BWT ECO-MX Nano SERIES ON-SITE GENERATOR

1.0 and 2.0

Installation, Operation, and Maintenance

Manual

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1 INTRODUCTION

This manual is designed to provide installation, operation, and maintenance guidelines to the system operator. Proper maintenance of the system will increase cell life and system performance. Follow all warnings and precautions when installing, operating, and maintaining your BWT ECO-MX Nano System. Should advanced troubleshooting be required to solve a problem, please contact your BWT Corporation Customer Service provider for further assistance. Contact information for BWT Customer Service is located at the front and back for this manual.

Regulatory Compliance

U. S. Environmental Protection Agency (US EPA)

On-site oxidants are listed as a compliance technology for water disinfection. To be listed as a compliance technology, the system must be cost effective and achieve compliance with the regulated maximum contaminant levels (MCLs), and the operator must be capable of reliably operating the technology. The on-site oxidant category was added to this list in 1997 primarily based on independent research.

List of Certifications

EPA Registration Number: 69723-NM-001

NSF International

BWT Corporation maintains a policy of verification and compliance of BWT technology for water applications. The NSF Standard provides the criteria used to evaluate the public health safety of materials, components, products, or systems that contact drinking water, drinking water chemicals, or both. For details of specific NSF standards for specific BWT equipment, please consult with BWT. NSF listings are also available through NSF International at (800) NSF-Mark or their web site at www.nsf.org.

State Approvals

BWT Corporation maintains a policy of obtaining state regulatory approval in all states where BWT equipments is installed and operated. BWT has never been rejected for approval in any state. For a complete list of states currently approving on-site oxidant technology, please contact BWT.

BWT ECO-MX Nano System Specifications

	1.0	2.0
Rated Free Available Chlorine (FAC) Capacity	1.0 lbs/day 0.45 kg/day	2 lbs/day 0.9 kg/day
Water Treatment Capacity (at 1 ppm FAC)	120,000 gal/day 454 m3/day	240,000 gal/day 908 m3/day
Flow Rate (± 15%)	1.3 gph 4.9 lph	2.7 gph 10.2 lph
Self Cleaning	YES	
FAC Concentration*	4,000 ± 1,000 mg/L	
Water Hardness	0 tu 1.7 °F	
Electrical Service Requirement	110 VAC to 240 VAC 1 ph, 4 Amp Rating 50/60Hz	
Number of Dedicated Circuits Required	One	
Approximate Salt Ratio*	3.0 - 3.5 lb/kg salt per lb/kg FAC	
Air Temperature Requirements	42°F to 120°F 6°C to 49°C	
Feed Water Temp Requirements	50°F to 80°F 10°C to 27°C	
Feed Water Pressure	1 - 75 psi 6.8 - 517 kPa	

For the continued protection against risk of fire, replace fuse only with fuse of the same type and current rating

**Performance may vary depending on salt quality, water quality, and water temperature*

Components of the System (Standard Offerings)

The BWT ECO-MX Nano System (see Figure 1-1) is an on-site oxidant generator. The unit operates automatically and is self-diagnosing.

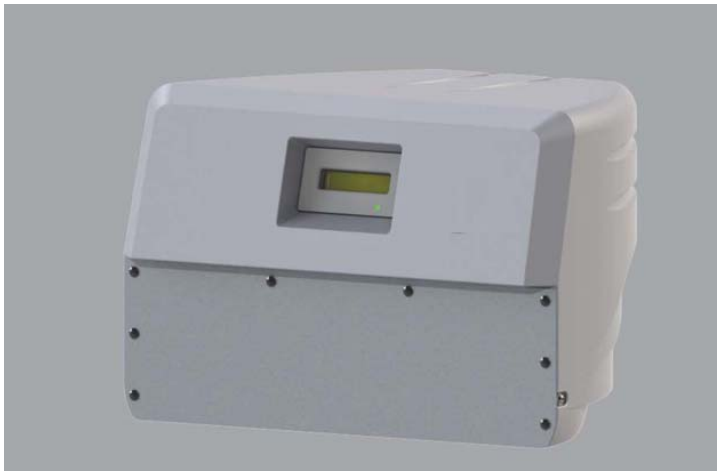


Figure 1-1. BWT ECO-MX Nano System

System Enclosure Assembly

The BWT ECO-MX Nano enclosure houses the control board, display, power supplies, cooling fan, electrolytic cells and pumps (see Figure 1-2). The system operates on single phase AC electric power and is shipped with a 10 foot power cord for direct wiring to circuit breaker/power source. The electronic controls are designed to diagnose and adjust the unit to optimum conditions or shut down the system should a fault occur.

BWT Electrolytic Cell

A membraneless electrolytic cell that produces an oxidants. BWT offers 2 ranges of capacity: 1.0 lb (0.45 kg) and 2.0 lb (0.91 kg) Free Available Chlorine (FAC) per day.

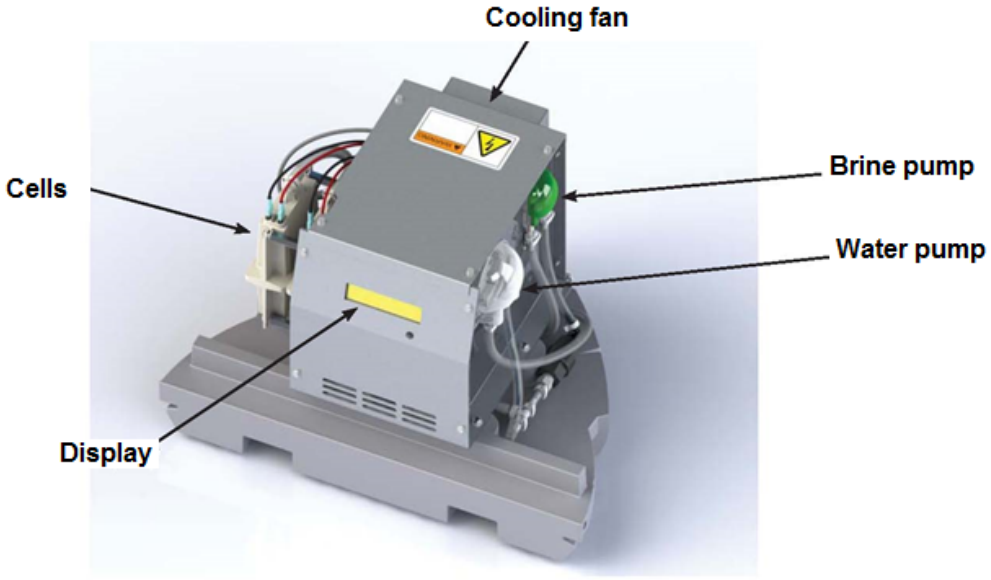


Figure 1-2 BWT ECO-MX Nano with enclosure removed

Brine Pump

This variable speed peristaltic pump controls the volume of water entering the electrolytic cell using a signal from the controller. The pump operates on 12VDC power. Refer to figure 1-3 Pump ISO View (with enclosure removed) for location of the pump within the system.

Figure 1-3 BWT ECO-MX Nano pump ISO View (with enclosure removed)

Oxidant Tank Level Switch

This switch functions to turn the BWT ECO-MX Nano on from a standby condition when the solution reaches the preset low level and turn the system off when the solution reaches the high level. The switch is required when utilizing an oxidant storage tank. In the instances when an oxidant tank or level switch is not required, the oxidant level switch signal must be jumpered in order to operate the system. Lack of a jumper on the oxidant switch will prevent the unit from starting and remain in standby mode. Refer to Section 2.

Tubing and Fittings

All fitting connections inside the BWT ECO-MX Nano are barbed with hose clamps for sealing. The clear tubing is vinyl with high chemical resistance characteristics. The tube is rated to 35-psi. The brine and water pump have their own dedicated tube assemblies that will have to be periodically replaced due to tube wear from the pump rollers. Only replace pump tube assemblies with Pharmed BPT tubing assemblies that are provided in the spare parts kit.

NOTE: **For optional items not listed above see Appendix E, F and G for a listing of optional items available for the BWT ECO-MX Nano. Additional items may include, but are not limited to integrated brine/water tank, oxidant tank, hydrogen vent, oxidant pump, water heater and water chiller. Contact BWT for additional details on available options.**

Site Specific Information for the BWT ECO-MX Nano System

This chapter will provide you with information necessary for proper site selection. Specifications and conditions regarding electrical power to the BWT ECO-MX Nano System, water quality, water line pressure requirements, and space and security requirements for the installation of the system will be discussed. The information in this chapter is contained under the following sections:

Space Requirements

Water Quality

Electrical Power

Water Pressure and Line Conditions

Temperature Conditions

The BWT ECO-MX Nano System has been factory tested and must be properly installed to ensure proper operation. The guidelines provided in this manual should be followed to ensure proper use of the BWT ECO-MX Nano System. Most of the start-up problems associated with BWT systems have been traced to an inadequately configured feed water supply, power source, or poor salt quality.

Space Requirements

The system should be installed on a clean and level surface. Standard installation for a unit is a tabletop or counter top surface. A minimum floor space of 5 feet (1.52 meters) by 5 feet (1.52 meters) is required for the BWT ECO-MX Nano System. This space requirement is adequate if the optional integrated brine/water tank is installed. Additional space may be required if an external brine and/or oxidant tank are installed. Space requirements vary depending on size of tanks. Contact BWT for additional details. Refer to Figure 1-4.

