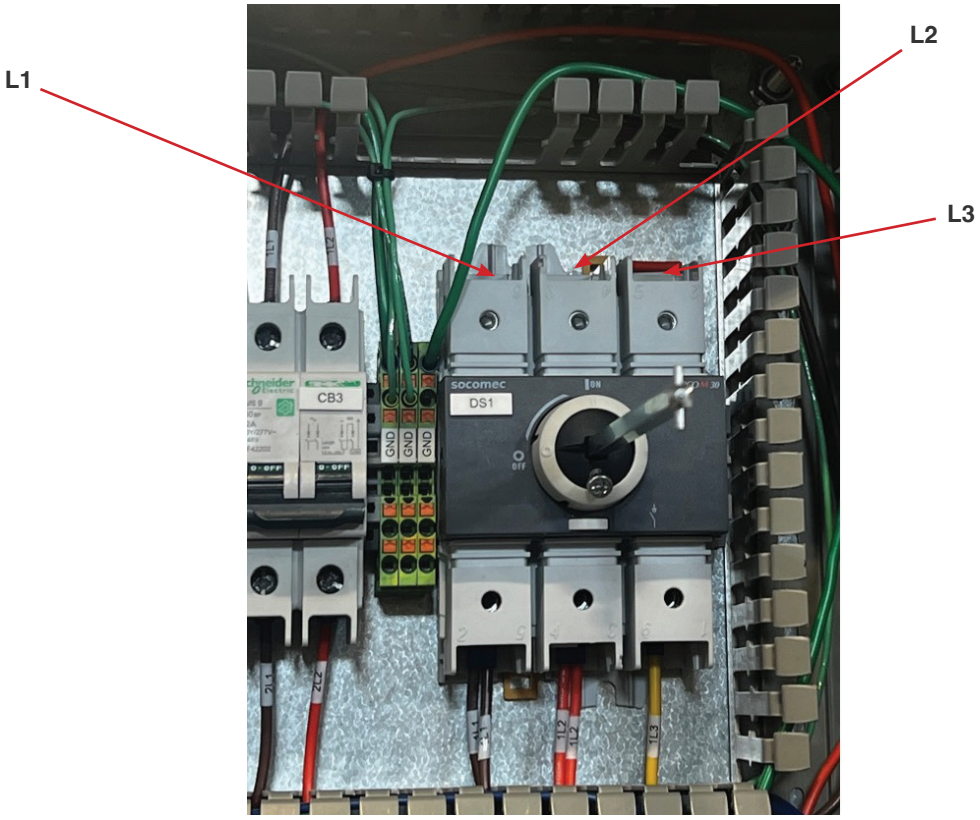


Fig. 3.3 - 5 - *Customer 480VAC/3PH connection*

6. Check the direction of rotation of the **Transfer Pump** motor by bump starting the MS1 contact (Fig. 3.3 - 6). The correct direction of rotation is indicated by the arrows on the motor fan cover (Fig. 3.3 - 7). The pump should rotate counter-clockwise when viewed from the motor end. **This needs to be done by the electrician prior to completing electrical installation.**

Fig. 3.3 - 6 - *MS1 contact location*

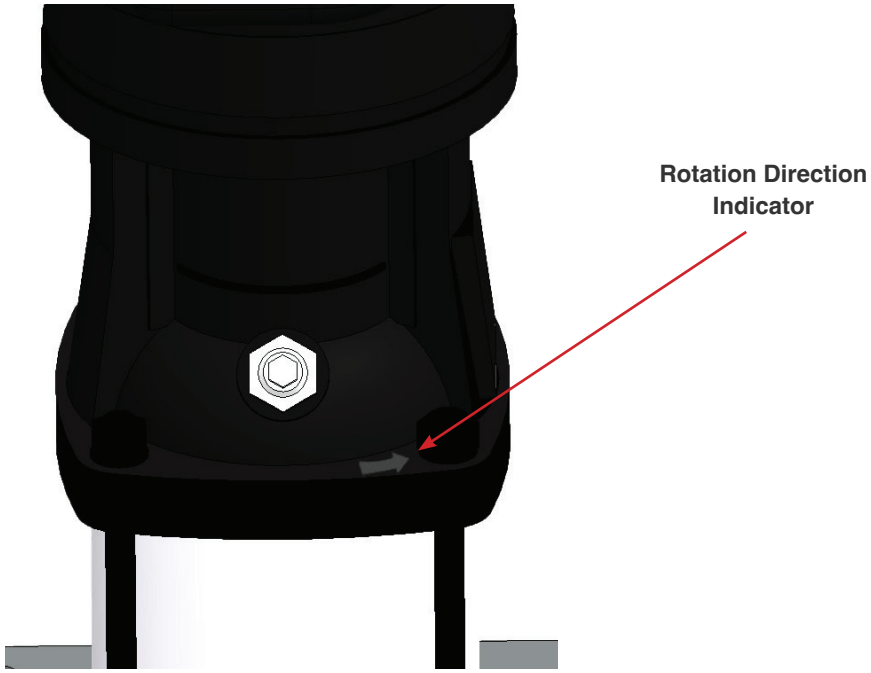


Fig. 3.3 - 7 - *Arrow indicating direction of rotation on the Transfer Pump casing*

7. If the pump fan rotates clockwise, stop the pump, turn off the **Main Disconnect** and the utility supply power, and interchange any two of the incoming 480VAC/3PH supply wires.

4. Startup & Operation

NOTE

Ensure all steps and precautions in Section 3 have been completed before starting up the RO System.

Verify phase rotation from utility power supply to the RO System.
This is critical for pump rotation to operate correctly.

Going to **START** mode (which starts the RO pump) before purging air from the pump can result in a compromised pump shaft seal or, if left long term, may require the pump to be replaced.

4.1.1 Turning On Air & Power Supply

NOTE

Confirm the proper supply voltage on all three phases using a multi-meter.

1. Verify all drain ports are closed (membrane housing, carbon manifold, and RO tank). The ball valves are perpendicular to the unit when closed, and inline when open. See Appendix 1 for drain valve locations.
2. Turn on air supply to the RO System and set the air regulator to **80 psi.**
3. Turn on the utility power from the wash to the RO System.
4. Open electrical enclosure and turn on all breakers. Ensure all 4 thermal fuses are pressed in.
5. Turn **480VAC Main Disconnect** switch on the front of the electrical enclosure to the **ON** position.
6. Wait for the HMI Overview Screen to appear. Verify the HMI screen is the same as the one in **fig. 5 - 2**. If not, please contact **support@innovateITcarwash.com** for more information.
7. Confirm positions of **Process Valves**.

4.1.2 Turning On Water Supply & Purging Carbon Blocks

1. Partially open your municipal water supply line ball valve to allow water to flow into the system.
2. Verify the pressure at the **Inlet** and **Outlet** of the carbon filter on the HMI (see Fig. 4.1.3 - 1).
3. Press down the red air valve on top of each of the carbon filter housing covers to bleed air out of the system. Release the air valve when water stream is emitted from the red valves. This process may take **10-15 MINUTES** or more but it is a **critical step** to protect the system during initial start-up or after any maintenance during which air could enter any part of the system. (do not pull or remove yellow tag)
4. Press down the red air valve on top of each of the carbon filter housing covers to bleed air out of the system. Release the air valve when water stream is emitted from the red valves. This process may take **10-15 MINUTES** or more but it is a **critical step** to protect the system during initial start-up or after any maintenance during which air could enter any part of the system. (do not pull or remove yellow tag).

4.1.3 Purging The Production & Transfer Pumps

NOTE

You may hear a loud noise as the membranes pressurize and the top and bottom ports seat themselves.

1. On the **OVERVIEW** screen of the HMI, press the **STOP** button followed by the **MANUAL** button to put the system into **MANUAL** mode.
2. Navigate to the **AIR VALVE TESTING PAGE** (see Fig. 4.1.3 - 1) by pressing the square in the upper right corner of the HMI.

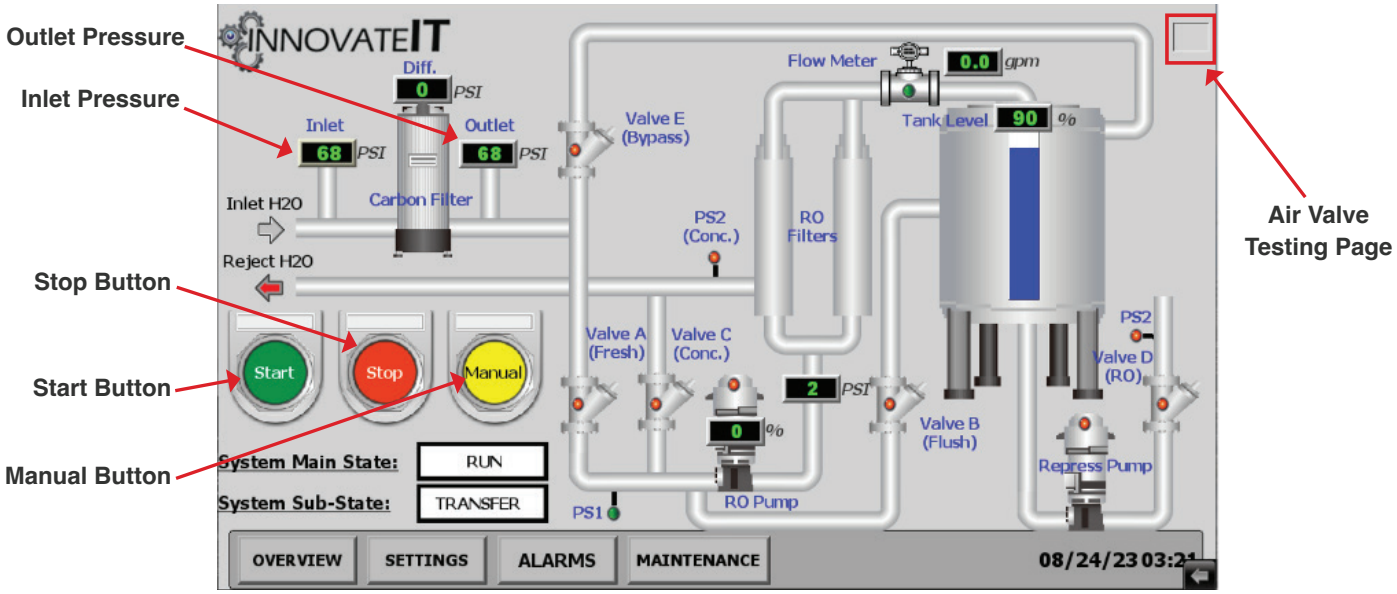


Fig. 4.1.3 - 1 - *HMI Overview Screen and Air Valve Testing Page location*

3. Open Valve A and Valve C to allow water to flow to the Production Pump and through the membranes (Fig. 4.1.3 - 2)
   - Valve A needs to remain open while priming the Production Pump. This allows water to start filling the RO storage tank and for municipal water to saturate the membranes.
4. Once water can be seen flowing into the tank from the membranes, fully open your municipal water supply line ball valve.
5. Loosen the Production Pump priming vent plug with a 10mm wrench until there is a constant stream of water, then tighten the vent plug to close (Fig. 4.1.3 - 3).

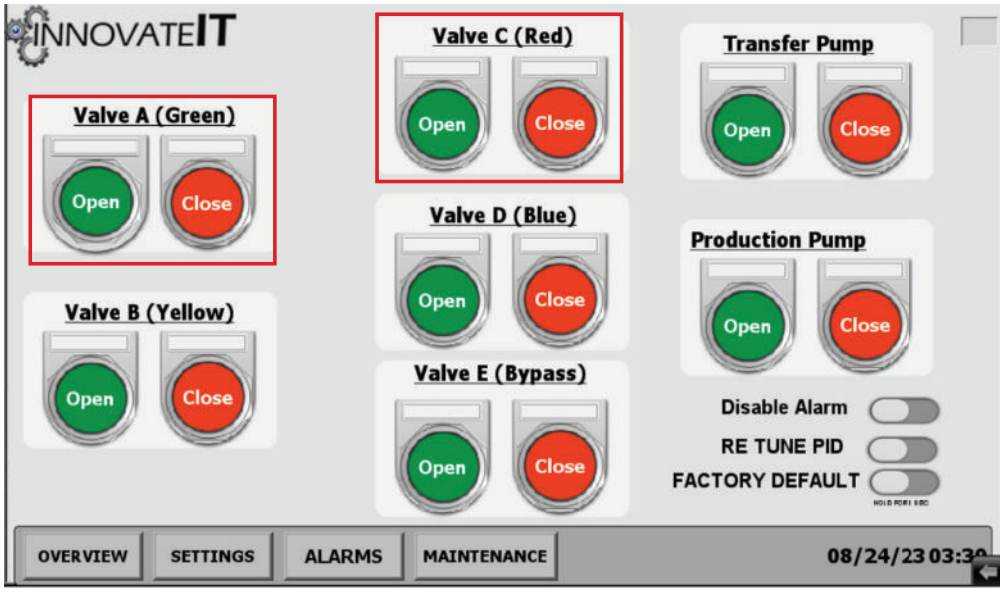


Fig. 4.1.3 - 2 - *Air Valve Testing Page*

6. Once the tank level is about 25% filled (visually check), close Valves A and C.
7. Loosen the Transfer (Re-Pressurization) Pump priming vent plug with a 10mm wrench until there is constant stream of water, then tighten the vent plug to close (Fig. 4.1.3 - 2).

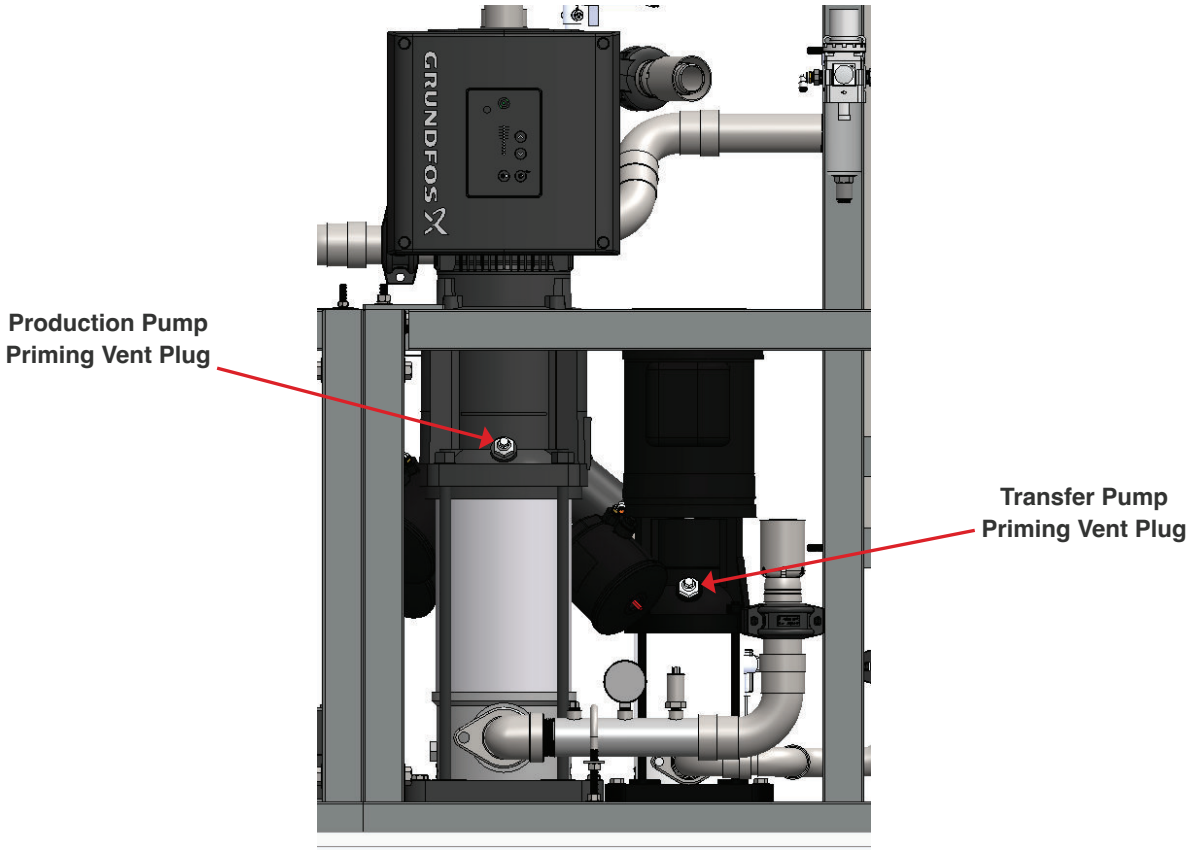


Fig. 4.1.3 - 3 *- Production and Transfer Pump priming vent plug location*

4.1.4 Filling The Tank

1. Return to the **OVERVIEW** screen and ensure the system is in **MANUAL** mode.
2. Navigate to the **MAINTENANCE** screen.
3. Press the **START** on the **TANK FILL** (Fig. 4.1.4 - 1).
    - Running the **TANK FILL** will open the bypass valve and fill the tank with concentrate water (not permeate).
4. Once the tank reaches the desired fill level (just below the overflow plug) , press **SET** on the **TANK SPAN**.

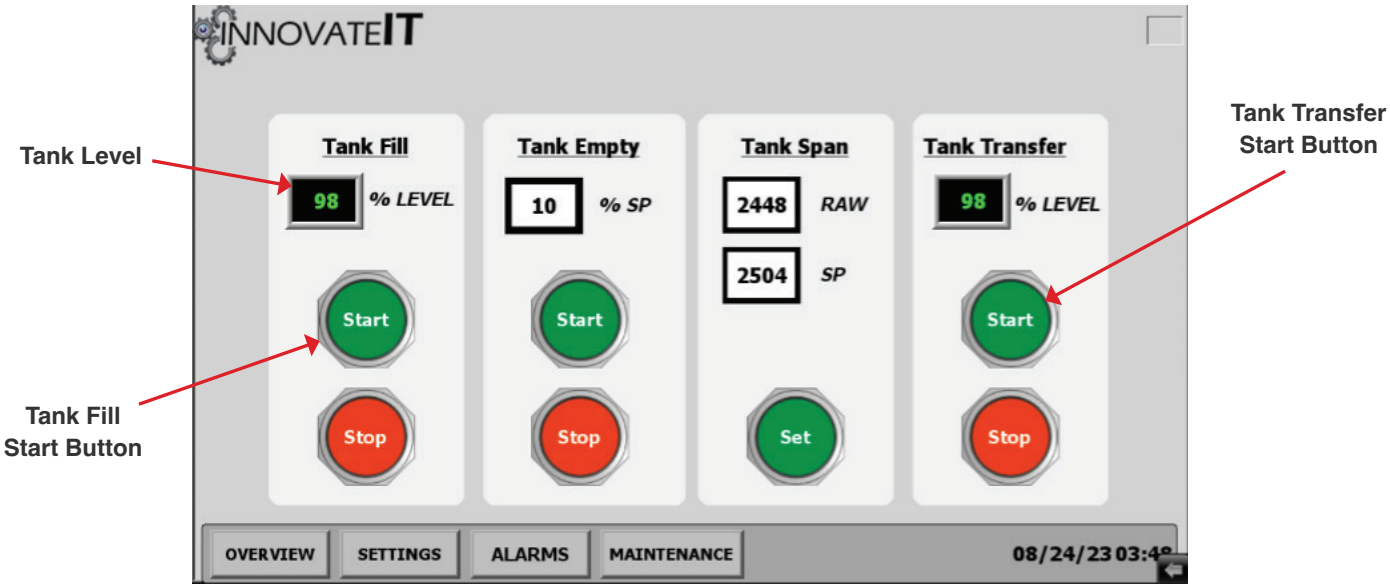


Fig. 4.1.4 - 1 - HMI Maintenance Screen and Tank Fill

4.1.5 Tank Transfer & Secondary Pump Purging

1. Return to the **MAINTENANCE** screen.
2. Ensure your RO applicator solenoids are open and water can flow freely to the wash.
3. Once the solenoids are open, press **START** on the **TANK TRANSFER** (Fig. 4.1.4 - 1).
4. After starting the **TANK TRANSFER**, prime the Transfer Pump again by following the instructions in **step 7 of Section 4.1.3**.
5. Allow the tank to drain to roughly 60% before pressing **STOP** on the **TANK TRANSFER** to remove any residual air.
6. Return to the **OVERVIEW** screen and press the **START** button (Fig. 4.1.5 - 1). If the system registers an alarm during this process, press the **STOP** button. Navigate to the **ALARMS** page and press **RESET**. Return to the **OVERVIEW** screen and press the **START** button again. This may occur a couple of times during startup as all the air is purged from the system.

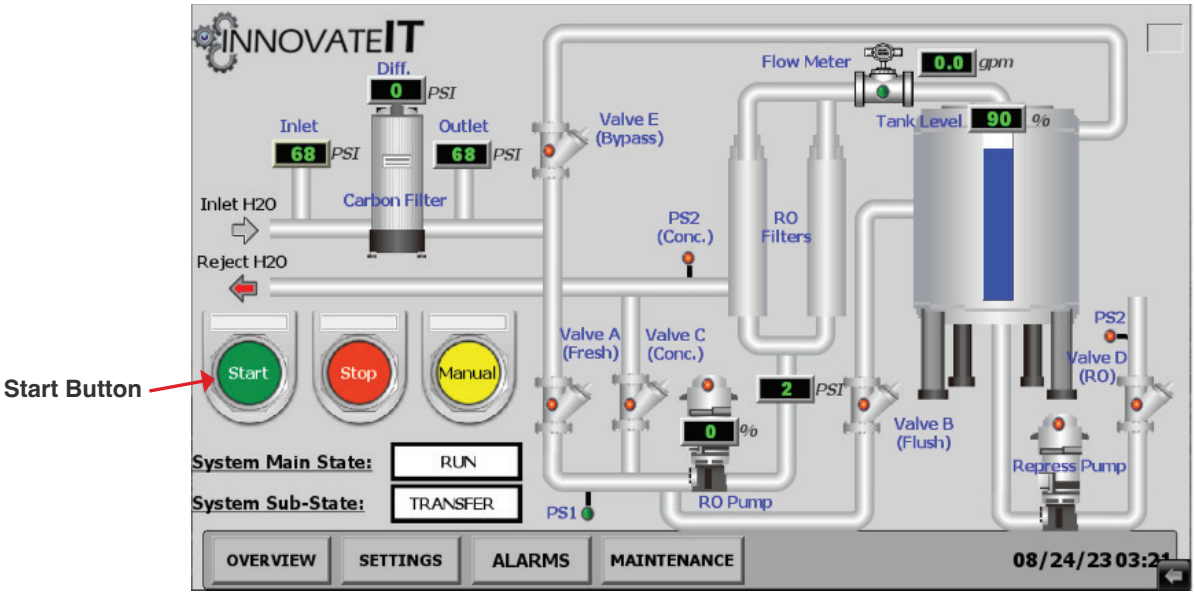


Fig. 4.1.5 - 1 - *Starting the system from the HMI Overview screen*

7. The system will now initialize. You will be able to see the differential pressure across the filters, pump performance, and the current GPM flow rate of the system.
8. With the system running, purge the Production Pump by following the instructions in step 5 of Section 4.1.3. This will remove any excess air stuck in the impellers.
9. Verify the Production Pump shuts down once the RO tank is full, and the system goes into **FLUSH** mode after 15min of inactivity.

The initial RO water produced will need to be dumped down the drain. During the first 2 hours of RO production the water is high concentrate. The initial TDS from the unit will be high (**50-150 PPM**) because of manufacturing chemicals rinsing from the dry membrane.

The TDS will slowly go down as the unit operates, stabilizing in the **1-20 PPM** TDS range (based on the TDS of the feed water) within the first few hours of operation. If the TDS of the RO remains higher than **20 PPM** a seal in the RO housing may be damaged. In this case, the operator will need to identify the damaged seal ring and replace it.

With new membranes, normal TDS will remain below **10 TDS**.

4.2 System Operation

NORMAL OPERATING CONDITIONS

The system has two normal operating conditions: **Run/Production** and **Flush**.

- **Run/Production** - When the tank drops below 75%, the pump will ramp up speed to meet the targeted flow rate until the tank reaches 95%
- **Flush** - Occurs after 15 minutes of inactivity. The flush replaces high TDS concentrate water that is surrounding the membranes with low TDS permeate water.

ABNORMAL OPERATING CONDITIONS

The system's only abnormal operating condition is when it enters into a Bypass.

- Bypass - Occurs when the demand from the car wash exceeds the production capacity of the system and the tank level falls below 25%. The system will open the bypass valve and fill the tank with municipal water until it reaches 35%.
- The TDS of the water in the tank will be high momentarily due to the feed of high concentrate water.

5. Service & Maintenance

The best method to maintain this system is to take a few minutes daily to review and record the operational data from the system and examine the unit for leaks or any indication of a mechanical or electrical fault.

If a change in performance or operation is observed, it is essential to take corrective action quickly to minimize the potential damage to the membranes or other parts of the system.

There are elements of the system that will require normal maintenance actions. These items are listed in the following section.

5.1 Service Schedule

Table 5.1 - 1 - *Service schedule*

Check	Frequency	Process
Free Chlorine Level	1 x week	• While the unit is running, drain out a small amount of sample water from an outgoing ball valve on the carbon filter manifold. (Fig. 5.1 - 1). The ball valve has ¼" push connect built in for ease of use. • If the result is free of chlorine (0.00 PPM or <0.10 PPM) the unit carbon filter is working well. If not, the carbon filter will need to be replaced (see Section 7.2.1).
TDS Level	1 x week	• While the unit is running, drain a small amount of sample water from the port at the bottom of each membrane. • If the TDS levels exceed 20 PPM, membranes should be cleaned or replaced (see Section 7.2.2).
Visual Inspection	Daily	• Check for leaks/dripping water from all system connections, manifolds, and pumps. • Verify there are no bad hoses (bend, kink, bad connections, or rips).
Production Pump/Transfer Pump Motor Inspection	Every 500 hours of operation **or** every 3 months (whichever occurs first)	• Check that the motor is clean. • Check that the interior and exterior of the motor are free of dirt, oil, grease, water, and similar. Oily residue, paper, pulp, textile lint, and similar can accumulate and block the motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.

Check	Frequency	Process
Production/Transfer Pump Inspection	1 x Month	• Check that the pump meets the required performance and is operating smoothly and quietly. • Check that there are no leaks, particularly at the shaft seal • Check that the motor is not overheating. • Remove and clean all strainers or filters in the system. • Check that the tripping function of the motor overload protection works. • Check the operation of all controls. • If the pump is not operated for unusually long periods, maintain the pump in accordance with these instructions. In addition, if the pump is not drained, the pump shaft must be manually rotated or run for short periods of time at monthly intervals.

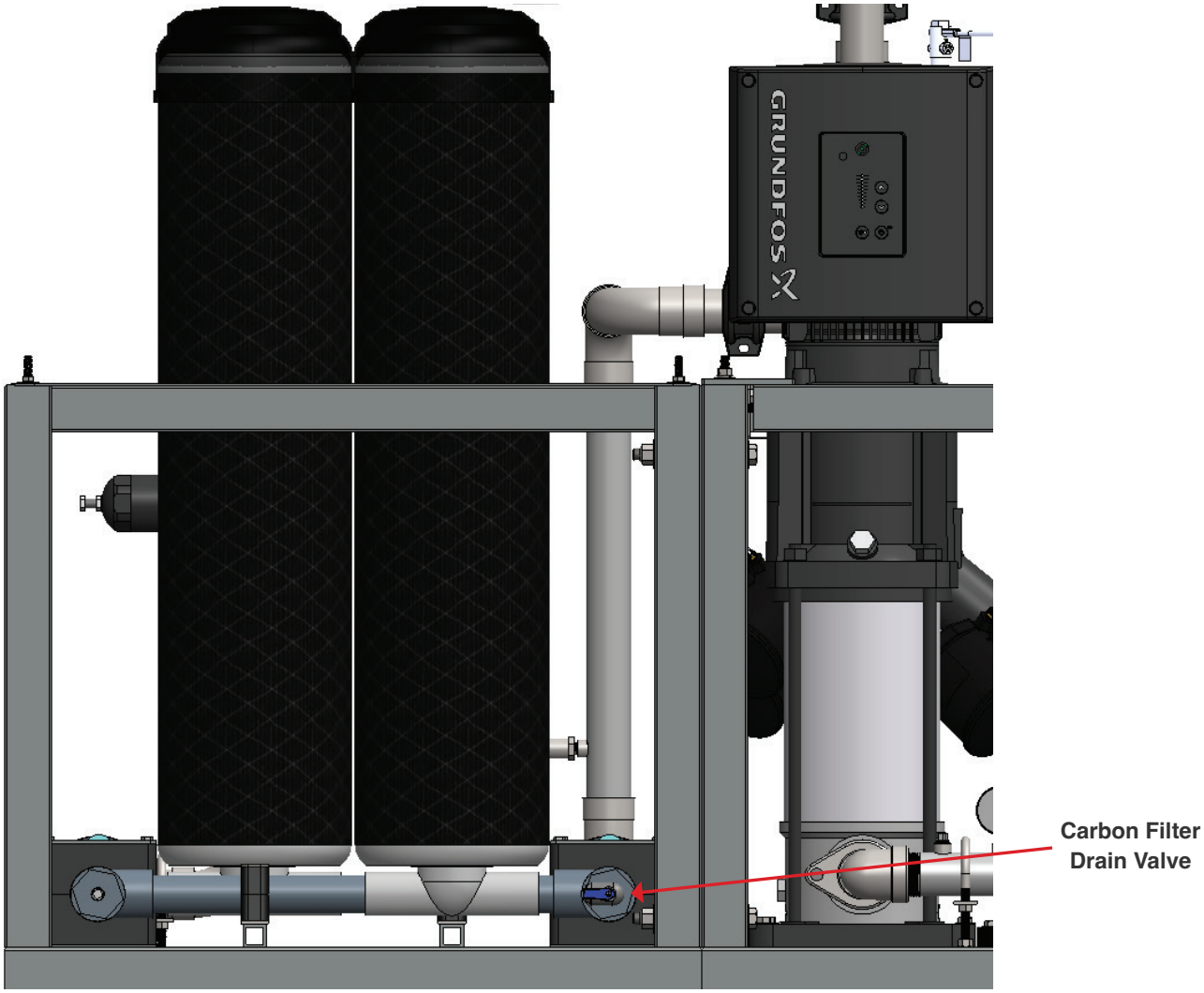


Fig. 5.1 - 1 - *Carbon filter manifold drain valve location*

6. Troubleshooting

For product support, contact support@innovateITcarwash.com, or call (518) 741-4200 (option 2).

HMI Alarm	Problem	Potential Causes	Solution
1	Sensor 01 (Flow Meter) Signal Fault	• Sensor is disconnected	• Verify Flow Meter has power as indicated by the HMI • Check M12 connection
		• Signal received is out of range	• Check wiring
2	Sensor 02 (Tank Level) Signal Fault	• Sensor is broken or disconnected	• Check for water in the plug • Replace sensor
3	Sensor 03 (Production Pump Discharge Pressure) Signal Fault	• Sensor is broken or disconnected	• Check wiring • Replace sensor
4	Sensor 04 (Carbon Filter Inlet) Signal Fault	• Sensor is broken or disconnected	• Check for water in plug • Replace sensor
5	Sensor 05 (Carbon Filter Outlet) Signal Fault	• Sensor is broken or disconnected	• Check for water in plug • Replace sensor
6	Sensor 06 (Temperature) Signal Fault	• Signal received is out of range	• Check wiring or cabling from the Flow Sensor on the top of the RO skid

HMI Alarm	Problem	Potential Causes	Solution
7	Pump Discharge Low Pressure Switch failed to close	• Municipal Water Supply is turned OFF to unit	• Verify municipal water is turned ON
		• Low outlet pressure on the Carbon Block filter during 'Produce RO' sub-state	• Replace filters if outlet pressure is under 5 psi during 'Produce RO' sub-state
		• Valve A is not opening	• Verify the air regulator is set to, and reading, 80 psi • Confirm Valve A solenoid is opening indicated by the red light on the solenoid • Confirm Valve A (ASCO Valve) is opening indicated by red nipple visible on head of valve • Verify there are no leaks in the air line
		• Air supply is OFF or less than 80 psi	• Verify the air regulator is set to, and reading, 80PSI • Verify Valve A is opening • Verify there are no leaks in the air line
		• A failed switch (or corrosion in the connector) can cause a high resistance and cause the system to fault	• Verify sensor cable is installed correctly
8	Pump Discharge VFD Relay	• VFD is faulted	• Consult Grundfos manual for VFD error code • If no code is displayed, check wiring
9	Transfer Pump Motor Starter Overload Relay	• Overload relay is tripped	• Reset overload relay • Confirm dial is set to 3.75 A • Examine motor for shorts
10	Production Pump pressure over limit	• The system is demanding an unachievable flow rate	• Lower the MAX Production Flow Rate on the **SETTINGS** screen
11	Carbon Filter differential pressure is too high	• Carbon filters are clogged	• Replace filters • If the issue persists or filters require constant replacement, a 5-micron pre-filter may be required
12	Bad quality Production Pump feedback signal	• PLC is receiving an invalid input	• Confirm analog output pump settings