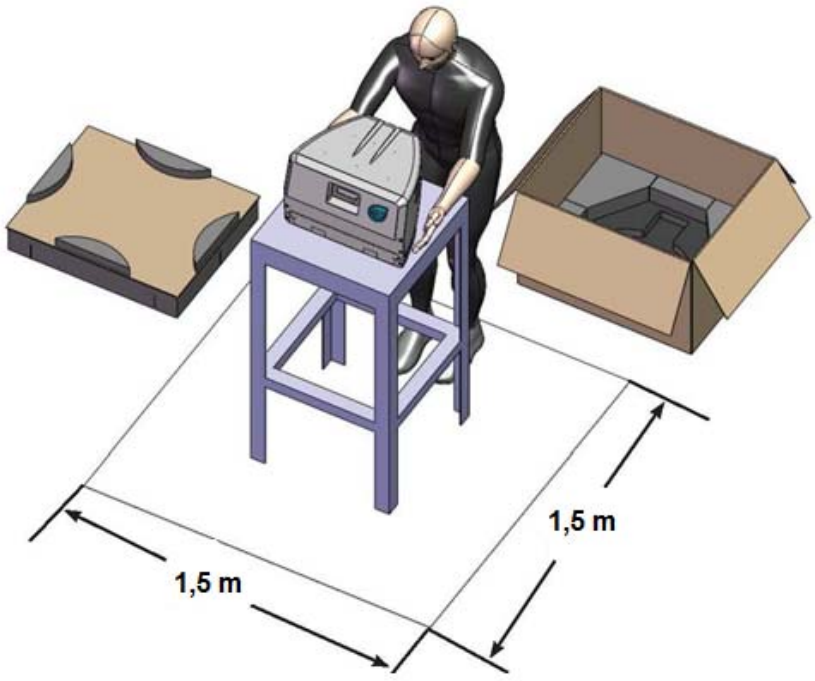


Figure 1-4. BWT ECO-MX Nano Space Requirements

It is recommended that the BWT ECO-MX Nano is installed in a building or protected structure that provides shelter from the weather and extreme temperature variances, and which can be locked or otherwise secured. Physical security is required to ensure that the system is not tampered with and unauthorized persons are prevented from having access to the unit.

Water Quality

Quality and chemistry of the raw water source must analyzed to determine the oxidants' ability to provide the desired disinfection. These factors should be analyzed before the system is sized to calculate the proper system size and appropriate injection rate. Factors such as pH, hardness, temperature, microbial types, turbidity, and so on, vary greatly and affect the oxidant demand of each individual water system and may impact the oxidant production of the BWT system. Oxidant demand can only be accurately determined through an oxidant demand test. (Please contact BWT Corporation or your sales agent regarding this subject or see Appendix D - Procedures "Oxidant Demand Testing".)

Since water quality can vary from season to season, it is important that the "worst case" measures are used in calculating the injection rate. System feed water with hardness greater than 1,7°F must be softened, which enhances the life of the cell, and reduces system maintenance. Refer to the table in Appendix C – Water Quality Parameters for other parameters that affect system performance. Most of these parameters will be below the limits at any give water system, but should be checked nonetheless. If a value is exceeded, depending on which parameter, the substance can be removed. Otherwise, when sizing the system, the distributor must take into account the possibility of decreased chlorine production or increased maintenance. Each parameter is marked according to whether it affects oxidant demand, FAC production or cell life.

Electrical Power

Required power specifications and conditions for a BWT ECO-MX Nano System are as follows:

- Reliable and transient free power
- Proper grounding
- Avoid ground loop conditions
- Avoid power spikes, surges, and brown-outs
- AC single phase and 50 or 60 Hz power
- 110 VAC conventional grounded 3-prong plug (Standard)

Power sources that can cause problems include those that are connected on the same circuits as the BWT system, and that create power spikes, surges, and brown-outs, such as high load start-up devices, including pumps, compressors, welders, and other devices.

NOTE: **Failure of the system that can be traced to a poor power source is not covered under the BWT warranty.**

All BWT systems require a good earth ground, both for personal safety and safety of the system. The surge protection devices inside the system are ineffective without a good earth ground. A common point earth is the green wire in the power cable.

Safety Advisory

All BWT systems require a good earth ground. A neutral is not a substitute for an earth ground. Electrical wiring to all BWT units should be wired on a separate circuit from other power devices, like pumps, etc. BWT cannot be held responsible for systems wired improperly that do not meet UL or National Electrical Code (NEC) requirements. If the system is improperly grounded, the BWT warranty is void. If a local code requires a GFI (Ground Fault Interrupter) circuit breaker, it is the responsibility of the customer to install the GFI to meet local code requirements.

Water Pressure

The BWT ECO-MX Nano utilizes a peristaltic pump to draw water from a non-pressurized water source as feed to the system. If a pressurized water source is provided, a pressure reducing valve (PRV) must be installed on the inlet water line to lower the feed pressure to the unit to around 1-2 psi. Feed water pressures above 10 psi can cause pump blow-by and could cause hose barb connections to leak inside the system. Refer to Appendix E for details on feed water installation to an optional integrated brine/water tank. For system flow rates, refer to specification sheet located at the beginning of the manual.

Temperature Conditions

The ambient air temperature must not, under any conditions, drop below 42°F (6°C) or exceed 120°F (49°C). Temperatures outside of this range can damage the system and render it inoperable, as well as reduce the operating effi ciency.

The feed water temperature must be maintained between 50°F (10°C) and 80°F (27°C). If the water temperature goes below 50°F (10°C), the cell will be rendered inoperable within a short period of time. Temperatures outside of this range need to be addressed with a heater or chiller. If the temperature exceeds the maximum of 80°F (27°C), chlorine production may be affected. At even higher temperatures, the cell and oxidant tubing can be damaged.

NOTE: **Failure of the system that can be traced to improper temperature conditions is not covered under the BWT warranty.**

2 INSTALLATION

The BWT ECO-MX Nano System has been factory tested and must be properly installed per the instructions from this manual. The chapter contains general information about the installation of the BWT Series System.

Safety Advisory

SAFETY PRECAUTIONS AND WARNINGS

- **Ensure that the facility and the installation are in conformance with all codes and standards. Please refer to the BWT Corporation Hydrogen White Paper or your local authority having jurisdiction for more information.**
- **A liquid barrier system is mandatory. Ensure that all hydrogen vent lines slope towards the oxidant tank.**
- **Ensure that no valves, drop legs, or P-traps are in the hydrogen vent lines. Do NOT cross connect vent lines.**
- **Ensure that storage tanks are labeled properly.**
- **Disconnect power before working on the system. Do not reconnect the power to the rear panel until installation is complete.**
- **All BWT Corporation systems require a good earth ground. A neutral is not a substitute for a proper earth ground. Electrical wiring to all BWT Corporation systems should be performed by a certified electrician. The circuit feeding the BWT OSG should be separated from other powered devices.**

Unpacking the BWT ECO-MX Nano System

The BWT ECO-MX Nano System has been carefully packed to avoid shipping and handling damage. Carefully inspect the system for any damage that may have occurred as a result of shipping. After completing a visual inspection, compare ordered items against what was delivered. Should you find anything damaged or missing, contact your BWT distributor or BWT Corporation directly.

To safely unpack the BWT ECO-MX Nano System, complete the following steps and refer to Figure 2-1:

1 Unpack the BWT ECO-MX Nano – the system is shipped inside a shipping box with appropriate protection around the enclosure. Remove the system from its box and place it on a fl at surface.

2 Unpack the Operations Kit – carefully remove the items packed inside the operations kit.

Figure 2-1. Unpacking BWT ECO-MX Nano

External Connections to the BWT ECO-MX Nano System

This chapter will provide you with information and instructions for installing the BWT ECO-MX Nano System as a stand alone system.

NOTE: **Refer to Appendix E for additional installation instructions on mounting the BWT ECO-MX Nano System to an optional integrated brine/water tank.**

Information in this chapter is contained under the following sections:

Electrical:

- Main Electrical Power
- System Fuse
- Oxidant Levels Switch and Connector (pre-installed)
- USB
- Ethernet
- Firmware Update Instructions

Mechanical:

- Water
- Brine
- Oxidant

Normal precautions should be taken with regard to electrical components in the vicinity of a water source. The BWT ECO-MX Nano System should be disconnected from the power source before opening/servicing. High voltage sources may be accessible near the power supply or rear of system with enclosure removed.

Main Electrical Power Connection

The BWT ECO-MX Nano System is pre-wired internally, and supplied with the appropriate power cable that connects to the system on the rear (10 feet, 3-18 AWG) for 110-120 VAC connection. For a 220-240 VAC connection remove plug on end of cord and wire per local electrical requirements. Connections to the electrical service circuit breaker are to be made by a qualified electrician per NEC, UL or local electrical codes.

Fuse

One 8-amp fuse is supplied as the overcurrent protection for the 2.0 lb/day system. One 4-amp fuse is supplied as the overcurrent protection for the 1.0 lb/day system. The fuse holder is mounted on the backpanel located at the rear of the system (see Figure 2-2).

Oxidant Tank Levels Switch and Connector (Supplied and if utilized)

There are two parts to the Oxidant Tank Levels Switch Assembly that are separated by an in-line connector. The first part, which is wired directly to the rear backpanel, has a female 4-pin connector that is routed out of the panel and is a standard offering. See Figure 2-2 and refer to Appendix F Oxidant Tank Level Switch for details on installation.

Safety Advisory

The switch is only required when utilizing an oxidant storage tank and thus the system will not operate and remain in standby mode when an oxidant tank and level switch are not utilized.