HMI Alarm	Problem	Potential Causes	Solution
13	Production Pump not running	• PLC is not receiving a run relay signal from the Production Pump	• Confirm pump relay output settings • Check wiring and relay operation
14	Transfer Pump Flow Switch is open	• No flow or restricted flow on the RO Out line	• Verify there are no restrictions downstream • If feeding a valve bank, verify all downstream valves are timed properly
		• Valve D is not opening	• Verify the air regulator is set to, and reading, 80 psi • Confirm Valve D solenoid is opening indicated by the red light on the solenoid • Confirm Valve D (ASCO Valve) is opening indicated by red nipple visible on head of valve) • Verify there are no leaks in the air line
15	Low pressure during Clean/Flush	• RO membranes are fouled or clogged	• Replace membranes
16	Concentrate Flow Switch failed to close	• Municipal Inlet pressure is too high	• Verify Inlet pressure is <60 psi • May require the addition of a pressure restrictor to the Inlet
		• Switch failed	• Replace flow switch
17	Production tank has overfilled	• Valve A is stuck open	• Confirm operation of Valve A • Verify the air regulator is set to, and reading, 80 psi • Confirm Valve A (ASCO Valve) is opening indicated by red nipple visible on head of valve) • Confirm Valve A solenoid is opening indicated by the red light on the solenoid • Verify there are no leaks in the air line
18	Emergency Stop has been depressed	• Emergency Stop button engaged	• Twist to release Emergency Stop button • Check wiring
19	Production Tank not spanned, default value used	• Production Tank not spanned	• Fill tank to 100% • With tank filled, navigate to the **MAINTENANCE** screen on the HMI and press **SET** under **TANK SPAN**
20	Carbon Filter Inlet and Outlet sensors reversed	• Inlet and outlet sensors have been swapped	• Swap the sensor cables on the carbon block

Spare Parts

7.1 Recommended Spare Parts

Below is a list of recommended spare parts that may require replacement during the course of system operation.

innovateIT Product Number	Description
RO-MBRN-440I	RO Membrane
RO-CBF-CAT-01230065	3 Micron Carbon Filter
RO-HSNG-80S30-1	Membrane Housing
RO-HS-11/2BKFRNTR200RL	Hose Clamps - 1.5” Hose

7.2 Spare Part Replacement

CARBON FILTER (see Fig. 7.2 - 1)

1. Before starting, close the ball valve from your municipal feed water supply line.
2. Turn **480VAC** Main Disconnect switch on the front of the electrical enclosure to the **OFF** position.
3. Verify the feed pressure is 0 psi.
4. Press down the red air valve on the top of the carbon filter housing cover to bleed air out of the system.
5. Carefully remove the snap ring from the cover of the filter housing and remove the cap.
6. Remove the filter using the tabs at the top of the filter.
7. Apply a generous coating of silicone grease to the two o-rings at the bottom of the new filter.
8. Insert the new filter into the housing.
9. Apply a generous coating of silicone grease to the filter cover and reinsert into the housing.
10. Reinstall the snap ring starting with the tail and working around to the peg and ensure it is fully seated.
11. Turn **480VAC Main Disconnect** switch on the front of the electrical enclosure to the **ON** position.
12. Crack open your municipal water supply line ball valve.
13. Slowly open the line to allow water to flow back into the system.
14. Refer to **Section 4 - Startup & Operation** of the RO System manual for instructions on filling and purging the RO System before bringing it back online.

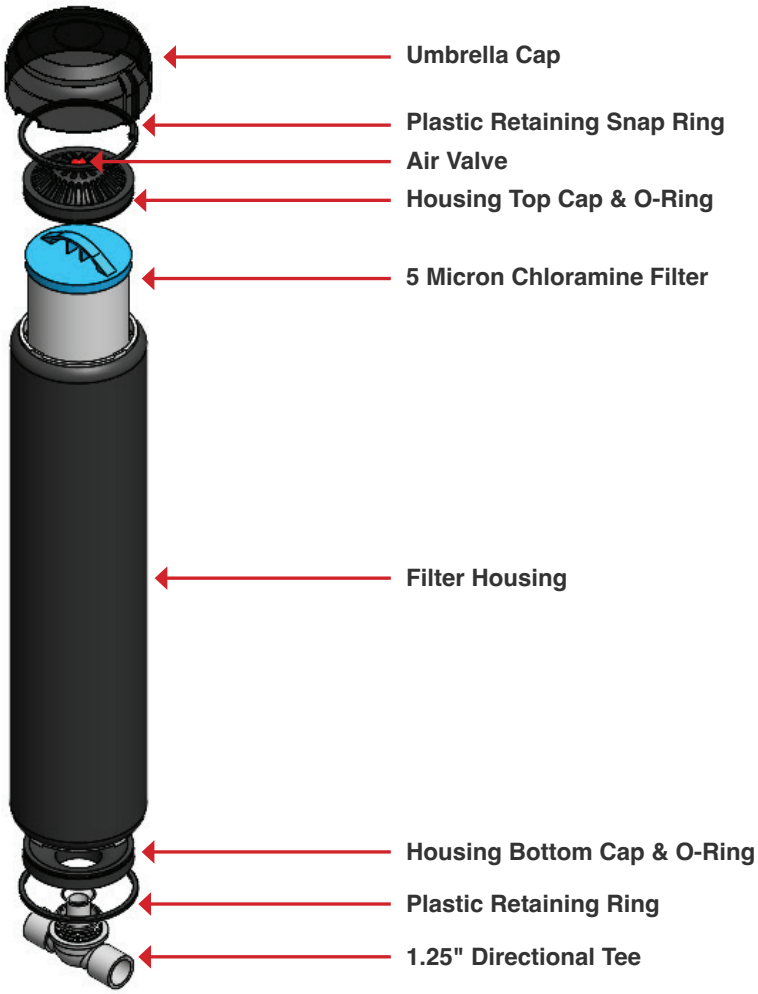


Fig. 7.2 - 1 - *Carbon block components*

RO MEMBRANE (see Fig. 7.2 - 2)

1. Inspect all seals prior to installation and ensure there are no nicks or tears.
2. Turn **480VAC Main Disconnect** switch on the front of the electrical enclosure to the **OFF** position.
3. Verify the feed pressure is 0 psi.
4. Open the lower membrane ball valve to drain the membrane housing.
5. Disconnect the flow switch sensor cable.
6. Remove the split clamps from the top manifold.
7. Remove the top manifold from the top of the membrane.
8. Remove the spiral snap ring.
9. Remove the plumbing from the top of the membrane cap.
10. Rotate the membrane cap counterclockwise and remove it from the top of the membrane.
11. Thread four heavy duty zip ties through the openings and the top of the membrane to create handles.
12. Using the handles, remove the membrane from the housing.
13. Apply a generous coating of silicone grease to the O-ring on the lower cap of the new membrane.
14. Attach the membrane cap to the bottom of the new membrane.
15. The feed water flow runs from the top to the bottom of the membrane housings.

NOTE

The membrane brine seal (black seal at one end of the membrane must be located at the feed port end (top port) to ensure proper flow of feed water through the membrane.

16. Apply a generous coating of silicone grease to the brine seal on the opposite end of the membrane
17. Thread four heavy duty zip ties through the openings to create handles.
18. Using the handles, insert the membrane into the housing from the top opening.

NOTE

Take extra care when lowering the new membrane into the housing. Do not drop it or press down with too great of a force. Ensure O-rings are not damaged during insertion, as this will cause untreated water to leak into the permeate.

19. If the membrane is seated correctly, there should be approximately 9.5” from the top of the membrane to the top of the housing.
20. Install the top membrane cap and ensure is locked into place.
21. Apply a generous coating of silicone grease to the membrane’s top plumbing and attach it to the membrane cap.
22. Reinstall the spiral snap, ring, and ensure it is fully seated.
23. Reattach the top manifold and split clamps.
24. Reconnect the flow switch sensor cable.
25. Close the membrane ball valve.
26. Turn **480VAC Main Disconnec**t switch on the front of the electrical enclosure to the **ON** position.
27. Crack open your municipal water supply line ball valve.
28. Slowly open the line to allow water to flow back into the system.
29. Refer to **Section 4 - Startup & Operation** of the RO System manual for instructions on filling and purging the RO System before bringing it back online.

NOTE

New membranes are installed dry. It will take a few hours of operation for the manufacturing chemicals to flush off the surfaces of the membrane and the RO TDS to drop below 20.

After replacing a membrane, the initial RO production should be dumped to the drain until the TDS of the water is at normal operating levels.

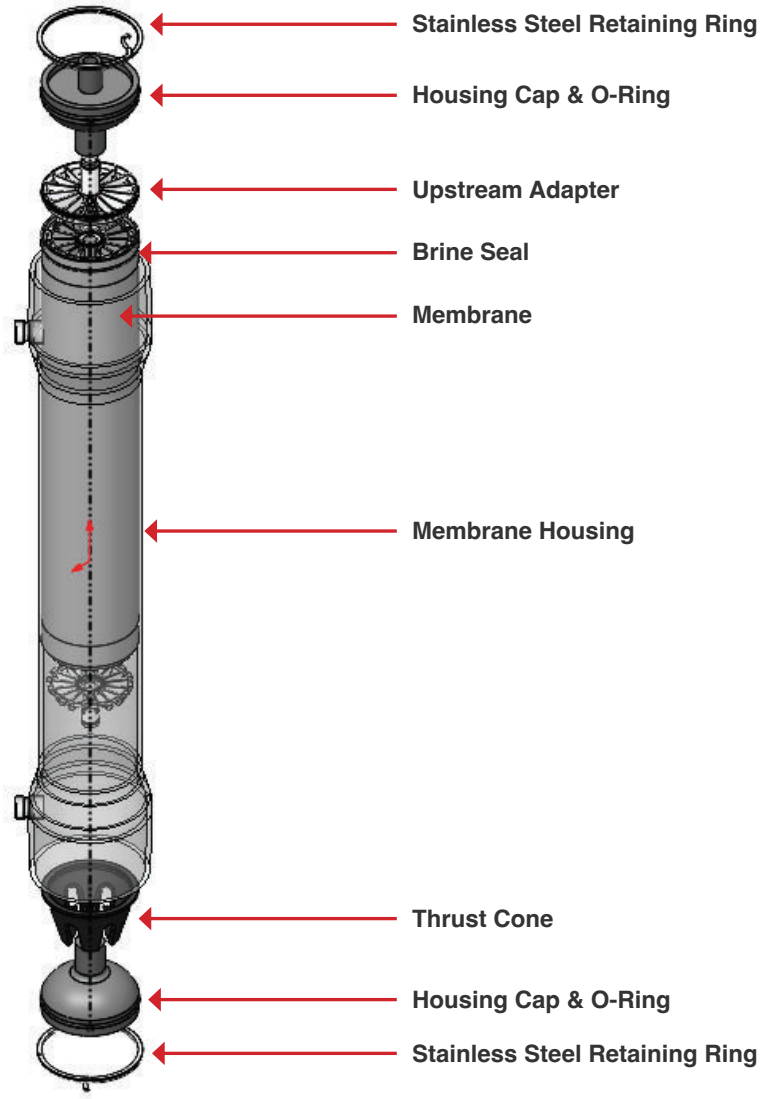
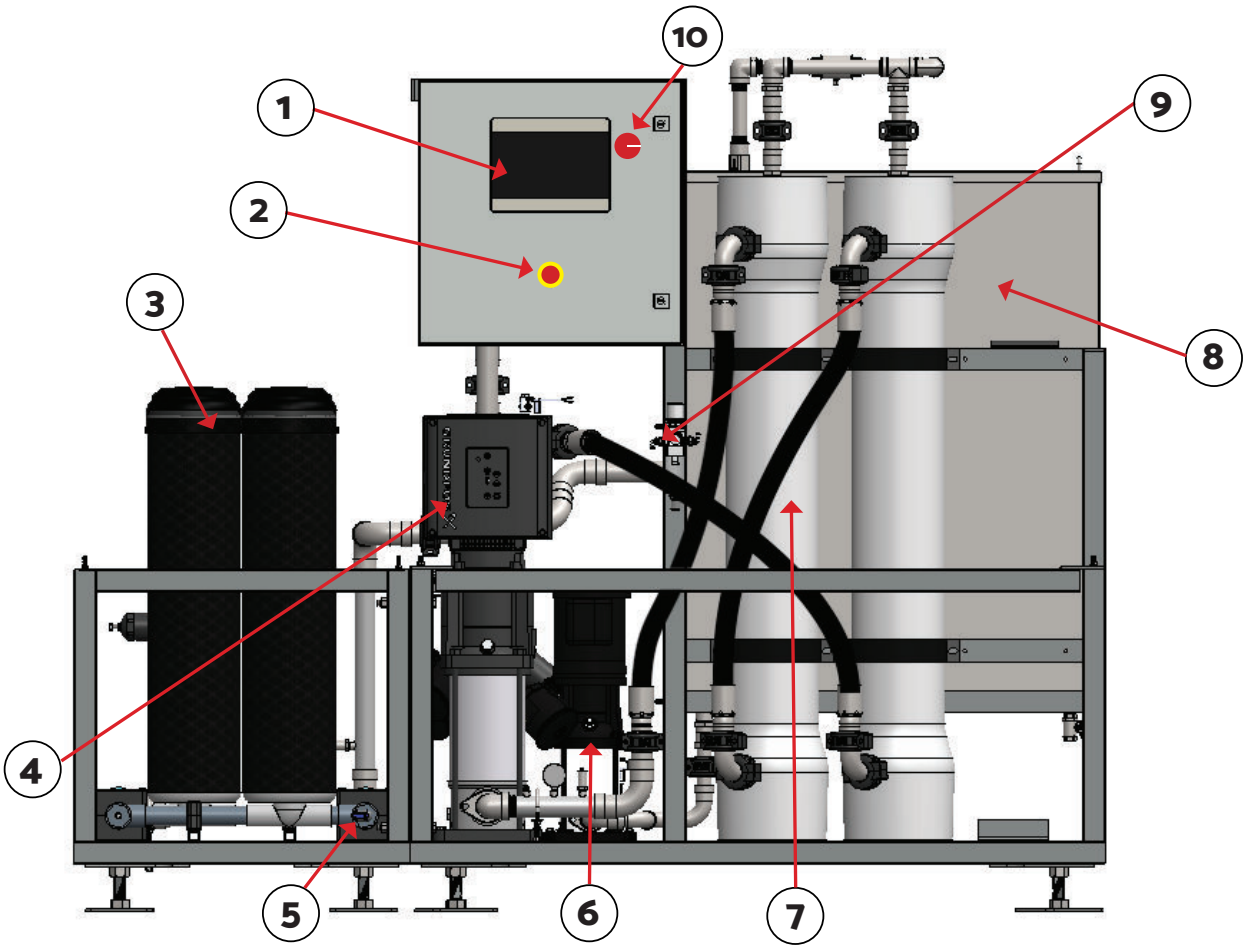
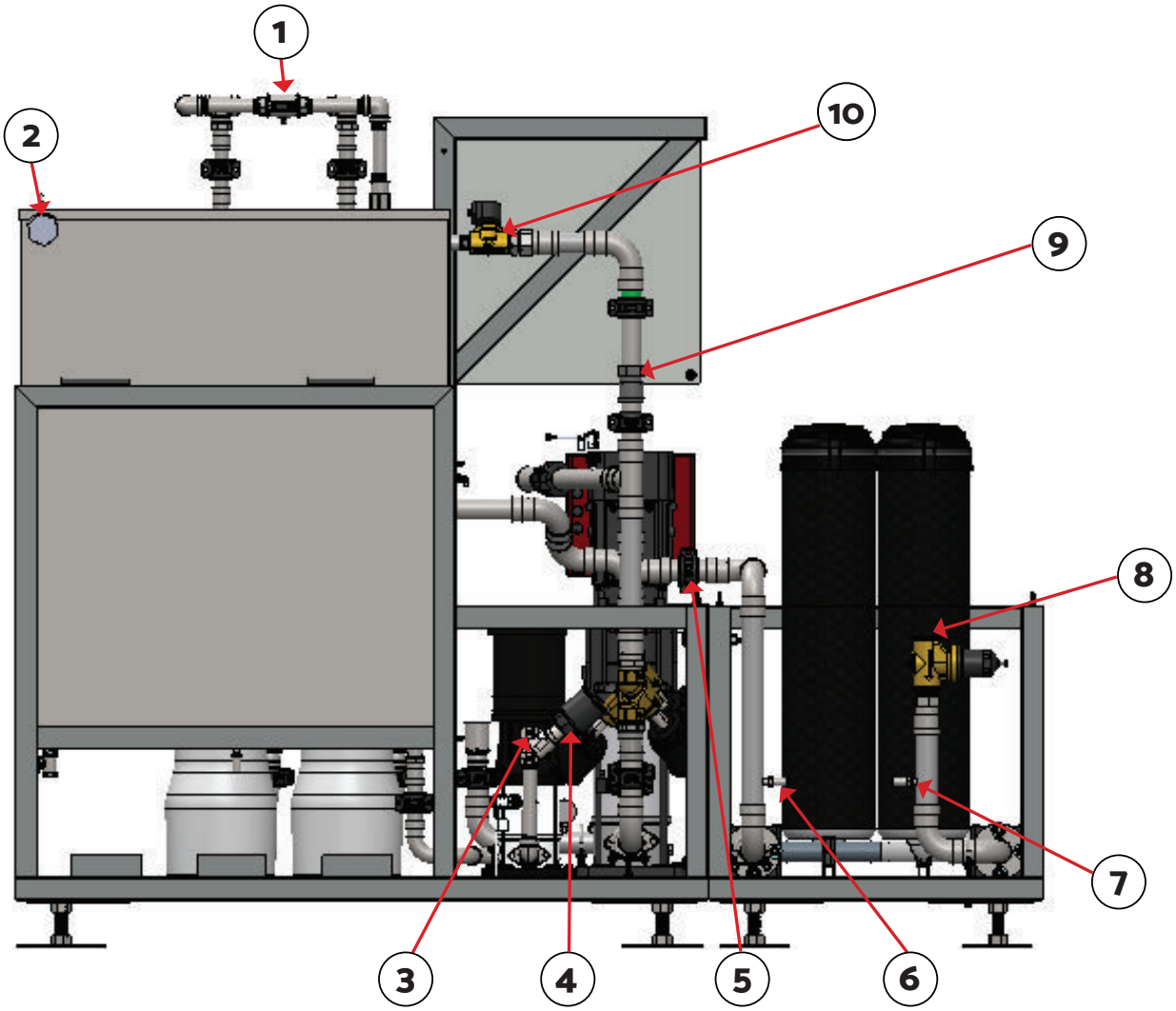


Fig. 7.2 - 2 - *Membrane components*

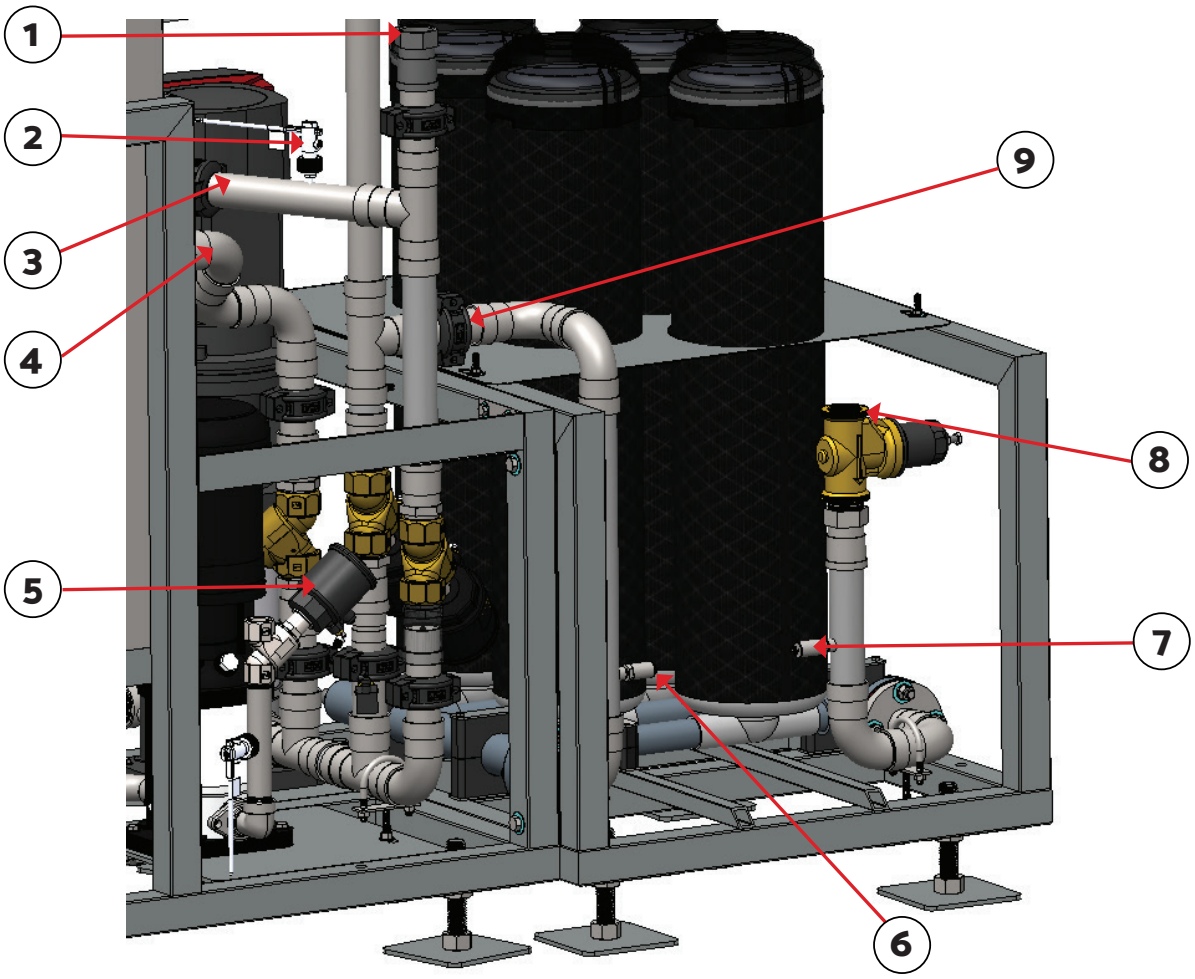
Appendix 1 - System Identification



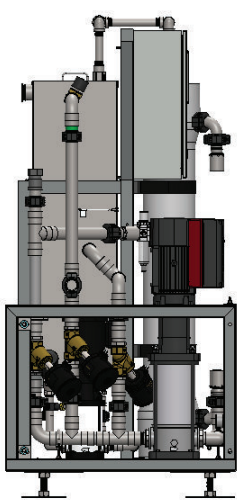
#	Component
1	Human Machine Interface (HMI)
2	Emergency Stop Push Button
3	Carbon Block Filters
4	Production Pump
5	Carbon Filter Drain Valve
6	Transfer (Re-Pressurization) Pump
7	Membranes
8	Storage Tank
9	Air Regulator
10	480VAC Main Disconnect

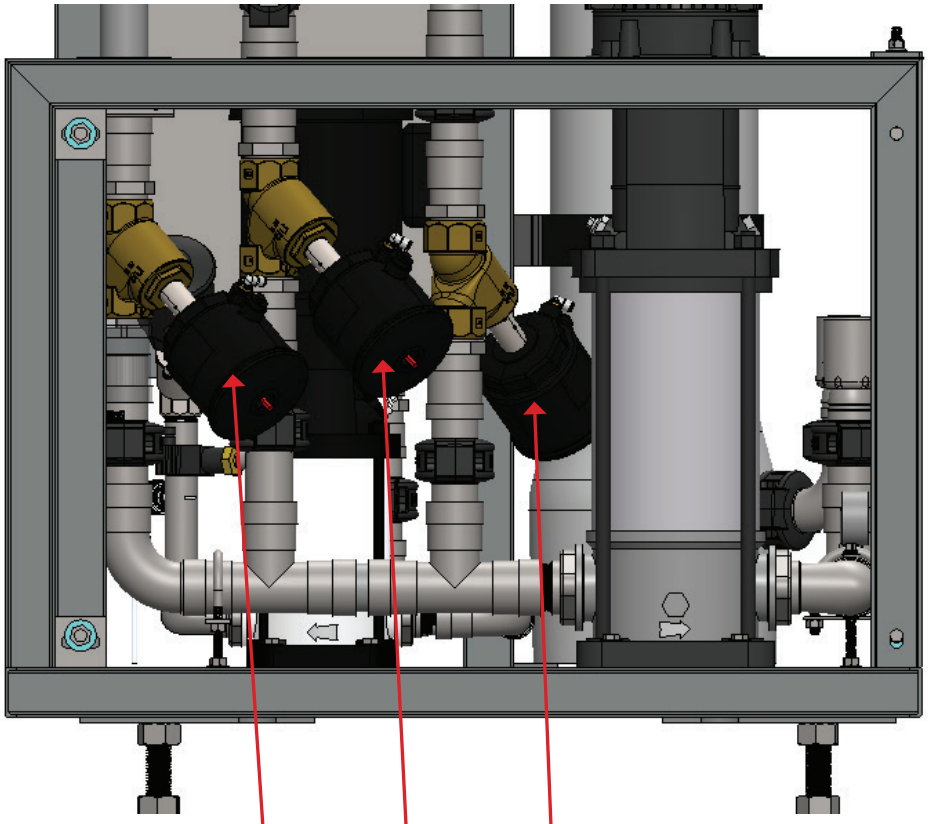


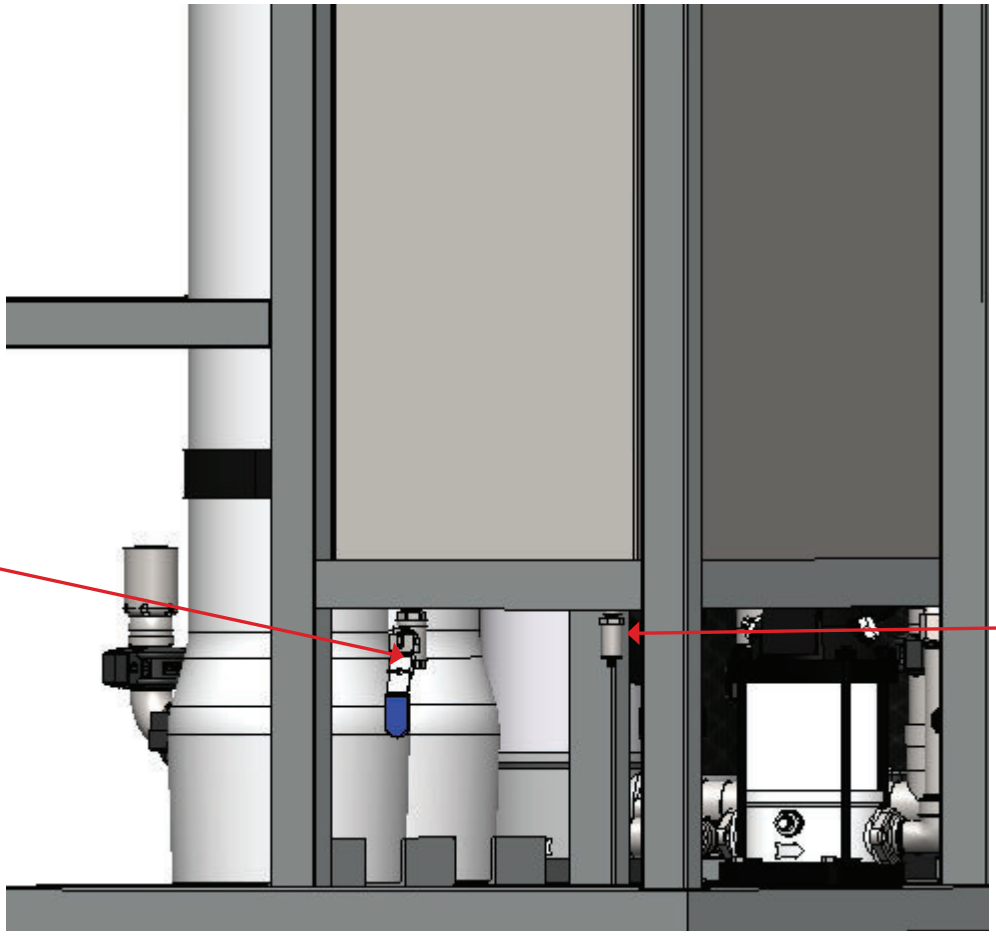
#	Component
1	Flow Meter
2	Overflow Connection
3	Spot-Free Outlet
4	Valve D
5	Groove Coupling/Nipple
6	Carbon Pressure Outlet Transducer
7	Carbon Pressure Inlet Transducer
8	Municipal Water Inlet
9	Reject Outlet
10	Valve E

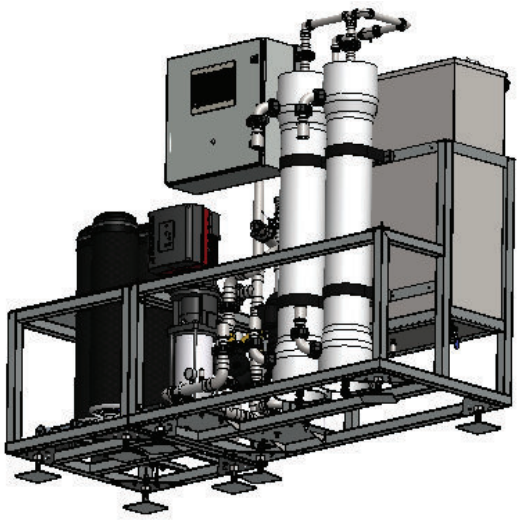


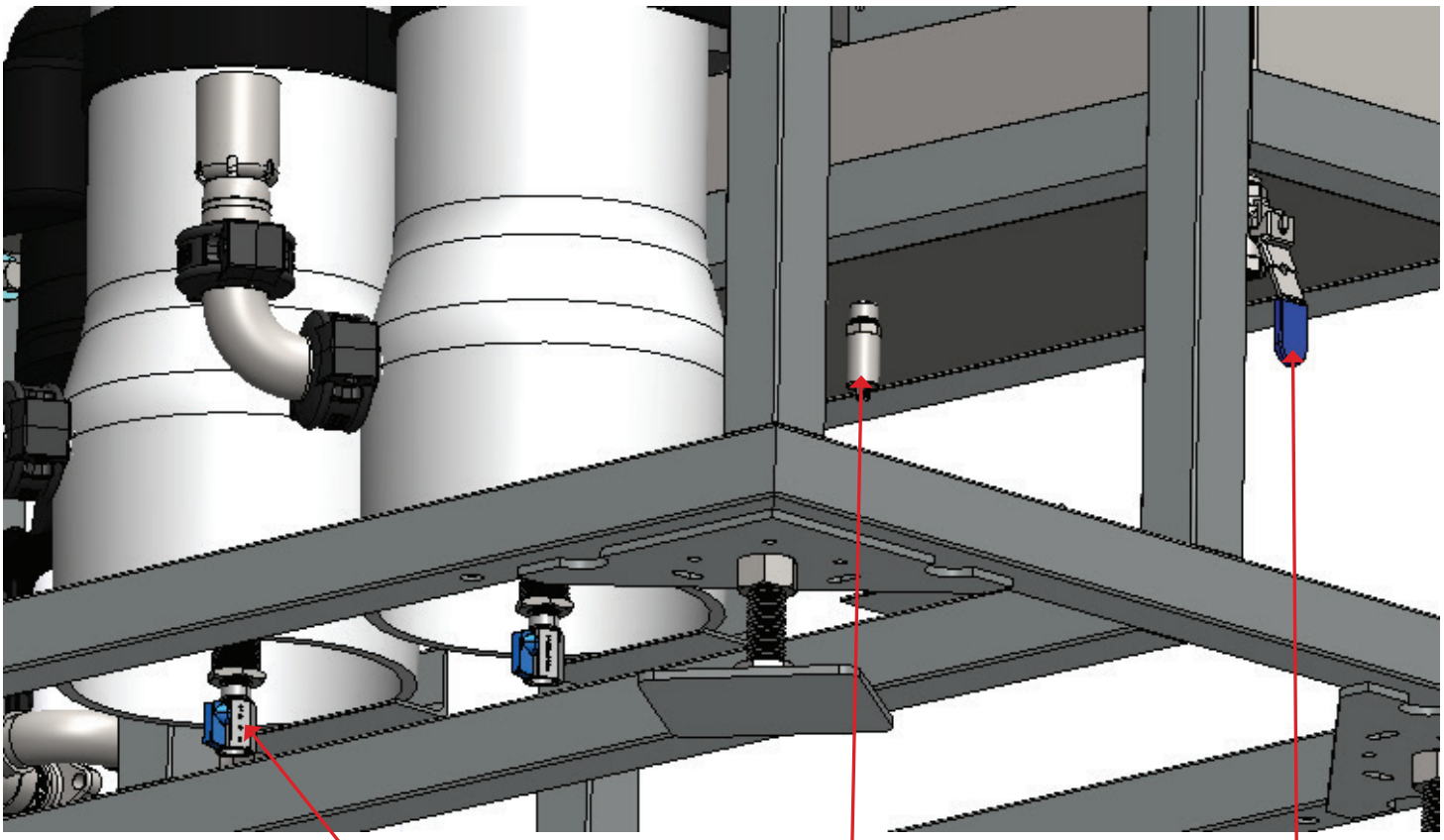
#	Component
1	Reject Outlet
2	Reject Line Flow Switch
3	Reject Line
4	Membrane Flush Line
5	Valve D
6	Carbon Pressure Outlet Transducer
7	Carbon Pressure Inlet Transducer
8	Municipal Water Inlet
9	Groove Coupling/Nipple