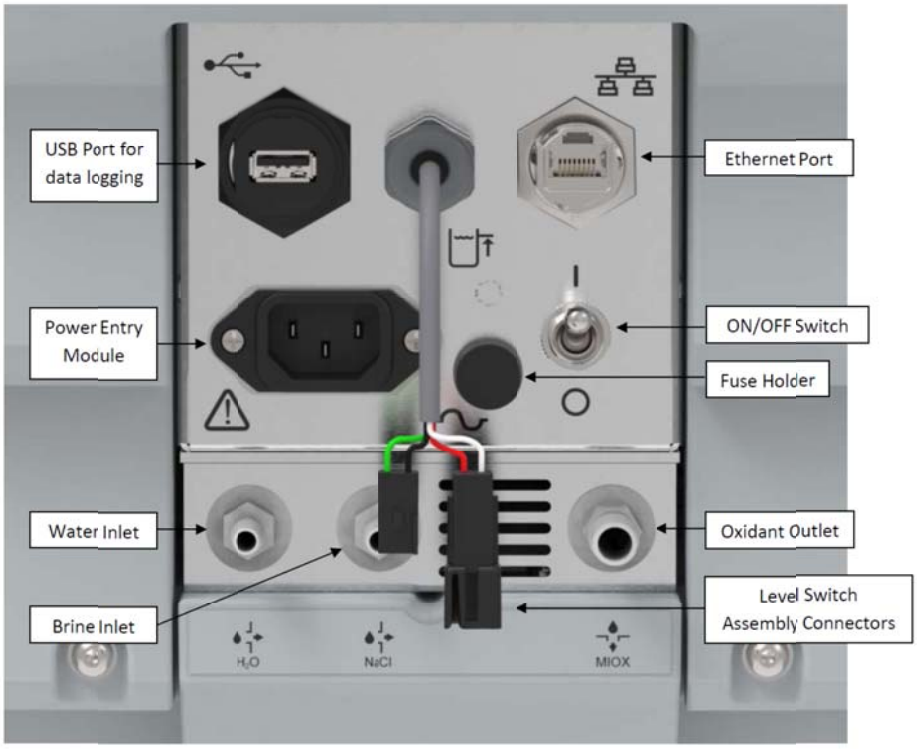


Figure 2-2. BWT ECO-MX Nano Backpanel

USB and Ethernet

The BWT ECO-MX Nano is equipped with dedicated USB and Ethernet ports to facilitate datalogging and remote monitoring. Both ports are pre-wired to the control board. External connection to the USB port is made by removing the protective cap and plugging in a USB memory stick into the port. The most recent date code file will be displayed and should be selected. It will be in the format of month, day, year and is a .CSV file. This file can be opened with Microsoft Excel for viewing the raw data collected during the operational run time. External connection to the Ethernet port is accomplished by removing the protective cap and inserting a RJ45 connector (not supplied) into the Ethernet port. Once a network connection is secure and the system finishes the Priming Cycle, it will indicate on the Display the location of the Ethernet address assigned by the network. It will display model and code version. The system will then enter into a normal Start-up sequence. If external USB/RJ45 cables are used, make certain the lengths of the cables are under 10-feet (3-meters) to eliminate electrical noise being introduced to the system.

Firmware Update Instructions

The following instructions must be completed to load the most recent firmware for the ECO-MX Nano. In the event of an update, BWT will provide the updated code, which must be installed to a laptop or PC in order to synch with the equipment. Once installed, complete the steps below:

1 Ensure unit is turned off; remove Enclosure Clover (see Figure 3-2) and top metal cover such that the control board is accessible. The top metal cover is removed by unscrewing the for self-tapping srews utilizing a 1/4" hex nut driver or wrench.

2 Press and hold the small button located in the middle of the control board labeled as "SW2" and turn on the system. (Refer to Figure 2-4 for location of SW2 button)

3 Verify Ethernet connection is made with laptop/PC and the ECO-MX Nano.

4 Open Windows Explorer and right click on My Network Places: select Properties; right click on Local Area Connection: select Properties. Select Internet Protocol and click Properties tab on menu.

5 Type in the following address: 192.168.1.10 and select OK. Close menu.

6 Launch the application "PIC32UBL.exe" found in directory "C:\PIC32_Bootloaders_V2012_02_29\PC Application"

7 Enable the Ethernet option with default address. (Ensure that the PC can reach this address - steps 4&5)

8 When the program comes up select the "Connect" button.

9 Next click the "Load Hex File" button selecting file "Rio Zuni USB ETH.hex" located in the "C:\Microchip Solutions v2012-02-15\USB\Zuni USB\Firmware" directory or provided by BWT on USB flash drive.

10 Next select the "Erase-Program-Verify" button

11 If the program verifies successfully, select "Run Application". The system should now be ready for operation.

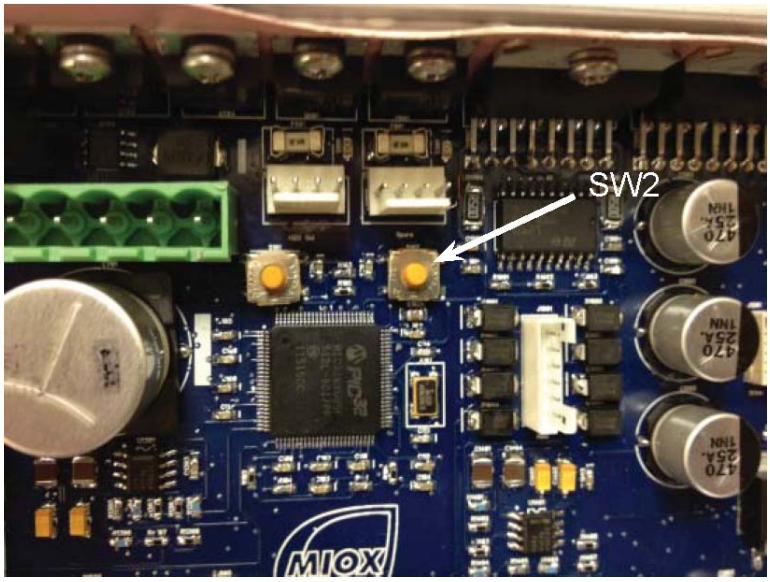


Figure 2-4. BWT ECO-MX Nano Control Board

Auxiliary I/O

The BWT ECO-MX Nano provides one spare I/O port for connection to an external device such as an additional peristaltic pump. Connection to the system is accomplished by replacing the spare plugged port on the rear backpanel with an optional liquid tight pass-through connector. Contact BWT for additional details on incorporating the auxiliary device to the control board.

Feed Water and Brine Connections

The BWT ECO-MX Nano is equipped with two ¼" barb fittings for providing water and brine feed to the system. Connection to each port is accomplished with provided ¼" clear vinyl hose provided in Operations Kit. A 3/8" OD hose clamp is recommended to seal the hose to the barb fitting and prevent leaks. Refer to Figure 2-2 for details on connection to plumbing rear I/O.

Oxidant Line Connection

The BWT ECO-MX Nano is equipped with a 3/8" barb fitting for delivering oxidant from the system to an oxidant tank or direct injection. Connection to the fitting is accomplished with the 3/8" clear vinyl hose provided in the Operations Kit. A 1/2" OD hose clamp is recommended to seal the hose to the barb fitting and prevent leaks. Refer to Figure 2-2 for details on connection to plumbing rear I/O.

Safety Advisory **For direct injection applications, the maximum pressure the BWT ECO-MX Nano System can overcome is around 10-psi.**

NOTE: **Hose dimensions referred to are inside diameters with size given in inches. Tubing dimensions are measured from the outside diameter.**

Initial System Settings and Start-Up

The following sections describe system operational settings and start-up conditions for the BWT ECO-MX Nano System:

Salt Specifications – refer to BWT Salt Guidelines For BWT Generators for details on salt specifications for the BWT ECO-MX Nano.

Initial Salt Filling – refer to Appendix E for details on loading salt into a generic or optional integrated brine/water tank.

System Start-up Checks

This section describes the procedures to follow to start up the system. Checks Prior to Start-Up After the system has been installed, the following items should be checked prior to turning on the system:

1. Hose fi ttings tightened
2. Electrical power connection good (cord plugged in) and is provided per system specifications.
3. Brine tank drain valve in closed position (for generic or integrated brine tanks)
4. Water valves open
5. Brine tank filled with salt to high level (for generic or integrated brine tanks)

BWT ECO-MX Nano System Controls

There is a single toggle switch on the rear backpanel that turns the system ON/OFF. Once triggered the system will go through a priming sequence to prime the brine line up to the brine pump. After priming, the system will start (display will read Starting System) and begin displaying the following performance data:

- Brine Duty (brine pump speed as a %)
- Inlet Water Temp (°F)
- Cell Current (Amps)

Oxidant Temp (°F) The display will then indicate what the mode status is for the system. The list of modes is:

- Starting System
- System Running
- System Shutting Down
- System In Standby
- Cleaning System
- System Stopped

Summary of Controller Start up Sequence

The BWT ECO-MX Nano goes through a start-up sequence that includes water purge and brine pump activation. The automatic controller varies the cell amperage by varying the brine pump speed. If the brine concentration is too high, the brine flow rate is reduced by slowing down the pump; conversely, too low a concentration is corrected by speeding up the pump. The cell amperage will increase until stabilized in the optimal operating range. Anytime the display states “System Running” or the green LED is solid, oxidants are being produced. However, rated capacity is only achieved within the operating window. When the operating window is reached, the BWT cell is producing full strength oxidants and filling the solution tank. The electrolytic cell receives a 1215 VDC potential. This voltage enables the cell to reach the optimum current operating range, indicated by the amperage shown on the display. The amperage should be 10 Amps ± 1.5 A for the 1-lb and 2-lb/day systems. During normal operation, the amperage will fluctuate between the high and low values above. For instances when the brine pump duty reaches 45%, the display will read Check Brine Supply and the LED will flash blue to indicate to the operator that the brine supply is getting low.

NOTE: **This warning will not prevent the system from operating but rather is a forewarning that the brine supply is about to be depleted. Typically this warning will provide a 16-24 hour period (when used with the optional integrated brine/water tank) before the brine is completely depleted and the system faults for High Brine Pump Duty.**

Starting System

The first line on the display will be Starting System and the LED will flash green during the sequence. A timed water purge occurs to pre-flush the cell(s). The brine pump turns on and once the cell(s) reach target current, the LED will remain solid green and the display will show System Running and No Errors.

System Running

The display provides pertinent operation information for each cell. For a two cell configuration (2-lb/day capacity) the display will scroll through Cell #1 Amperage and then scroll through Cell #2 Amperage (if equipped). The system will continue to operate and generate oxidants until it is manually shut off (via ON/OFF switch), faulted or until the oxidant tank high level float is reached and the system enters Standby Mode.

System in Standby

When the high level is reached, the system will enter into a shut-down sequence. After the shut-down sequence is completed, the LED will remain solid blue and the display will scroll Oxidant Tank Full – System in Standby. The system remains in this state until the oxidant level drops below the low-level float. At that point the system re-starts through the start-up process.

Cleaning Cycle

Periodically the system will enter into a self-cleaning cycle to clean the electrodes within the electrolytic cell. The cleaning cycle will occur after 168 hours of operation. The system will enter into a cleaning cycle with a water purge on the front end of the cycle and once the cleaning is complete, a final water purge is activated to push particulates through the cell(s) and into the oxidant tank. Total time for the cleaning process is approximately 5 minutes. During the cleaning cycle the display will indicate Cleaning System.

System Shutting Down

During a shut-down sequence, the brine pump shuts off and the blinking green LED will turn to blinking yellow during the timed water purge cycle. The display will indicate System Shutting Down.

System Stopped

The last mode for the BWT ECO-MX Nano occurs once the shut-down sequence is completed. The display will indicate System Stopped.

Safety Advisory

The oxidants collected should be used as quickly as possible in treating raw water to gain the maximum benefit of their disinfectant power. If the oxidant solution is stored for more than 30 minutes before use, it should be stored in a covered container. Containers for storage should be plastic HDPE. oxidant solution that has been properly stored for up to 5 days can be used for disinfection.

System Shut-Down Procedure

System shut-down is completed by toggling the ON/OFF switch located in the rear of the system from ON to OFF. If the system will be off for a prolonged time period, water and brine feed to the BWT ECO-MX Nano should be isolated and turned off. In addition, tanks and all plumbing lines should be drained. The brine pump should be flushed with fresh water. The system should also be unplugged. If the system is being shut down for the winter, the BWT ECO-MX Nano should be completely drained to prevent accidental freezing of components.

Fault Conditions

The BWT ECO-MX Nano controller is designed to diagnose and correct all irregular conditions prior to sending the system into a fault condition and shutting down. If the system cannot self-correct, then a fault is identified. There are five fault conditions that can occur:

1 High Brine Pump Duty Fault – This condition is the result of insufficient amperage to the cell(s) within the desired time. The system will shut down to prevent production of low concentration oxidant. Possible causes are loss of brine feed to the system, no salt, ruptured brine pump tubing, or loss of electrical connection to the cell(s). If it is verified that no brine is entering the system, the brine line should be inspected back to the brine suction line at the tank (or brine supply) to make sure there are not any obstructions in the line. Refer to Figure AG 1-1 Brine Tank Cross sectional View in the Optional Integrated Brine/Water Tank Appendix.

2 Low Feed Water Temperature – This condition is the result of the inlet water temperature below 50°F (10°C). Possible causes are supply water is too cold or inlet water temperature sensor has failed.

3 Delta Temperature Fault – This condition is the result of oxidant temperature exiting the cell(s) is greater than allotted differential set-point. Possible causes are obstructions in the cell exit plumbing lines or oxidant temperature sensor has failed.

4 Very High Oxidant Temperature - This condition is the result of the oxidant temperature exiting the cell(s) is greater than the maximum temperature set-point. Possible causes are obstructions in the cell exit plumbing lines, oxidant temperature sensor has failed or loss or decrease of water flow.

5 Very High Cell Current – This condition is the result of excessive current to the cell. The system will shut down to prevent damage to the electrolytic cell. Possible causes are loss of water supply to the BWT ECO-MX Nano, ruptured water pump tubing, pinched inlet water line or loss/decrease of water flow.

Problem	**Possible Cause**	**Remedial Action**
Display Reads: VERY HIGH CURRENT (Cell #1 or Cell #2) Explanation: Cell amperage exceeds maximum current rating.	1. Loss of water supply. 2. Blockage of cell exit ports.	1. Check water feed line to RIO Zuni™ System. 2. Turn system off, remove cell exit port disconnects, and remove any obstructions within ports. 3. Toggle 3X for 30 seconds each, let third restart complete.
Display Reads: VERY HIGH CELL OX TEMP (Cell #1 or Cell #2) Explanation: Oxidant temperature exceeds maximum temperature rating	1. Loss of water supply. 2. Blockage of cell exit ports. 3. Temperature sensor failure.	1. Check water feed line to RIO Zuni™ System. 2. Turn system off, remove cell exit port disconnects, and remove any obstructions within ports.
Display Reads: LOW FEED WATER TEMP X□F Explanation: Inlet water temperature below 50□F (10°C).	1. Feed water temperature too low. 2. Temperature sensor failure.	1. Increase feed water temperature above 50□F (10□C) prior to restarting system.
Display Reads: HIGH BRINE PUMP DUTY Explanation: Not enough cell amperage for more than 4 minutes.	1. Low brine concentration. 2. Brine pump air locked. 3. Brine pump locked due to debris. 4. Brine line ruptured or clogged. 5. Controller board failure or brine pump worn out. 6. Cell life depleted.	1. Check the salt, water and brine level in the brine tank. Add salt to the brine tank to salt fi ll level. 2. Verify brine inlet valve is open. Remove the tube on the inlet to the brine pump and purge the air from the brine line. 3. Remove debris from brine pump. 4. Replace peristaltic pump brine line with provided tubing 5. Replace brine pump.

System Troubleshooting Charts

Problem	Possible Cause	Remedial Action
Display Reads: DELTA TEMP CELL **Explanation: Differential temperature across the cell exceeds maximum** rating.	1. Blockage of flow through cell (#1 or #2). 2. Temperature sensor failure.	1. Turn system off, remove cell exit port disconnects and remove any obstructions within the ports. 2. Replace temperature sensor. 3. Verify temperature (inlet oxidant temp).
No Display Visible Explanation: Power not getting to system.	1. Power to system interrupted (blackout, etc.) 2. 15V power supply failure.	1. Check and repair main power source and check external breaker. 2. Check 15V power supply output and fuse with appropriate meter. Refer to Figure 1-2.
Low Chlorine Explanation: BWT system production lower than normal, or chlorine residual in water system below normal.	1. High flow through cell. 2. Cell exit ports blocked. 3. Injection system malfunction. 4. Cell life depleted. 5. Break in water distribution lines. 6. oxidants stored too long before use.	1. Measure fl ow. 2. Replace cell. 3. Check cell amperage, fl ow, chlorine production, and salt consumption. Replace cell if necessary. 4. Check for leaks and repair. 5. Call sales agent or BWT Customer Support. 6. Verify measurements with demand free water.

3 MAINTENANCE

The BWT ECO-MX Nano System requires minimal maintenance to perform properly. Regular maintenance generally consists of adding salt to brine generator and doing periodic preventative checks. However, the system must be watched more closely during the first few weeks of operation, since parts can loosen during shipping and site specific problems will usually become apparent within the first few weeks. BWT Corporation has provided a suggested log (See Figure 3-1. Operator's Maintenance Log Sheet) to maintain a history of system performance and assist with troubleshooting and warranty work. It is recommended that these be kept near the BWT ECO-MX Nano System for easy record keeping.

In order to maintain a history of system performance and assist in troubleshooting and warranty work, a suggested log is shown on the following page. BWT Corporation recommends making several copies of the log sheet and keeping them near the system for easy record keeping.

Operator's Maintenance Log Sheet

BWT ECO-MX Nano serial number: _____
BWT Cell Serial Number: _____

Date	Operator	Brine PumpDuty Cycle(%)	Inlet Water Temperature(F)	Cell #1Amps(A)	Cell #2Amps(A) (if_equipped)	OxidantTemp(F)	BWTSystem Hours	SystemFAC Measured at _____	PoundsSalt Added	Comments

General Periodic Maintenance

The BWT ECO-MX Nano should be monitored periodically to ensure that the system is running properly. BWT recommends the following maintenance tasks are completed at least once a month:

1. Check Salt Level

There must always be ample salt in the brine tank for system use. BWT recommends keeping salt level of at least one foot in the tank at all times.

2. Record Operation Parameters

On the BWT System Log Sheet that is provided, record the date, name of operator, Brine Pump Duty Cycle, Inlet Water Temperature, Cell Amps, Oxidant Temp, System Hours, System FAC, Pounds Salt Added and utilize the Comments section for fault recording or any other abnormal operation.

3. Check for Leaks

Ensure that hoses and fittings are tight and leak-free. Any leaks found can usually be corrected with re-tightening of the hose clamps or with Teflon Tape. Check the brine pump and water pump fittings regularly for seepage and check the connections to verify that there is no salt around the clamp/barb sealing area.

4. Replace Peristaltic Pump Tube

Both brine and water pumps will require periodic tube replacement due to tube wear from the plastic rollers inside the pump head. To replace the tube follow the Install/Removal of Enclosure Assembly Cover to gain access inside the cover assembly and refer to Appendix H and I for details on how the tubes are physically removed and re-installed into the pump head.

Install/Removal of Enclosure Assembly Cover

Prior to removal, turn system OFF and disconnect power cord from power source to fully electrically isolate the system. Locate the four mounting screws on the side and rear of the system with button-head caps. Utilizing a 1/8” Allen wrench, remove the four #10-32 screws and washer hardware and set aside. Vertically lift the cover assembly until it clears the electrical box assembly. Set aside on a flat surface. Refer to Figure 3-2 for details on removing the cover assembly. To install the cover, repeat the above procedure in reverse order, making sure no electrical cables or plumbing lines are pinched during the cover installation.

Figure 3-2. Removing Enclosure Cover

Appendix A - Recommended Tools for Installation

1. Small Flatblade Screwdriver (1/8” wide)
2. Medium Flatblade Screwdriver
3. Medium Phillips Screwdriver
4. Channel Lock Pliers
5. Allen Wrench (Hex Head Wrench) 1/8” (3-mm)
6. Allen Wrench (Hex Head Wrench) 3/16” (5-mm)
7. 1/4” Hex Nut Driver or Adjustable Wrench
8. Tefl on Tape

Appendix B - Recommended Spare Parts

For two years of operation, the following spare parts are provided:

- (1x) of 301-00376 Tube, 1/8”-135, WT6 Pharmed (replacement tube for brine pump)
- (1x) of 301-00377 Tube, 3/16”-2, WT6 Pharmed (replacement tube for water pump)
- 10-ft of 700-01240 Tubing, 3/8” x ½” Clear Vinyl
- 10-ft of 300-00349 Tubing, 3/8” Poly ¼” ID
- (1x) of 400-02549 Fuse, 250V 8A (replacement fuse for 2-lb/day system)
- (1x) of 400-02548 Fuse, 250V 4A (replacement fuse for 1-lb/day system)

Appendix C - Water Quality

Water Quality

Knowing what to look for when sizing a system will help remove hidden surprises after installation. Most of the items on the following list will be below the limits but should be checked nonetheless. Concentrations or measurements in brine feed water and/or treated water that are less than the stated limits are not anticipated to have the stated effect. These factors can affect the oxidant demand of each individual water system, the oxidant production of the BWT system, or the life of the cell itself. It is important to use “worst case” measures since water quality can vary from season to season.