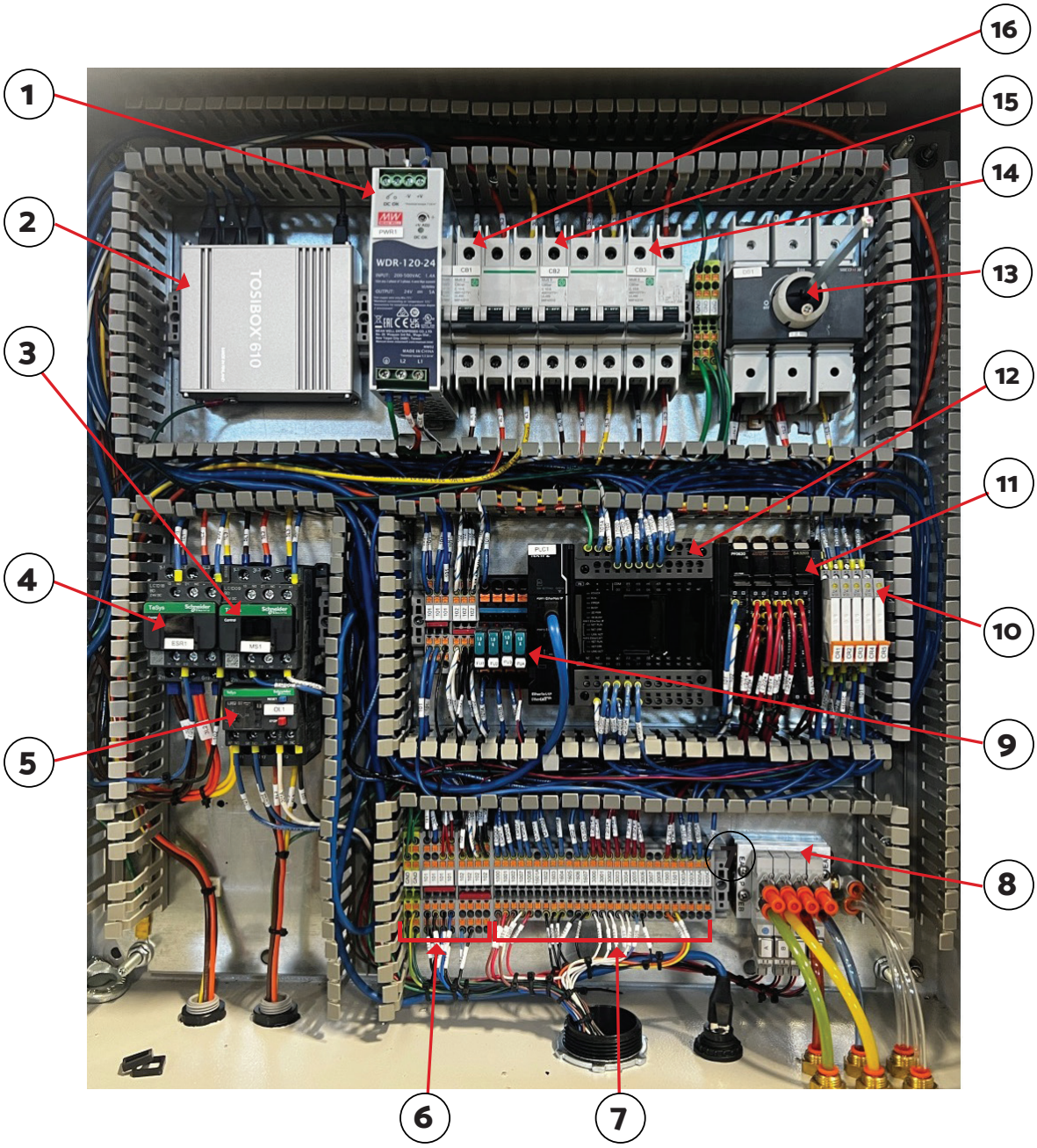



Valve C
Valve A
Valve B


RO Tank
Drain Valve
Reject Line
Flow
Switch



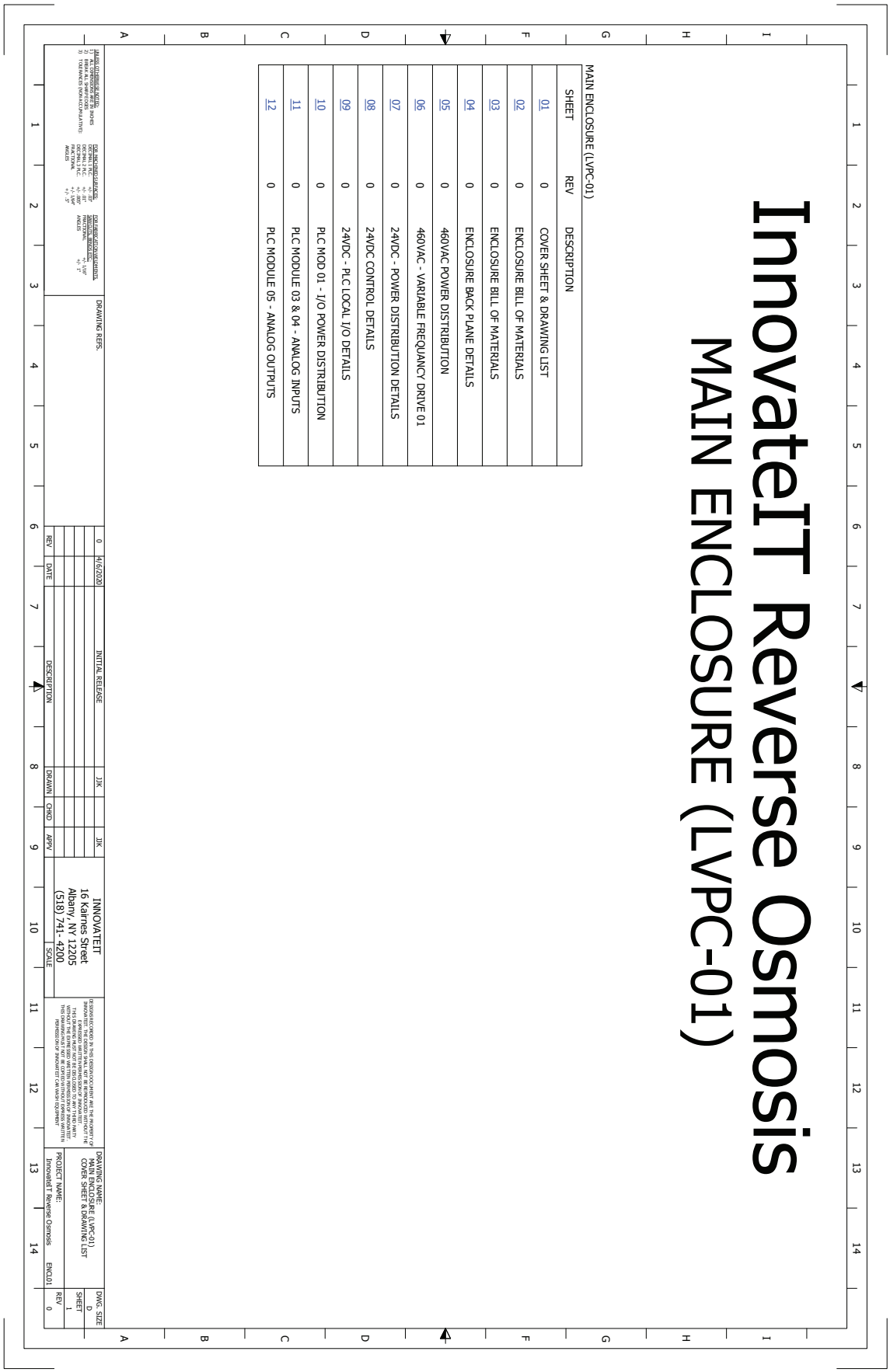

Membrane
Drain Valve
Reject Line
Flow Switch
RO Tank
Drain Valve



#	Component
1	Power Supply (PWS) 480VAC to 24VDC
2	VPN Tosibox
3	Transfer Pump Contactor (MS1)
4	E-Stop Contactor (ESR1)
5	Transfer Pump Overload Coil (OL1)
6	24VDC Terminal Strips
7	PLC (I/O) Terminal Strips
8	Air Valve Manifold

#	Component
9	24VDC Components Fuse
10	Circuit Relay (CR 1-5)
11	PLC (I/O)
12	PLC
13	Main Disconnect (DS1)
14	Power Supply BRK (CB3)
15	Transfer Pump BRK (CB2)
16	Production Pump BRK (CB1)

Appendix 2 - Electrical Schematic



ITEM	QTY	DESCRIPTION	MFG	CATALOG - MFG	CATALOG - ICWE	Mark
1	2	VFD, 480 VAC, 3 Phase, 10.5A, 5 HP, 4.0 kW, FRAME B, NO FILTER	Allen-Bradley	25B-D010N104	6404203	VFD2, VFD3
2	1	POWER SUPPLY, 180-550 VAC, 24 VDC, 5A	MEAN WELL	WDR-120-24	EL-PS-WDR-120-24	PWR1
3	2	PLC ANALOG INPUT MODULE, 4CH DIFF	Omron	NX-AD3204	OMRON-NXAD3204	MOD3, MOD4
4	1	PLC ANALOG OUTPUT MODULE, 4-20ma, 4 CH	Omron	NX-DA3203	OMRON-NXDA3203	MOD5
5	1	PLC POWER EXANSION MODULE, 4A, PUSH TERMINALS	Omron	NX-PF0630	OMRON-NX-PF0730	MOD2
6	1	PLC, 24 I/O POINTS, NPN DO	Omron	NX1P2-9024DT	OMRON-NX1P29024DT	PLC1
7	4	CIRCUIT BREAKER, THERMAL, TERMINAL BLOCK PLUGIN, 1A	Phoenix Contact	0712194	6203237	CB4, CB5, CB6, CB7
8	4	DIN RAIL, 35mm x 7.5mm, PERFORATED	Phoenix Contact	0801733	ELE-DIN-RAIL,	ENCL01 BPL01
9	5	Relay Module, 24VAC/DC Coil, SPDT	PHOENIX CONTACT	2966184	2966184	CR1, CR2, CR3, CR4, CR5
10	1	TERMINAL BLOCK BRIDGE, BLUE, PITCH 8.2mm, 30A	Phoenix Contact	3032583	6103297	ENCL01 BPL01
11	9	TERMINAL BLOCK, END CLAMP, GRAY	Phoenix Contact	0800886		TS1 , TFU1 , TS2 , GND1
12	4	TERMINAL BLOCK, FUSE HOLDER, 24V LED, 25A	Phoenix Contact	3212172	6203206	TFU1 1, TFU1 2, TFU1 3, TFU1 4
13	28	TERMINAL BLOCK, GRAY, 24A, 1 ROW/ 2PT, 26...12 AWG	Phoenix Contact	3209510	EL-TRM-3209510,	TS2 1000, TS2 1001, TS2 1002, TS2 1007, TS2 1601A, TS2 1607, TS2 1602, TS2 1603, TS2 1604, TS2 1606, TS2 3000, TS2 3001, TS2 3002, TS2 3003, TS2 3004, TS2 3005, TS2 3006, TS2 3007, TS2 3008, TS2 1500, TS2 1003A, TS2 1003C, TS2 1605A, TS2 1605C, TS2 1501, TS2 1601C, TS2 1601B, TS2 1008
14	8	TERMINAL BLOCK, GRAY, 24A, 1 ROW/ 4PT, 26...12 AWG	Phoenix Contact	3209578	EL-TRM-3209578	TS1 5, TS1 6, TS1 7, TS1 8, TS1 3, TS1 10, TS1 4, TS1 9
15	5	TERMINAL BLOCK, PE, GREEN/YELLOW, 24A, 1 ROW/ 4PT, 26...12 AWG	Phoenix Contact	3209594	EL-TRM-3209594	TS1 1, GND1 1, GND1 2, GND1 3, TS1 2
16	1	TERMINAL END COVER, GRAY, 1 ROW/ 2PT	Phoenix Contact	3030417	EL-TRM-3030417	TS2
17	4	TERMINAL END COVER, GRAY, 1 ROW/ 4 PT	Phoenix Contact	3030514	EL-TRM-3030514	TS1 , GND1
18	1	ENCLOSURE BACK PANEL, 22" x 22" GALVENIZED	Rittal	WM 8018.601		ENCL01 BPL01
19	1	OVERLOAD RELAY, 3P, 1.6..2.5A, CLASS 10	Schneider Electric	LRD07	ELE-MS-OVRLD-LRD07	OL1
20	1	CIRCUIT BREAKER, 10A, C-CURVE, 2P, BRANCH PROTECTION	Schneider Electric	M9F42210	ELE-BRK-M9F42210-10A	CB3
21	2	CIRCUIT BREAKER, 10A, C-CURVE, 3P, BRANCH, 10kA (UL489)	Schneider Electric	M9F42310	6203213	CB1, CB2
22	1	CONTACTOR, 3P, 18A, 24VDC COIL	Schneider Electric	LC1D18BD	ELE-CONTACTOR-18A-24 VDC	ESR1
23	1	CONTACTOR, 3P, 9A, 24VDC COIL	Schneider Electric	LC1D09BD	ELE-CONTACTOR-9A-24V	MS1

UNLESS OTHERWISE NOTED:
1) ALL DIMENSIONS ARE IN INCHES
2) BREAK ALL SHARP EDGES
3) TOLERANCES (NON ACCUMULATIVE):

FOR MACHINED SURFACES:
DECIMAL 1 PLC. +/- .01"
DECIMAL 2 PLC. +/- .01"
DECIMAL 3 PLC. +/- .005"
FRACTIONAL +/- 1/64"
ANGLES +/- .5°

FOR FABRICATION WELDMENTS, SAWCUTS, BENDS ETC:
FRACTIONAL +/- 1/16"
ANGLES +/- 1°

DRAWING REFS.

REV	DATE	DESCRIPTION	DRAWN	CHKD	APPV
0	4/6/2020	INITIAL RELEASE	JJK		JJK

INNOVATEIT
16 Kairnes Street
Albany, NY 12205
(518) 741- 4200

SCALE

DRAWING NAME: MAIN ENCLOSURE (LVPC-01) ENCLOSURE BILL OF MATERIALS
DWG. SIZE D
SHEET 2
PROJECT NAME: InnovateIT Reverse Osmosis ENCL01
REV 0

ITEM	QTY	DESCRIPTION	MFG	CATALOG - MFG	CATALOG - ICWE	Mark
24	1	DISCONNECT SWITCH HANDLE, LOCKABLE, 2 POSITION, RED/YELLOW	Socomec	147E1111	6103401	DS1
25	1	DISCONNECT SWITCH SHAFT	Socomec	14070532	6103402	DS1
26	1	DISCONNECT SWITCH, 3P, 600 VAC, 30A, 100kA, UL 98	Socomec	22013003	6103403	DS1
27	1	ROUTER, VPN ACCESS NETWORK DEVICE	TOSIBOX	TBL610US	TOSIBOX	ENSW1

UNLESS OTHERWISE NOTED:
1) ALL DIMENSIONS ARE IN INCHES
2) BREAK ALL SHARP EDGES
3) TOLERANCES (NON ACCUMULATIVE):

FOR MACHINED SURFACES:
DECIMAL 1 PLC. +/- .03"
DECIMAL 2 PLC. +/- .01"
DECIMAL 3 PLC. +/- .005"
FRACTIONAL +/- 1/64"
ANGLES +/- .5°

FOR FABRICATION WELDMENTS, SAWCUTS, BENDS ETC:
FRACTIONAL +/- 1/16"
ANGLES +/- 1°

DRAWING REFS.

REV	DATE	DESCRIPTION	DRAWN	CHKD	APPV
0	4/6/2020	INITIAL RELEASE	JJK		JJK

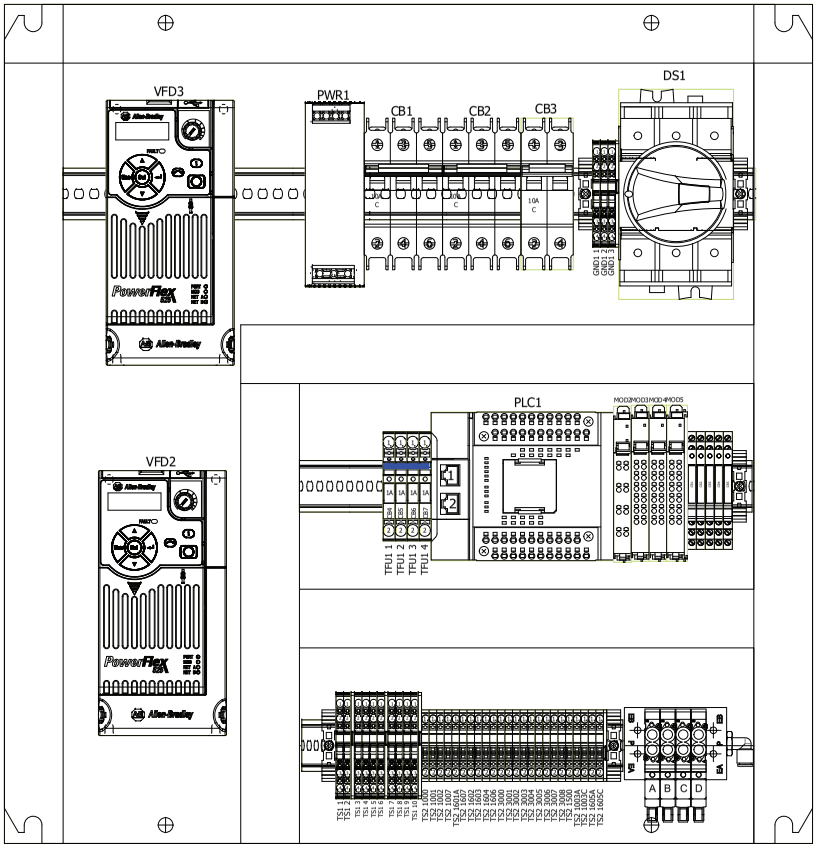
INNOVATEIT
16 Kairnes Street
Albany, NY 12205
(518) 741- 4200

SCALE

DRAWING NAME:
MAIN ENCLOSURE (LVPC-01)
ENCLOSURE BILL OF MATERIALS

PROJECT NAME:
InnovateIT Reverse Osmosis ENCL01

DWG. SIZE: D
SHEET: 3
REV: 0

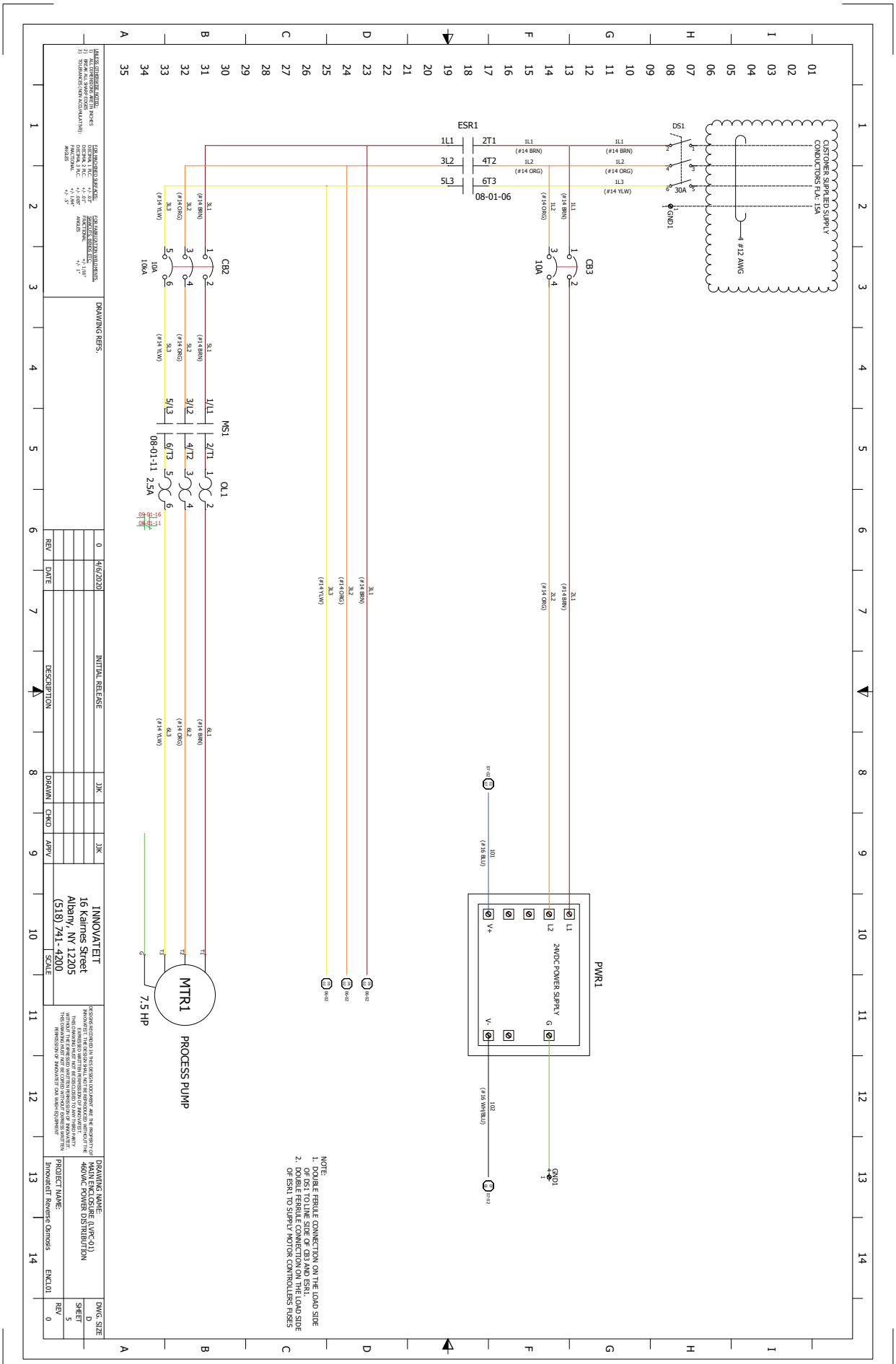


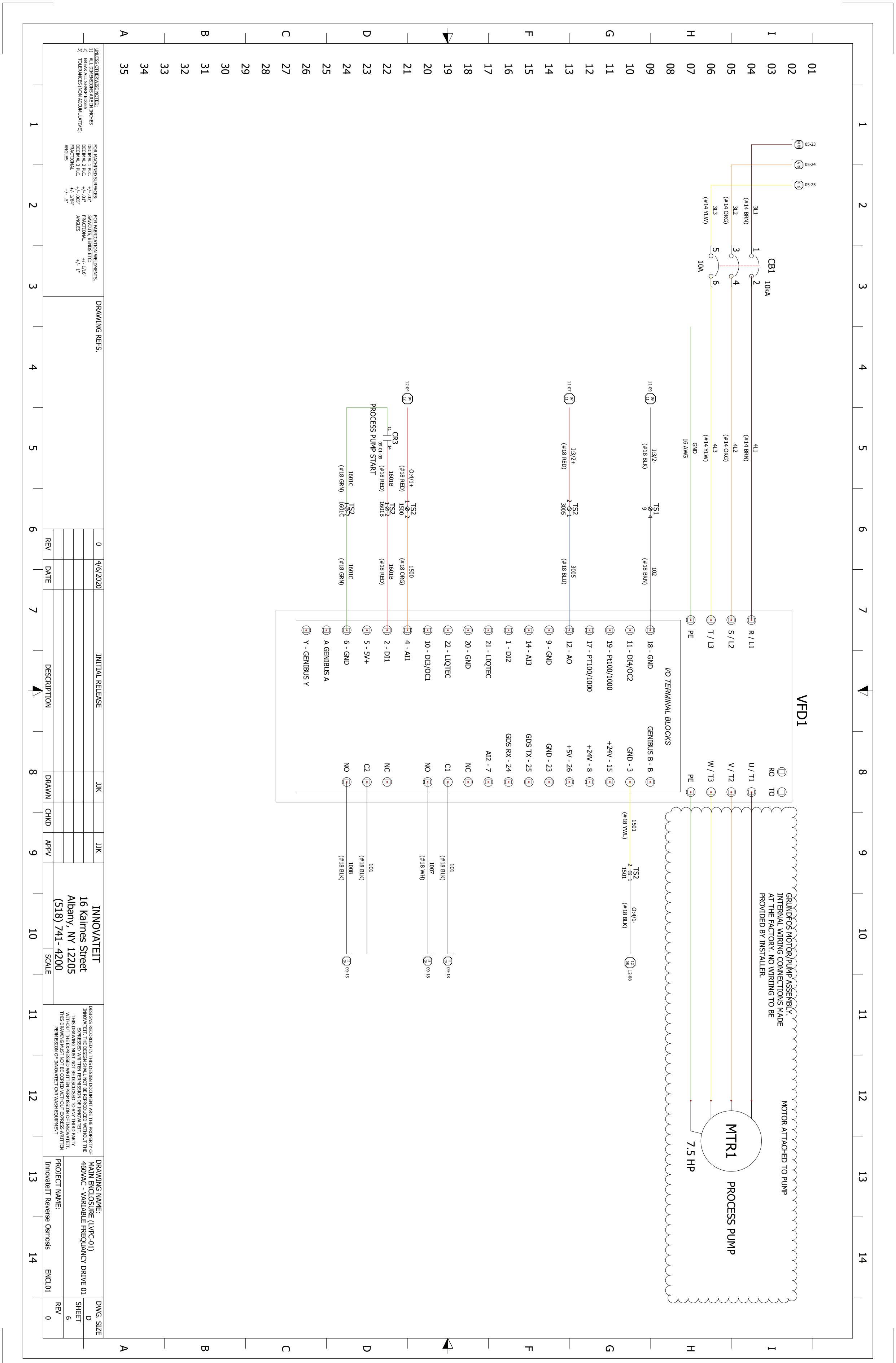
UNLESS OTHERWISE NOTED: 1) ALL DIMENSIONS ARE IN INCHES 2) BREAK ALL SHARP EDGES 3) TOLERANCES (NON ACCUMULATIVE):	FOR MACHINED SURFACES: DECIMAL 1 PLC. +/- .03" DECIMAL 2 PLC. +/- .01" DECIMAL 3 PLC. +/- .005" FRACTIONAL +/- 1/64" ANGLES +/- .5°	FOR FABRICATION WELDMENTS, SAWCUTS, BENDS ETC.: FRACTIONAL +/- 1/16" ANGLES +/- 1°	DRAWING REFS.							
				0	4/6/2020	INITIAL RELEASE	JJK		JJK
				REV	DATE	DESCRIPTION	DRAWN	CHKD	APPV

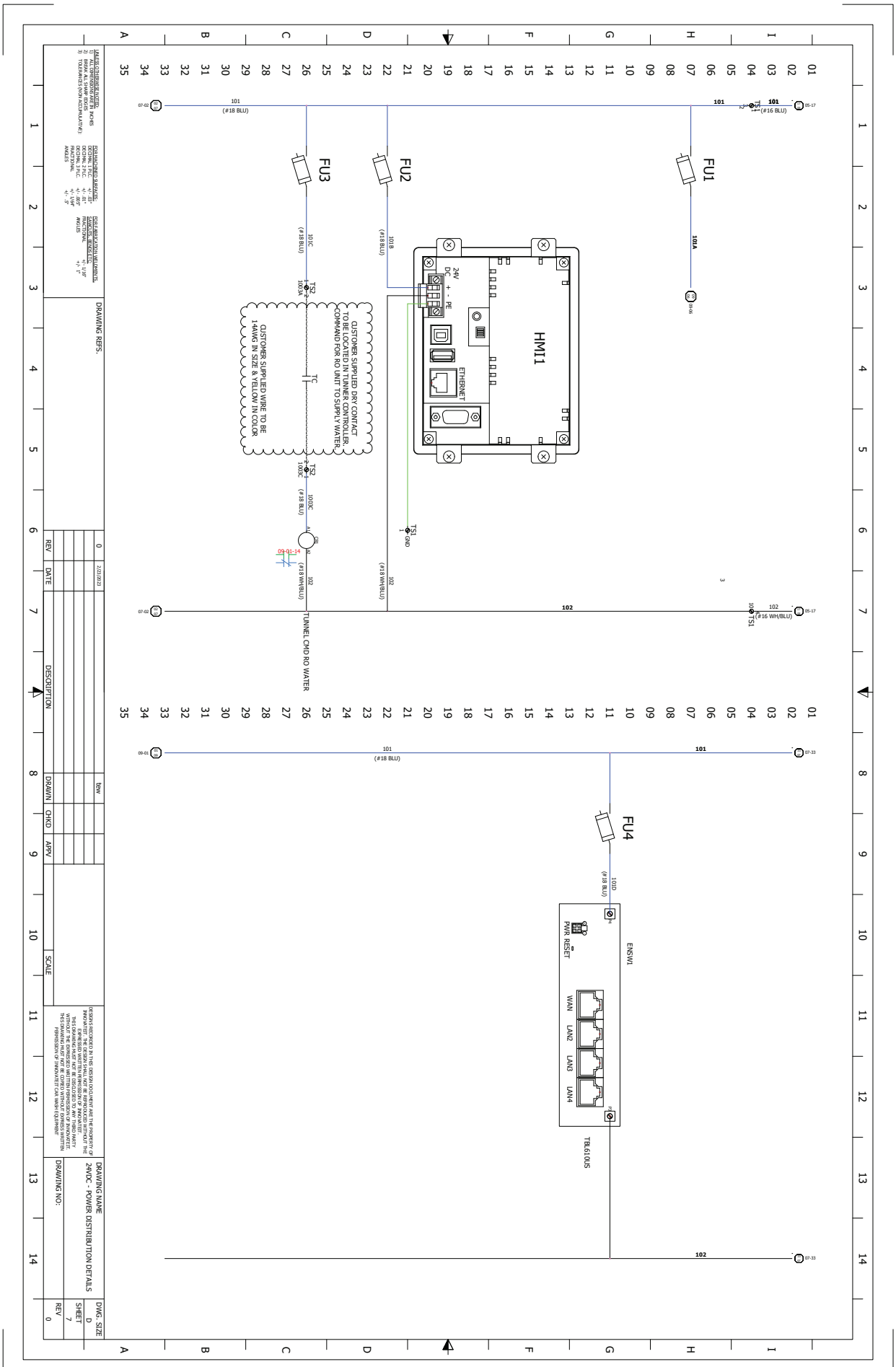
INNOVATEIT
16 Kairnes Street
Albany, NY 12205
(518) 741- 4200

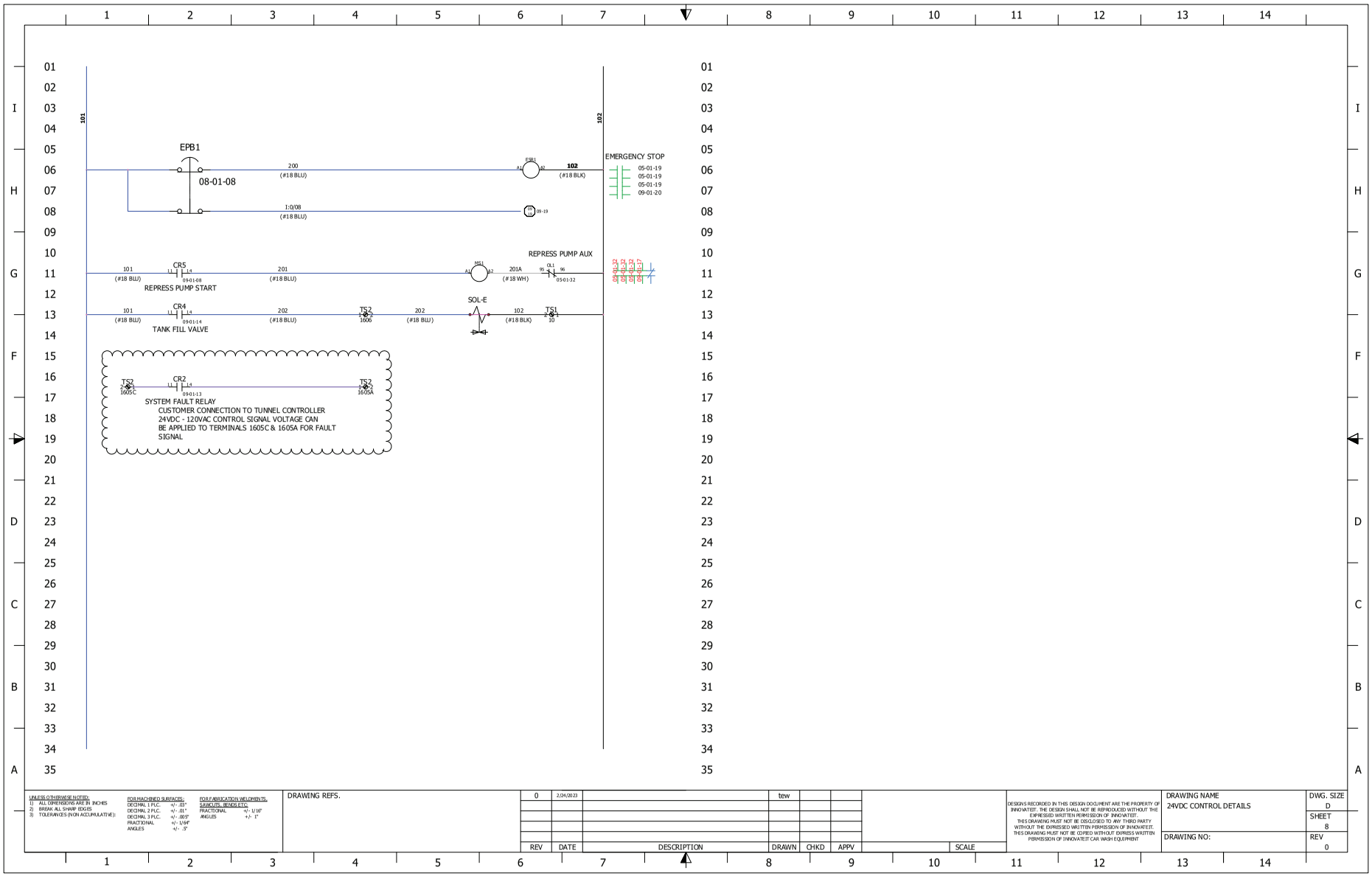
SCALE

DRAWING NAME:	DWG. SIZE
MAIN ENCLOSURE (LVPC-01) ENCLOSURE BACK PLANE DETAILS	D
	SHEET 4
PROJECT NAME:	REV
InnovateIT Reverse Osmosis ENCL01	0