Table AC-1 Water Quality Parameters

	MEASURE	LIMIT	WHAT IS IMPACTED		
			Oxidant Demand	Chlorine Production	Cell Life
Total Hardness **	°F	1,7**		✠	✠
Iron (Fe)**†	mg/L	< 1 mg/L**	✠		✠
Manganese (Mn)	µg/L	< 50 µg/L**	✠	✠	✠
Fluoride (Fl)	mg/L	< 1 mg/L			✠
Silica (SiO_2)	mg/L	< 80 mg/L		✠	✠
Bromide	mg/L	< 50 mg/L			✠
Cynide	mg/L	< 1 mg/L			✠
Lead (Pb)	mg/L	< 2mg/L			✠
Dissolved Sulfides (as H_2S)	mg/L	***	✠		
Ammonia Nitrogen (NH_3-N)	mg/L	***	✠		
Organic Nitrogen (Org - N)	mg/L	***	✠		
Total Organic Carbon (TOC)	mg/L	***	✠		
pH	-	5-9		✠	✠
Water Temperature Range	°F (or °C)	> 50°F < 80°F (> 10°C < 27°C)		✠	✠

**Caution: water softeners will remove these components up to a limit. See references to maximum ferrous iron and manganese in water softener documentation. Total hardness affects cell life only in that higher hardness requires acid washing to remove carbonate deposits from the cell. Use of water softened to < 1,7°F hardness should not require acid washing of the cell.

*** Oxidant demand is affected by any level of H_2S, ammonia or organic nitrogen, or TOC.

† Iron may deposit $Fe(OH)_3$ on the anode, causing an electrical “blind”, which would increase the brine proportion pump signal voltage (brine proportion pump speed) needed for the system to reach the operating window. Chlorine production would remain the same, but salt conversion efficiency will decrease. The same effect is true of silica on the cathode.

Appendix D - Procedures

Oxidant Demand Testing

The oxidant demand of water is a measure of the amount of oxidant needed to properly disinfect water. This value is extremely important for accurately sizing and maintaining BWT equipment. Oxidant demand is determined by adding oxidants in several concentrations to raw untreated (sample) water and measuring the FAC over time.

Equipment Needed

- 100 mL graduated cylinder
- Four (4) 100 mL glass jars with lids
- Pipette that can accurately measure 0.1 mL increments
- Chlorine test kit (i.e. DPD, Color Wheel, Colorimeter, or AccuVac)
- Timer or watch
- Calculator

Identify Starting Range

The initial oxidant demand test should use a 5 ppm dose to identify the correct starting range. If a 5 ppm dose is consumed in less than 30 minutes, the demand of the water is greater than 5 ppm, and the dose rates of 10, 15, and 20 ppm should be used for testing. Conversely, if the 5 ppm dose is only moderately decreased in 30 minutes testing should be performed with 1, 3, and 5 ppm doses.

Use the following formulas to determine the amount of oxidant and sample water to use (based on 100 mL samples).

Dilution Factor (X) = Oxidant FAC / Dose

mL of oxidant = 100 / X

mL of sample water = 100 - (100 / X)

Oxidant FAC is the concentration of oxidant, which varies with each BWT OSG model. The output of each unit should be measured, according to the procedure for Chlorine Testing, to determine the exact concentration of the oxidant and catholyte.

Example:

1. Determine the amount of oxidant and sample water to be used. Always start with start with a 5 ppm dose for the first test. Suppose you are using a BWT OSG that just generated an oxidant solution concentration of 250 ppm. First, you must determine the dilution factor (X): Dilution Factor (X) = Oxidant FAC / Dose = 250 / 5 = 50

2. Determine the volume of oxidant and sample water to be used based on X: mL of Oxidant = 100 / X = 100 / 50 = 2 mL mL of Sample Water = 100 - (100 / X) = 100 -(100 / 50) = 100 - 2 = 98 mL Thus, add 2 mL of oxidants to 98 mL of sample water for the first FAC reading

3. Determine the doses for subsequent measurements.

Dilute the oxidant as determined above, and after 30 minutes, take an FAC reading. If FAC is unmeasurable, all of the oxidants have been consumed, and you need doses of 10, 15, and 20 ppm for subsequent testing; otherwise if FAC has not significantly diminished, use 1, 3, and 5 ppm doses for subsequent testing. In this case, let us assume that the reading was 2.5 ppm after 30 minutes, indicating you should use test doses of 1, 3, and 5 ppm.

Setup Calculations

Use the formulas given above to determine the amount of oxidant and sample water to use (based on 100 mL samples) for each of the doses. The sum of your oxidant and sample water volumes should add up to 100 mL since it provides enough volume for multiple FAC measurements at the various testing times.

Example: Determine the oxidant and sample water volumes for the 1, 3, and 5 ppm doses. Assume the BWT OSG is still generating an oxidant concentration of 250 ppm.

1 ppm 3ppm 5ppm Dilution Factor (X) 250/1 = 250 250/3 = 83.3 250/5 = 50 mL of Oxidant 100/250 = 0.4 100/83.3 = 1.2 100/50 = 2 mL of Sample Water 100-0.4 = 99.6 100-1.2 = 98.8 100-2 = 98

For a 3 ppm dose, 1.2 mL of oxidant should be mixed with 98.8 mL of sample water For a 5 ppm dose, 2.0 mL of oxidant should be mixed with 98 mL of sample water

Procedure

Stagger preparation of each dilution by several minutes to allow enough time for accurate analysis of FAC at each dilution. FAC readings should be taken at the following times: T = 0, 30 minutes, 60 minutes, and 90 minutes. Readings beyond 90 minutes are determined by interpretation of data from the first 90 minutes.

- Accurately measure the volume (mL) of calculated sample water and place in a glass jar.
- Accurately measure the volume (mL) of oxidant required.
- Add oxidant to sample water jar and swirl briefly to mix.
- Immediately measure and record the FAC concentration and time the reading is taken (time = 0).
- Repeat the above steps for the other dilutions, measure each at time = 0 before preparing the next dilution, and then take FAC readings at 30, 60, and 90 minutes. Generate a table similar to the one given in the example below.

Example:

Fill out the table properly and completely. The oxidant solution must be diluted to 1 ppm, 3 ppm, and 5 ppm doses as determined in the previous example. The FAC residual is measured in 30 minute intervals until the chart is filled out as below (measurements are based on assumed tests for this example):

	Sample A (1 ppm)	Time	Sample B (3 ppm)	Time	Sample (5 ppm)	Time
t = 0	0.4	12:00	2.1	12:05	4.0	12:10
t + 30 min	0.08	12:30	2.0	12:35	2.5	12:40
t + 60 min	0.0	1:00	2.0	1:05	2.5	1:10
t + 90 min	0.0	1:30	1.8	1:35	2.4	1:40

Oxidant Demand Determination

After 90 minutes, determine which sample has the FAC residual nearest to the desired residual specified by the water system operator. If a desired residual is unknown, look for a FAC slightly greater than 0.2 ppm, which is usually the standard required by the state.

Subtract the selected FAC reading from the initial FAC dose for the corresponding sample. This signifi es how much of the oxidants were consumed by the water and thus how much of an oxidant demand there is in the sample water.

Example:

Determine the oxidant demand of the water. In this case, let's assume the operator wants a 1.0 FAC residual in the water system. Looking at the bottom row (t + 90 minutes) of the chart filled out above, note that Sample B at
1.8 ppm is closest to the desired residual. The initial FAC dose in this case was 3 ppm, so the oxidant demand of this water is 1.2 ppm (3.0 - 1.8 = 1.2). (This means that the operator must dose at 2.2 ppm (1.2 + 1.0 = 2.2) to achieve his desired residual of 1.0 ppm.

Chlorine Testing

Even though BWT systems produce a oxidant disinfectant, calculating chlorine production alone is the easiest way of checking the performance of a BWT system. A cell yielding a reading of 2500 ppm when it should be reading 3000 ppm may not be old and depleted—the flows may just be high. The following are the steps needed to correctly determine chlorine production.

Equipment Needed

- 250 ml glass beaker
- 500 ml or 1000 ml glass jar with lid
- Pipet that can accurately measure 0.5 ml or 1 ml samples
- Chlorine Test Kit (i.e. DPD , Color Wheel, Colorimeter or AccuVac)
- Chlorine Demand-Free Water (or if not available, Distilled Water will yield approximate values)
- Graduated Cylinder (500 ml)
- Timer or a watch with seconds
- Calculator

Preparing Chlorine Demand-Free Water

Add 5ml of 5.25% bleach into one gallon of distilled water. Shake to mix thoroughly. Allow the water to sit 2 days inside. After 2 days inside, move the water outside where it will be exposed to direct sunlight since ultraviolet light reduces chlorine to chlorides. Test a sample for chlorine and allow to sit longer in direct sunlight if chlorine is present.

Measuring Chlorine Concentration

Note: Use a 1:5000 dilution for BWT ECO-MX Nano systems. (1:5000 ratio would be 1 mL solution added to 5000 mL water or .5 mL solution to 2500 mL water.)

1 Fill the 250 mL beaker with approximately 200 ml of oxidant solution.

2 Rinse the jar several times with chlorine demand-free water and then fill to the 1000 mL or 2000 mL line.

3 Rinse the pipet several times by drawing in several mL of oxidant solution and discarding it.

4 With the pipet, accurately measure the solution sample needed and add to the jar containing demand-free (or distilled) water.