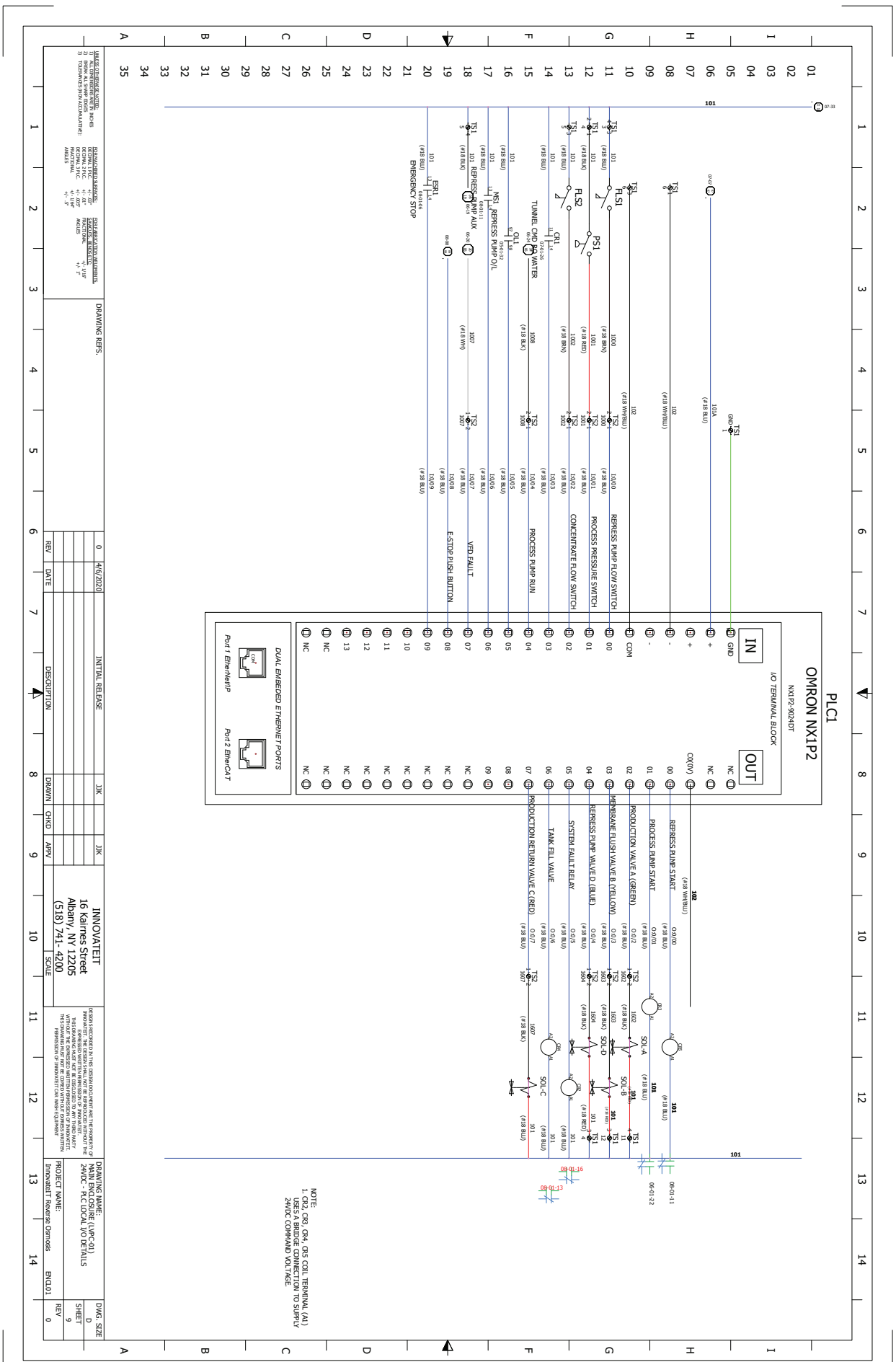

CUSTOMER SUPPLIED SUPPLY CONDUCTORS FLA: 15A
#12 AWG
DS1
30A
GND1
ESR1
2T1
4T2
6T3
1L1
3L2
5L3
08-01-06
(#14 BRN)
(#14 ORG)
(#14 YLW)
CB3
10A
CB2
10A
MS1
08-01-11
2.5A
OL1
MTR1
7.5 HP
PROCESS PUMP
PWR1
24VDC POWER SUPPLY
V+
V-
L1
L2
G
(#16 BLU)
(#16 WH/BLU)
NOTE:
1. DOUBLE FERULE CONNECTION ON THE LOAD SIDE OF DS1 TO LINE SIDE OF CB3 AND ESR1.
2. DOUBLE FERULE CONNECTION ON THE LOAD SIDE OF ESR1 TO SUPPLY MOTOR CONTROLLERS FUSES
DRAWING REFS:
REV
DATE
DESCRIPTION
DRAWN
CHKD
APPV
INITIAL RELEASE
4/6/2020
JJK
INNOVATEIT
16 Kaimes Street
Albany, NY 12205
(518) 741-4200
SCALE
DRAWING NAME:
PANEL SCHEMATIC (LVPC-01)
460VAC POWER DISTRIBUTION
PROJECT NAME:
InnovatelT Reverse Osmosis
ENCL01
DWG SIZE
D
SHEET
5
REV
0

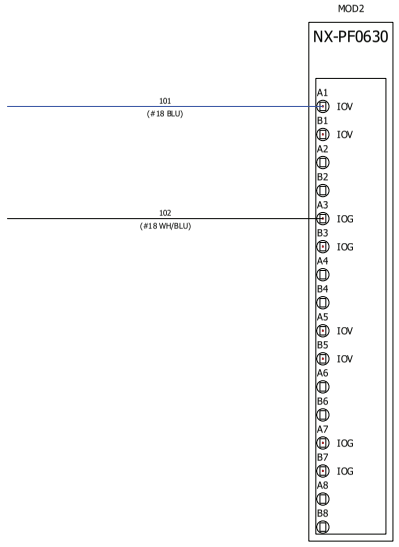

VFD1
I/O TERMINAL BLOCKS
CB1
10kA
10A
CR3
PROCESS PUMP START
TS1
TS2
R / L1
S / L2
T / L3
PE
U / T1
V / T2
W / T3
RO
TO
18 - GND
11 - DI4/OC2
19 - Pt100/1000
17 - PT100/1000
12 - AO
9 - GND
14 - AI3
1 - DI2
21 - LIQTEC
20 - GND
22 - LIQTEC
10 - DI3/OC1
4 - AI1
2 - DI1
5 - 5V+
6 - GND
A GENIBUS A
Y - GENIBUS Y
GENIBUS B - B
GND - 3
+24V - 15
+24V - 8
+5V - 26
GND - 23
GDS TX - 25
GDS RX - 24
AI2 - 7
NC
C1
NO
C2
GRUNDFOS MOTOR/PUMP ASSEMBLY.
INTERNAL WIRING CONNECTIONS MADE
AT THE FACTORY, NO WIRING TO BE
PROVIDED BY INSTALLER.
MOTOR ATTACHED TO PUMP
MTR1
7.5 HP
PROCESS PUMP
DRAWING REFS.
0
4/6/2020
INITIAL RELEASE
JJK
JJK
REV
DATE
DESCRIPTION
DRAWN
CHKD
APPV
INNOVATEIT
16 Kairnes Street
Albany, NY 12205
(518) 741-4200
SCALE
DRAWING NAME:
MAIN ENCLOSURE (LVFC-01)
460VAC - VARIABLE FREQUANCY DRIVE 01
PROJECT NAME:
InnovateIT Reverse Osmosis
ENCL01
DWG. SIZE
D
SHEET
6
REV
0


FU1
FU2
FU3
FU4
HMI1
ETHERNET
24V DC + - PE
TSI
GND
TC
ENSWI
PWR RESET
WAN
LAN2
LAN3
LAN4
TBL61UUS
101 (#18 BLU)
101 (#16 BLU)
101A
101B
101C
101D
102 (#18 WH/BLU)
102 (#16 WH/BLU)
CUSTOMER SUPPLIED DRY CONTACT TO BE LOCATED IN TUNNER CONTROLLER. COMMAND FOR RO UNIT TO SUPPLY WATER.
CUSTOMER SUPPLIED WIRE TO BE 14AWG IN SIZE & YELLOW IN COLOR
TUNNEL CMD RO WATER
DRAWING REFS:
DRAWING NAME
24VDC - POWER DISTRIBUTION DETAILS
DRAWING NO:
SHEET 7
REV 0
DWG. SIZE D
DESCRIPTION
DRAWN
CHKD
APPV
SCALE
DATE
REV



UNLESS OTHERWISE NOTED: 1) ALL DIMENSIONS ARE IN INCHES 2) BREAK ALL SHARP EDGES 3) TOLERANCES (NON ACCUMULATIVE): FOR MACHINED SURFACES: DECIMAL 1 PLC. +/- .03" DECIMAL 2 PLC. +/- .01" DECIMAL 3 PLC. +/- .005" FRACTIONAL +/- 1/64" ANGLES +/- .5° FOR FABRICATION WELDMENTS, SAWCUTS, BENDS ETC: FRACTIONAL +/- 1/16" ANGLES +/- 1°	DRAWING REFS.	0	2/24/2023		tew			DESIGNS RECORDED IN THIS DESIGN DOCUMENT ARE THE PROPERTY OF INNOVATEIT. THE DESIGN SHALL NOT BE REPRODUCED WITHOUT THE EXPRESSED WRITTEN PERMISSION OF INNOVATEIT. THIS DRAWING MUST NOT BE DISCLOSED TO ANY THIRD PARTY WITHOUT THE EXPRESSED WRITTEN PERMISSION OF INNOVATEIT. THIS DRAWING MUST NOT BE COPIED WITHOUT EXPRESS WRITTEN PERMISSION OF INNOVATEIT CAR WASH EQUIPMENT	DRAWING NAME 24VDC CONTROL DETAILS	DWG. SIZE D
											SHEET 8
		REV	DATE	DESCRIPTION	DRAWN	CHKD	APPV	SCALE		DRAWING NO:	REV 0


PLC1
OMRON NX1P2
NX1P2-9024DT
I/O TERMINAL BLOCK
IN
OUT
DUAL EMBEDED ETHERNET PORTS
Port 1 EtherNet/IP
Port 2 EtherCAT
REPRESS PUMP FLOW SWITCH
PROCESS PRESSURE SWITCH
CONCENTRATE FLOW SWITCH
PROCESS PUMP RUN
TUNNEL CMD RO WATER
REPRESS PUMP O/L
EMERGENCY STOP
REPRESS PUMP AUX
VFD FAULT
E-STOP PUSH BUTTON
REPRESS PUMP START
PROCESS PUMP START
PRODUCTION VALVE A (GREEN)
MEMBRANE FLUSH VALVE B (YELLOW)
REPRESS PUMP VALVE D (BLUE)
SYSTEM FAULT RELAY
TANK FILL VALVE
PRODUCTION RETURN VALVE C (RED)
SOL-A
SOL-B
SOL-C
SOL-D
NOTE:
1. CR2, CR3, CR4, CR5 COIL TERMINAL (A1) USES A BRIDGE CONNECTION TO SUPPLY 24VDC COMMAND VOLTAGE
DRAWING REFS:
DRAWING NAME: MAIN ENCLOSURE (LVPC-01) 24VDC - PLC LOCAL I/O DETAILS
PROJECT NAME: InnovatelT Reverse Osmosis
INNOVATELT
16 Kairnes Street
Albany, NY 12205
(518) 741- 4200
INITIAL RELEASE
4/6/2020



UNLESS OTHERWISE NOTED:
1) ALL DIMENSIONS ARE IN INCHES
2) BREAK ALL SHARP EDGES
3) TOLERANCES (NON ACCUMULATIVE):

FOR MACHINED SURFACES:
DECIMAL 1 PLC. +/- .03"
DECIMAL 2 PLC. +/- .01"
DECIMAL 3 PLC. +/- .005"
FRACTIONAL +/- 1/64"
ANGLES +/- .5°

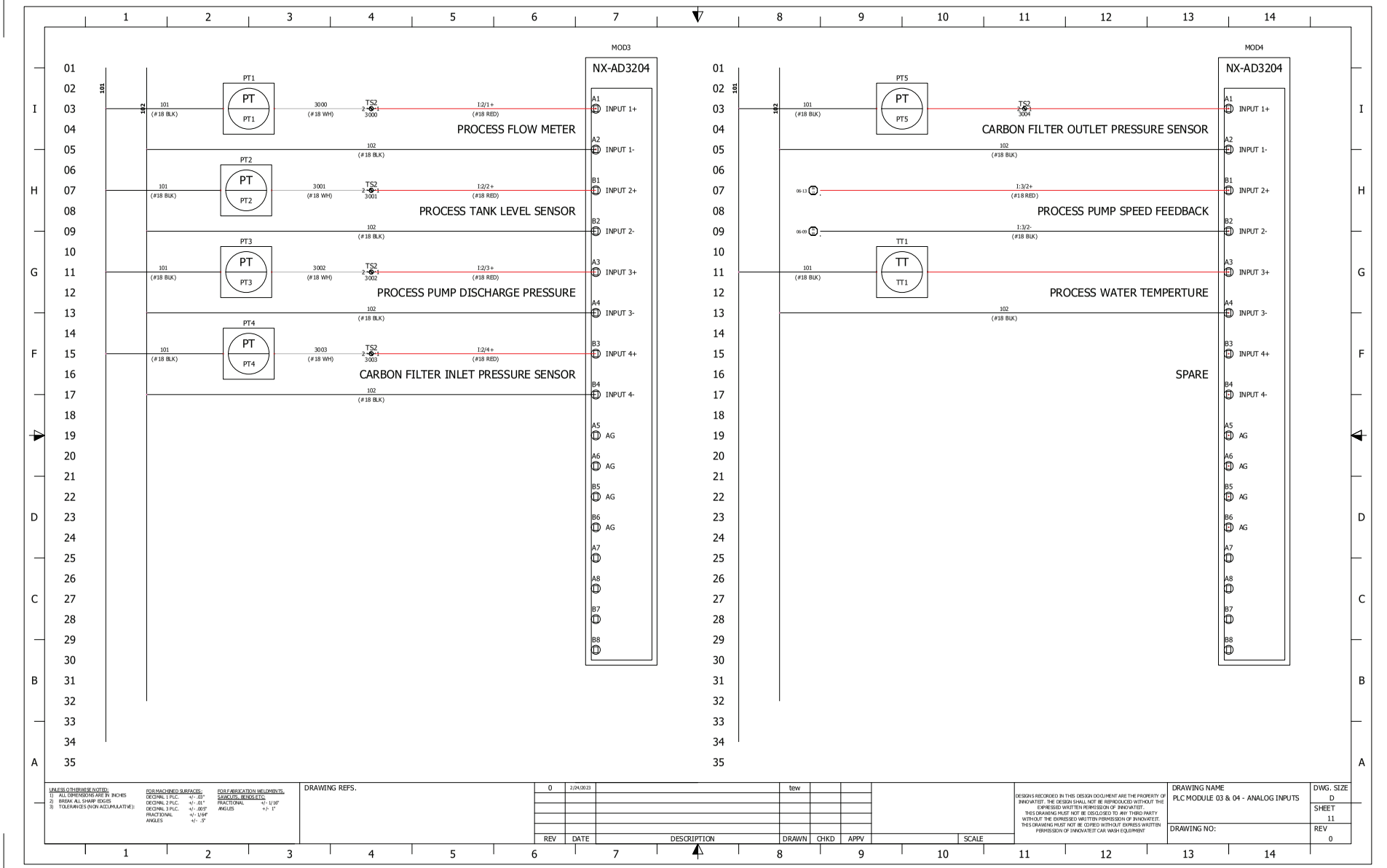
FOR FABRICATION WELDMENTS, SAWCUTS, BENDS ETC:
FRACTIONAL +/- 1/16"
ANGLES +/- 1°

DRAWING REFS.