5 Cap and shake the jar several seconds to mix thoroughly.

6 Using the solution from the jar, take a reading by following the directions provided with the test kit.

7 Multiply this value by the dilution ration used. (For example, if the chlorine reading was .75 ppm and the dilution ration was 1:5000, the chlorine concentration would be .75 x 5000 = 3750 ppm.)

8 Repeat this process three times, take the average of these readings and assign this value to X.

Measuring Flow

The cell output flow will be approximately 2.7 gph or the 2.0 lb system. To determine exact flow, remove the tubing that feeds the day tank and allow flow to stabilize into a bucket for 30 seconds or so. With a graduated cylinder at the same elevation as the end of the tubing, insert into the graduated cylinder for exactly 30 seconds. Assign this reading to F in the equation below to determine the flow of solution (Y) in GPH:

$$Y = F \frac{\text{ml}}{\text{30 seconds}} \times \frac{\text{60 seconds}}{\text{1 minute}} \times \frac{\text{60 minutes}}{\text{1 hour}} \times \frac{\text{1 liter}}{\text{1000 ml}} \times \frac{\text{1 gal}}{\text{3.79 liters}}$$

OR

Y=(F)0.0316

Calculating Chlorine Production

Chlorine production is a function of concentration and flow. To calculate daily chlorine production (Z) in lbs:

$$Z = F \frac{\text{mg}}{\text{liter}} \times \frac{\text{3,79 liters}}{\text{1 gal}} \times Y \frac{\text{gal}}{\text{hour}} \times \frac{\text{24 h}}{\text{1 day}} \times \frac{\text{1 lb}}{\text{454000 mg}}$$

OR

Z = (X)(Y)0.0002

Where the sample solution variables are:

X = ppm (mg/L) chlorine concentration

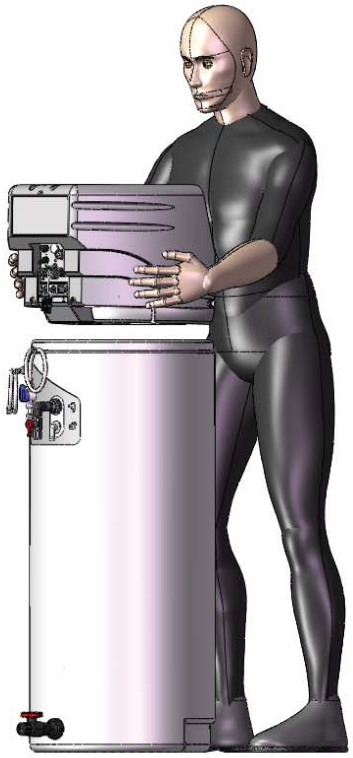
Y = gph flow

Appendix E - Optional Integrated Brine/Water Tank Assembly

Installation/Removal of ECO-MX Nano System to/from Integrated Brine/Water Tank

The BWT ECO-MX Nano System can be ordered with an optional, integrated brine/water tank assembly. This assembly provides a continuous brine and water supply for oxidant generation. The BWT ECO-MX Nano System is designed to nest on top of the optional Integrated Brine/Water Tank. The tank outer diameter will fit inside the bottom of the BWT ECO-MX Nano System. Place the system on the tank. Position the system and tank so the rear inlet and outlet connections face the same direction and the tubing can be routed easily to each. See Figure AE1-1. A plastic ¼-20 x 1.5" long socket head cap screw and nut are provided to lock down the system to the tank and prevent it from rotating. The holes for installing the screw and nut are located on the front of the unit. A 3/16" Allen wrench or hex is required for tightening the screw.

The tank has an inlet water connection that provides water to both the BWT ECO-MX Nano System and the brine tank. The inlet water connection is a ¼" PVC valve with a female NPT. BWT also provides a 3/8" JG quick disconnect tube fitting and a ¼" barb fitting for either inlet termination. BWT recommends using the JG disconnect in applications where

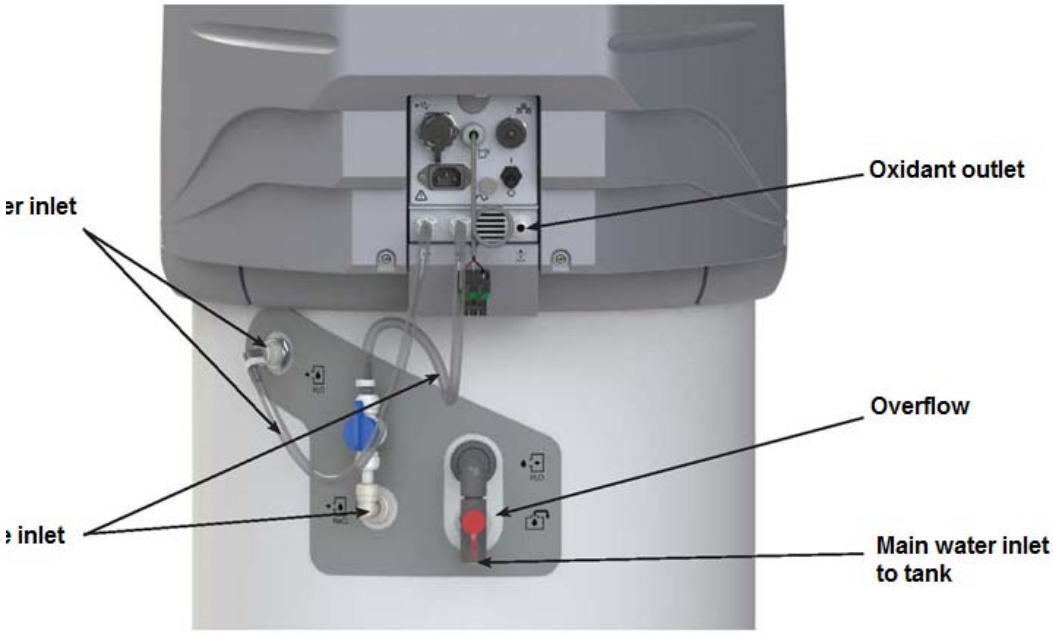


feed water pressure is above 30 psi. The overflow port is a 3/8" barb fitting that should be routed to a drain. A ½" PVC valve is provided for tank draining and maintenance. The brine/water tank is provided with an identification label with symbols that should be used to route the plumbing lines from the tank to the OSG. Refer to Figure AE 1-2.

Once the inlet water reaches the tank, it splits into two paths:

• Water stillwell fl oat assembly

Figure AE 1-2. BWT ECO-MX Nano Rear View (with optional tank)



• Brine stillwell fl oat assembly

The water stillwell float assembly has a water suction line that must not interfere with the float valve on the inside of the stillwell.
This suction line is routed to a quick-disconnect bulkhead fitting at the tank wall. The other end of the bulkhead connects to the BWT ECO-MX Nano System inlet water fitting on the rear of the unit.

The brine stillwell float assembly maintains the tank brine level. The means of brine delivery from the tank to the system is provided by the 3/8” PE tube that is routed through the plastic false bottom base. The 3/8” suction line is connected to a John Guest quick-disconnect fitting. A polypropylene mesh is fastened to the top of the base opening to facilitate maintenance. The suction line is routed to a quick-disconnect bulkhead fitting at the tank wall. An in-line valve is provided outside of the brine tank to isolate the brine line before entering into the BWT ECO-MX Nano System. In the event that the BWT ECO-MX Nano System needs to be removed from the tank, closing the valve will maintain the brine level and prevent accidental loss of brine prime. The brine line is routed from the valve to the brine inlet fitting on the rear of the unit. Refer to Figure AE 1-3 for further details on the floats and water/ brine lines.

It is recommended that the tank assembly is filled with water prior to adding any salt to verify the fl oat assemblies close and prevent leakage from either brine or water fl oat assembly. Once the floats are verified, drain the water to the halfway point on the tank so that when salt is added the water doesn’t overflow. Also be careful in not overfilling the tank with salt. Too much salt can reach the inside of the brine stillwell float assembly (lower stillwell inside brine tank) and prevent brine float from closing. Also make sure either float does not touch the inside of the stillwell wall. The integrated brine/water tank, provided as an option, has an approximate tank volume of 40 gallons (151 Liters) and can be filled with 250 lbs (113-kg) of dry salt if the tank is empty. When loading the tank with salt, it is recommended to use enough salt so that the salt fill line is approximately 1” (25.4 mm) below the bottom of brine stillwell. This ensures the salt level will not interfere with the brine float inside the brine stillwell.