REV	DATE	DESCRIPTION	DRAWN	CHKD	APPV
0	2/24/2023		tew		

SCALE

DRAWING NAME	PLC MOD 01 - I/O POWER DISTRIBUTION
DRAWING NO:	
DWG. SIZE	D
SHEET	10
REV	0



UNLESS OTHERWISE NOTED:
1) ALL DIMENSIONS ARE IN INCHES
2) BREAK ALL SHARP EDGES
3) TOLERANCES (NON ACCUMULATIVE):

FOR MACHINED SURFACES:
DECIMAL 1 PLC. +/- .03"
DECIMAL 2 PLC. +/- .01"
DECIMAL 3 PLC. +/- .005"
FRACTIONAL +/- 1/64"
ANGLES +/- .5°

FOR FABRICATION WELDMENTS, SAWCUTS, REMOS ETC:
FRACTIONAL +/- 1/16"
ANGLES +/- 1°

DRAWING REFS.

REV	DATE	DESCRIPTION	DRAWN	CHKD	APPV
0	2/24/2023		tew		

SCALE

DRAWING NAME	PLC MODULE 03 & 04 - ANALOG INPUTS
DRAWING NO:	
DWG. SIZE	D
SHEET	11
REV	0

UNLESS OTHERWISE NOTED:
1) ALL DIMENSIONS ARE IN INCHES
2) BREAK ALL SHARP EDGES
3) TOLERANCES (NON ACCUMULATIVE):

FOR MACHINED SURFACES:
DECIMAL 1 PLC. +/- .03"
DECIMAL 2 PLC. +/- .01"
DECIMAL 3 PLC. +/- .005"
FRACTIONAL +/- 1/64"
ANGLES +/- .5°

FOR FABRICATION WELDMENTS, SAWCUTS, BENDS ETC:
FRACTIONAL +/- 1/16"
ANGLES +/- 1°

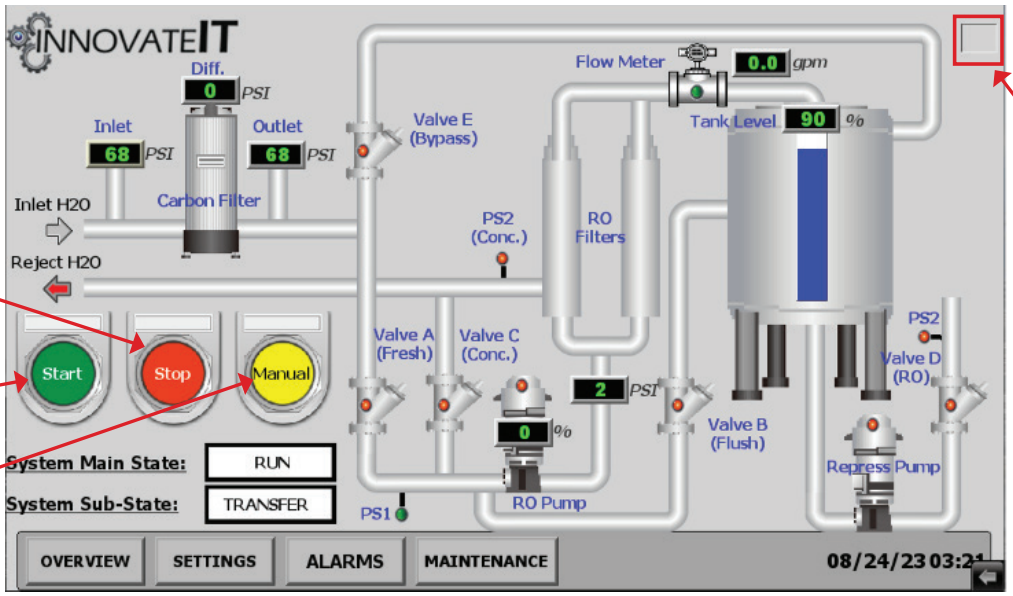
DRAWING REFS.

REV	DATE	DESCRIPTION	DRAWN	CHKD	APPV	SCALE
0	2/24/2023		tew			

DRAWING NAME: PLC MODULE 05 - ANALOG OUTPUTS
DWG. SIZE: D
SHEET: 12
DRAWING NO:
REV: 0

Appendix 3 - HMI Screens

Overview



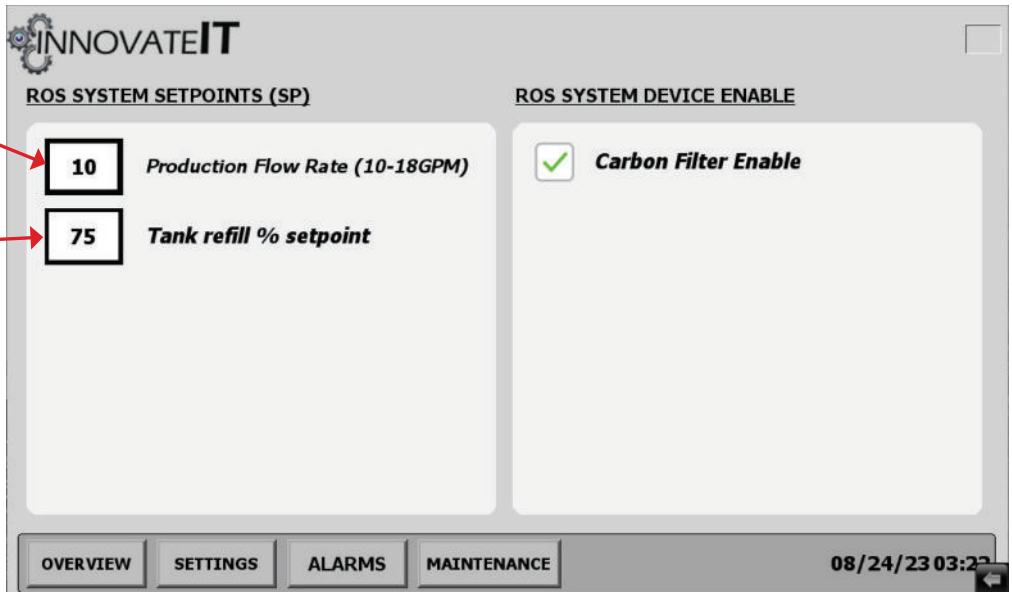
Stop Button

Start Button

Manual Button

Air Valve Testing Page

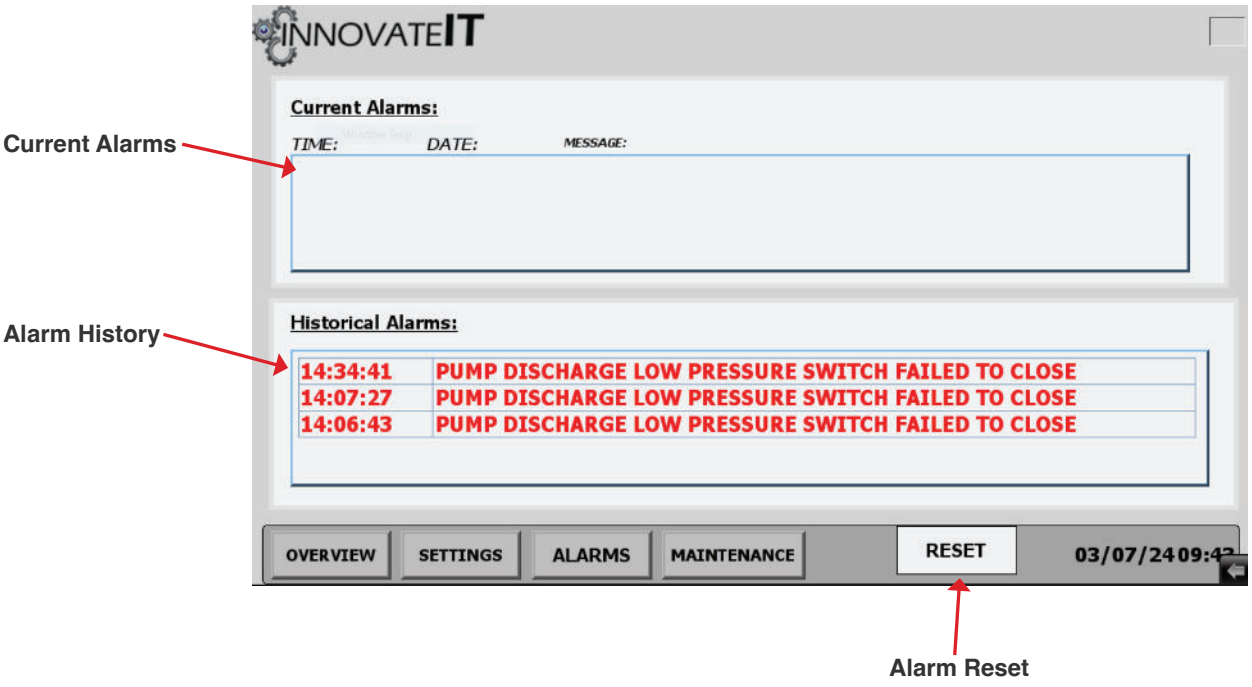
Settings



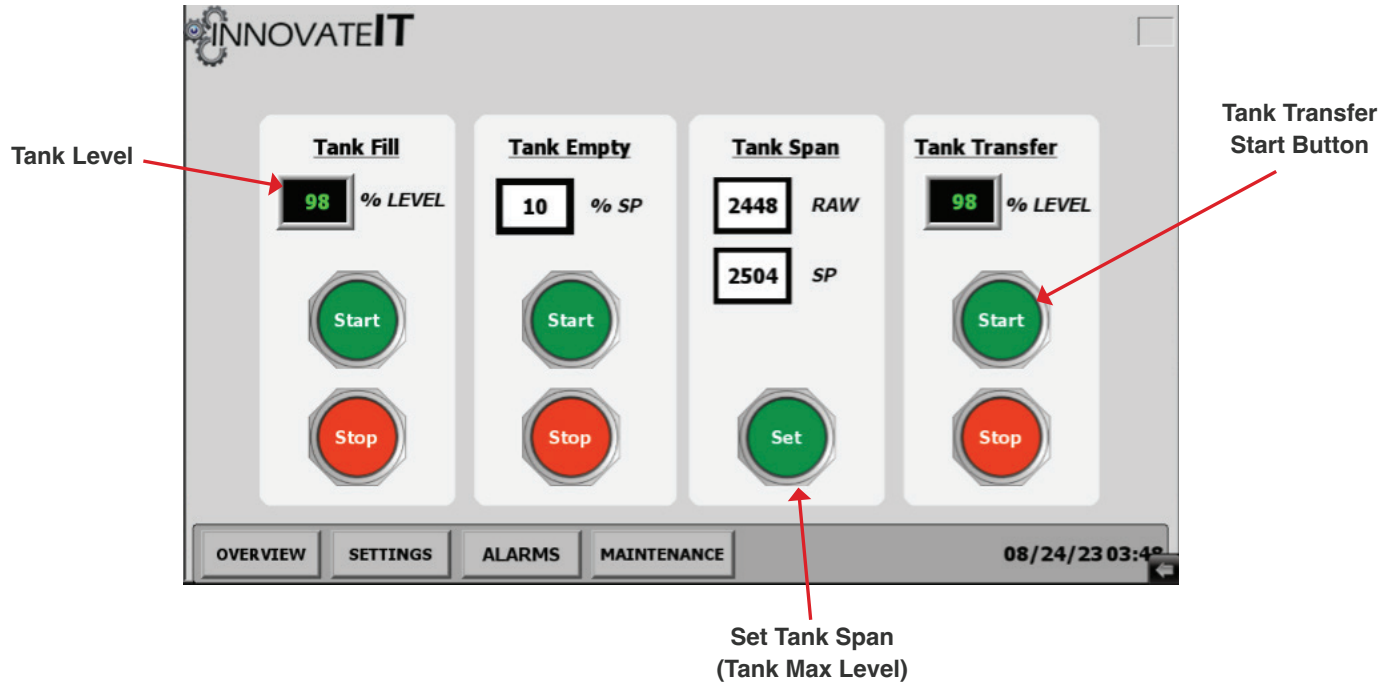
Max Flow Rate (GPM)

Tank Level To Activate Production Pump

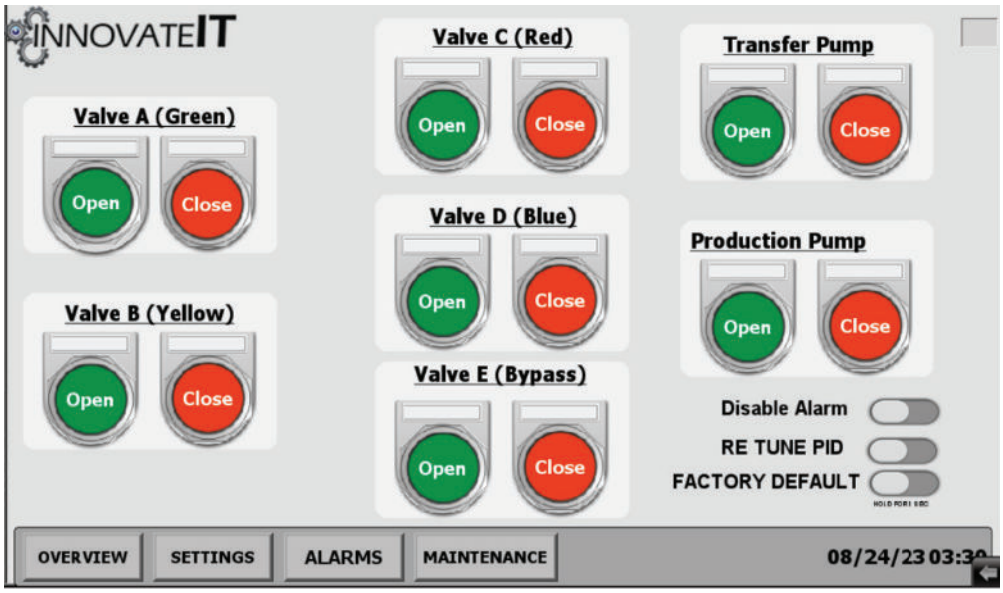
Alarms



Maintenance



Air Valve Testing Page



Appendix 4 - Glossary of Terms

Reverse Osmosis - A water purification technology that uses a semi-permeable membrane to remove dissolved substances from the water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, forcing water molecules to pass through the membrane while all dissolved solids remain in the feed water side of the membrane.

Transfer Pump (Re-Pressurization Pump) - A pump that delivers RO water to a wash, which is run by a command from the wash tunnel

Production Pump - VFD pump that matches the pump speed with municipal water pressure, to ensure the system delivers maximum RO water to the tunnel.

Thin Film Composite Membrane (TFC) - Thin Film Composite (TFC) membranes are a special type of RO membrane which offers high efficiency, long life and resistance to most adverse water conditions. The membrane material is very sensitive to free chlorine. If the feed water is chlorinated a chlorine pre-filter must be used to protect the membrane.

Municipal Feed Water - The incoming water supply which is directed into the membrane for processing.

Product Water (RO Product) - The purified water that has been separated from the feed water stream by the reverse osmosis membranes.

Recovery – The amount of RO Product water produced as a percent of the total amount of feed water.

- Example: If the system feed flow is 20 GPM and the RO Product produced is 10 GPM, then the recovery would be 50%.

Reject Water (RO Reject or Concentrate) – The portion of the feed water that does not pass through the RO membrane and is delivered to the Reject Tank. This water has a higher level of impurities than the municipal feed water and is captured in storage tank for other uses in the wash system.

Percent Rejection – The percentage of TDS removed from the feed water. Membranes typically reject greater than 99.5 % of the dissolved solids which are present in the feed water.

- Example: If the incoming feed water is 200 TDS, the RO water will measure approximately 1 ppm TDS.

Dissolved Solids (TDS) – TDS is measured in parts per million (PPM). The innovateIT RO system is designed to operate with feed water with TDS levels up to 1000 PPM which is much higher than general municipal water standards.

Parts Per Million (PPM) – PPM is the standard measure of total dissolved solids where 1 PPM is equivalent to 1ml / Liter of liquid. Generally, TDS levels below 20 PPM will provide a spot free rinse. Above 20 ppm the operator will see visible outline on glass or dark painted if water spots are allowed to remain on the surface.

Membrane Flush Cycle – RO membrane flush cycle starts 15 minutes after the tank is filled (flush cycle only starts if the wash tunnel does not demand RO water from the unit). Flushing the membranes increases the longevity of the membrane and reduces scaling build up.