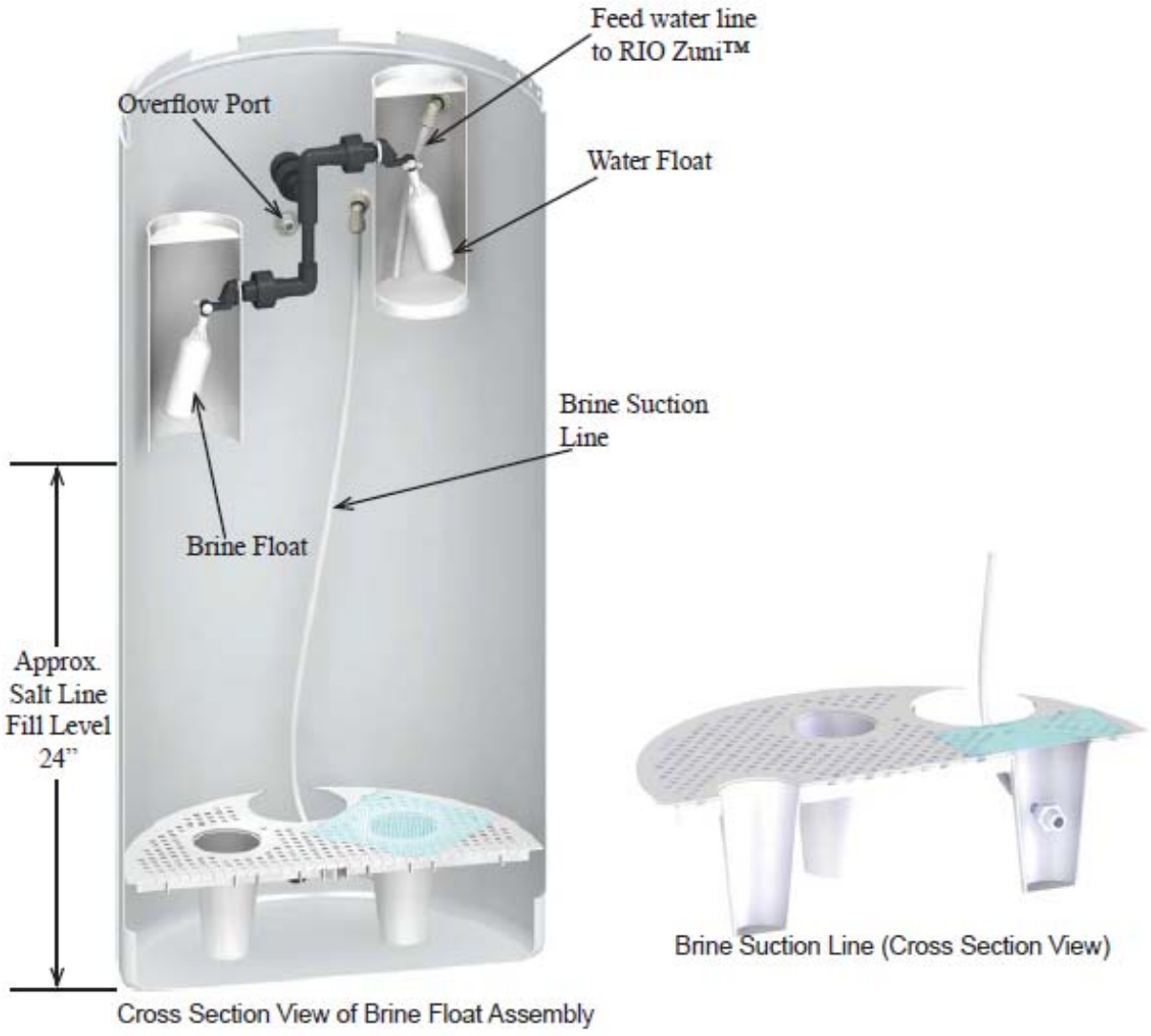


Figure AE 1-3. Brine Tank Internal Components

Appendix F - Optional Oxidant Tank Installation

NOTE: **The following section describes the installation for an oxidant tank. The tank can either be provided by BWT, as an option, or can be supplied by others. However the following section must be followed to ensure proper and safe installation with regards to Hydrogen safety, regardless of the provider.**

Safety Advisory

The specifications in BWT Corporation's Hydrogen Safety White Paper must be read before installation of oxidant tanks begins. Any deviation from these specifications may result in damage to person or property.

The oxidant tank is designed as a holding tank for the oxidant, and consists of the tank, drop tube assembly, vent assemblies, level switch, and safety placards.

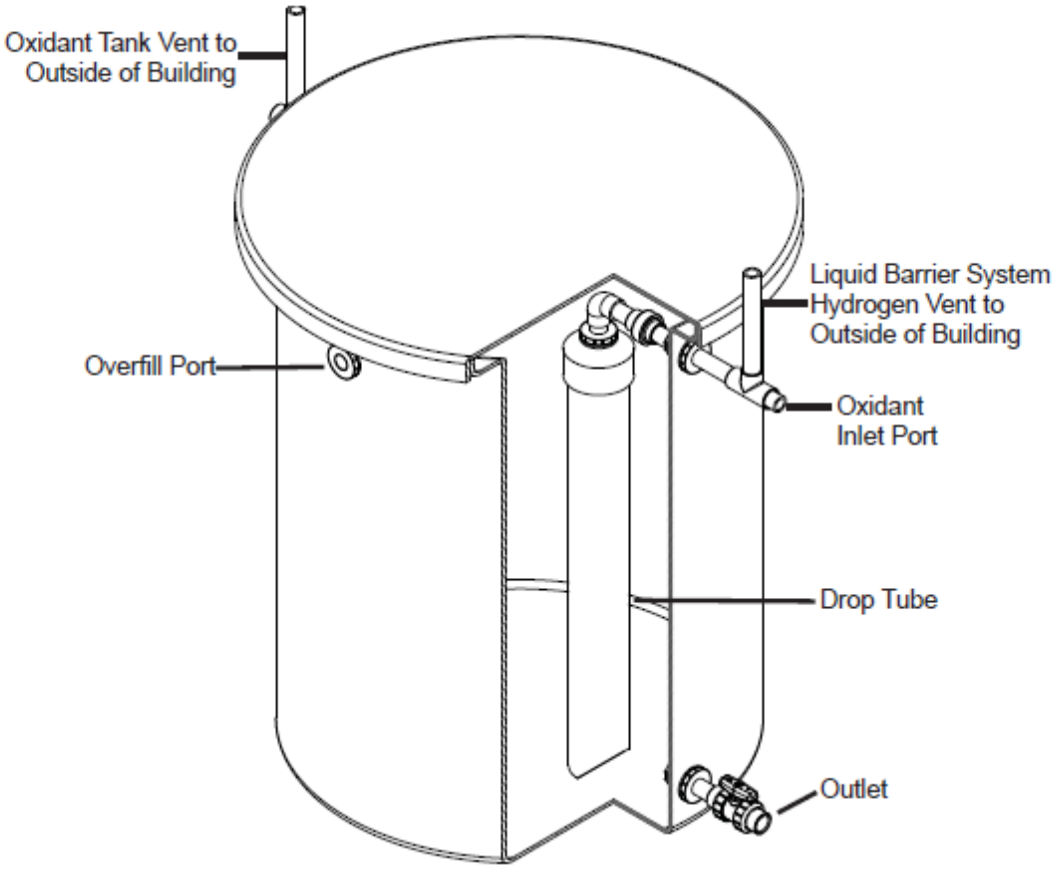


Figure AF 1-1. Oxidant Tank

Ventilation Requirements

BWT Corporation oxidant tanks require a drop tube and two vents, a Liquid Barrier System (LBS) hydrogen vent and the Oxidant Tank hydrogen vent (*Figure AF 1-1*). A drop tube assembly and LBS vent assembly are shipped with the oxidant tank. The user is responsible for supplying Schedule 80, CPVC piping to attach to the top of the LBS vent tee and for the Oxidant Tank vent. Vents must be installed with a minimum drain slope of 0.5 in. per foot (1.3 cm per meter), sloping towards the tank. If the oxidant tank is not supplied by BWT Corporation, a drop tube assembly and LBS vent assembly must be fabricated on-site.

All oxidant tanks must have a properly installed LBS vent and Oxidant Tank vent to operate safely. An optional Dilution Air System can be supplied upon request or on large installations, a combination stand pipe and Dilution Air System can be used. Please refer to BWT Corporation's Hydrogen Safety White Paper.

Safety placards are required on oxidant tanks and are attached to all oxidant tanks shipped directly from BWT Corporation. Oxidant tanks shipped directly from the tank manufacturer must have the BWT supplied safety placards attached to the outside wall of the oxidant tank per supplied guidelines and instructions.

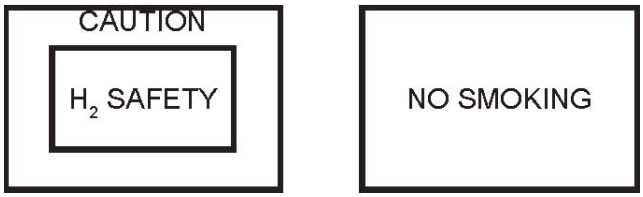
BWT oxidant tanks require that they be vented to the atmosphere outside the facility. Proper configuration of vent assemblies (Figure AF 1-2) is vital to ensure safety.

Safety Advisory

Safety placards signs are required on ALL HYDROGEN VENT OPENINGS external to the building. Refer to BWT CORPORATION'S HYDROGEN SAFETY WHITE PAPER.

Safety placards required on ALL hydrogen vent openings external to building

Hydrogen Vent Orientations



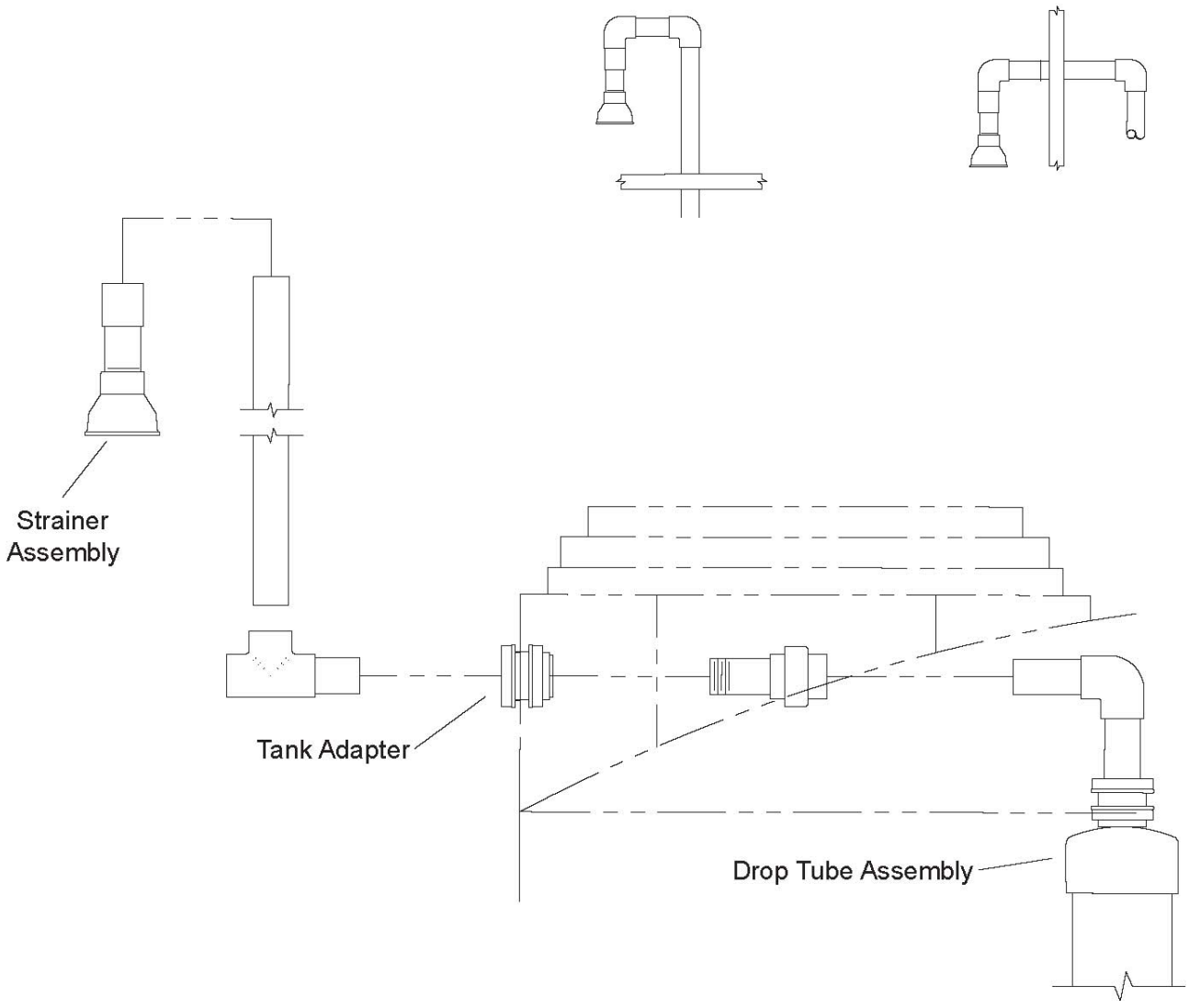


Figure AF 1-2. Ventilation Requirements

Feed Line Connection

The valve at the bottom of the oxidant tank provides oxidant to the water system for purposes of disinfection. Oxidant can be injected into the water system with a chemical feed pump or the oxidant pump provided as an option with the BWT ECO-MX Nano. The pump is typically mounted in a side stream of the main water line. The injection system should be designed by a qualified engineer, BWT Corporation distributor, or salesperson.

Overfl ow Port

A 1/2” overflow port connection fitting has been provided at the top of the oxidant tank. This should be piped to a drain or other suitable discharge outlet.

Appendix G - Oxidant Tank Level Switch

The levels switch is also a standard offering in the Operations Kit but is optional for installation into an oxidant tank. The level switch measures the level of oxidants in the solution tank, signaling to the BWT system when to resume production of oxidants and when to cease production of oxidants and go into standby. The switch functions with an upper float, which indicates a full tank, and a lower float, which indicates low level. When the oxidant solution tank is dry, the switch is Normally Closed (NC) with both floats in the down position. Within each float is a reed switch to signal the BWT system. Operation of the level switch can easily be checked with a multimeter that has continuity or resistance (ohms).

Level Switch Installation

The level switch cable assembly provided is wired to the BWT ECO-MX Nano unit with an in-line connector at the rear of the enclosure assembly. The level switch mating half is connected to a pre-assembled cable with an in-line 90° ½" PVC elbow that will connect to a ½" bulkhead tank adapter in the oxidant tank. The mating half does not have the connector installed to allow the cord assembly to pass through the tank adapter and retaining nut. Refer to Figure AG 1-2 Level Switch Connector.

Figure AG 1-1. Level Switch Connector

1 Feed the electrical cord through the elbow and out of the tank.

2 Tape the male end of the street elbow and thread it inside the oxidant tank into the 7/8” tank adapter at the top of the tank.

3 Tape the male end of the liquid level switch and thread it into the female end of the street elbow. Hand tighten. Connect the two mating halves of the connector (which is located on the rear of the BWT ECO-MX Nano). Refer to Figure 1-2.

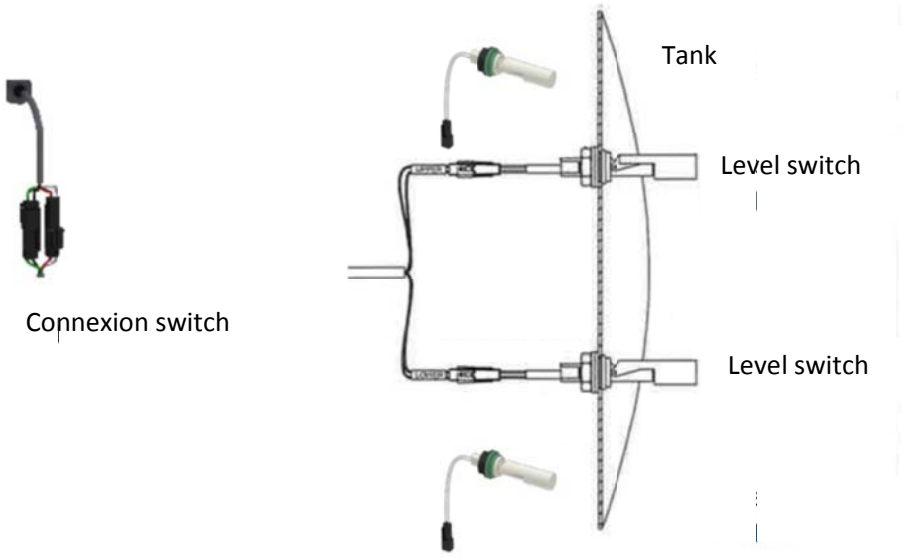


Figure AG 1-2. Oxidant Tank Level Switch Installation

Checking Operation

Before checking the electrical circuit, visually inspect the level switch for build-up or blockage that might be preventing proper motion of the floats. Also verify that the floats are properly limited in motion (should not move more than 0.5 inches). Next, locate the three wires coming out of the top of the level switch, and verify that all are corrosion-free:

- Black—Common
- Red—Bottom Switch
- White—Top Switch

To check electrical function, the probes of the multimeter can be touched either to the connector pins in the junction box or directly to the level switch wires, after disconnecting the wires from the junction box.

Bottom Switch:

To measure the circuit for the bottom switch, touch the black probe of the multimeter to the black wire on the level switch, and touch the red probe of the multimeter to the red wire on the level switch. The circuit should be closed when the bottom switch is down, regardless of the position of the top switch. To create an open circuit, toggle the bottom switch to the up position. Again, toggling the top switch should not affect the circuit.

Top Switch:

Continue touching the black probe to the black wire, and move the red probe of the multimeter to the white wire of the level switch. The circuit should be closed when the top switch is down, regardless of the position of the bottom switch. To create an open circuit, toggle the top switch to the up position. Again, toggling the bottom switch should not affect the circuit.

If the multimeter does not indicate a closed circuit when the instructions above are followed, the level switch is damaged. Contact your sales agent or BWT Corporation Customer Support for a new level switch.

Black – White (Top Switch): Black – Red (Bottom Switch):	Closed (↓) Closed (↓)	Closed (↓) Open (↑)	Open (↑) Closed (↓)	Open (↑) Open (↑)
BWT System Interpretation:	Tank is dry (system will begin operation)	Tank is fi lling (system is operating) or is in standby (tank is being drained)	System fault (impossible configuration)	System is in standby (tank just filled and is starting to drain)

Appendix H - Water Pump

Welco Peristaltic Tubing Pump Instruction Manual -

WP1000 Series

Pump Your Needs

WELCO

NOTE: **The following has been taken from the Welco Peristaltic Tubing Pump Instruction Manual. The whole manual has not been included. Only the pages that relate to the part/equipment used are included below.**

Instruction Manual
Peristaltic Tubing Pump

WP1000 Series

⚠ Caution	This symbol indicates information that, if ignored or applied incorrectly, creates the possibility of minor or moderate personal injury or property damage.

Tube fitting type: Descriptions & Sizes

W4

- Connectable hose sizes (OD)
  1/4"(6.4mm) or 6mm
- Available pump tube sizes & pump series
  WP1000: 1/8"(3.2mm), 4mm, 3/16"(4.8mm)
  WP1100: 3/16"(4.8mm),1/4"(6.4mm)

Fitting consists of compression nut, sleeve and insert. Supports various hose hardnesses.

WM3

- Connectable hose sizes (OD)
  3mm
- Available pump tube sizes & pump series
  WP1000: 1/16"(1.6mm), 3/32"(2.4mm), 1/8"(3.2mm)
  WP1100: N/A

Fitting consists of compression nut and sleeve.
Supports various hose hardnesses
Nut and sleeve will vary according to hose size.

WM4

- Connectable hose sizes (OD)
  4mm
- Available pump tube sizes & pump series
  WP1000: 1/16"(1.6mm), 3/32"(2.4mm), 1/8"(3.2mm)
  WP1100: N/A

Fitting consists of compression nut and sleeve. Supports various hose hardnesses
Nut and sleeve will vary according to hose size.

J8

- Connectable hose sizes (OD)
  1/8"(3.2mm) (Nylon or Polyethylene)
- Available pump tube sizes & pump series
  WP1000: 3/32"(2.4mm), 1/8"(3.2mm)
  WP1100: N/A

Nut and sleeve are integrated. Excellent workability.
Suitable for polyethylene, nylon and other plastic hoses.

J4

- Connectable hose sizes (OD)
  1/4"(6.4mm) (Nylon or Polyethylene)
- Available pump tube sizes & pump series
  WP1000: 1/8"(3.2mm), 4mm, 3/16"(4.8mm)
  WP1100: 3/16"(4.8mm),1/4"(6.4mm)

Nut and sleeve are integrated. Excellent workability.
Suitable for polyethylene, nylon and other plastic hoses.

WI6

- Connectable hose sizes (OD)
  6mm (Nylon or Polyethylene)
- Available pump tube sizes & pump series
  WP1000: 1/8"(3.2mm), 4mm, 3/16"(4.8mm)
  WP1100: 3/16"(4.8mm),1/4"(6.4mm)

Nut and sleeve are integrated. Excellent workability.
Suitable for polyethylene, nylon and other plastic hoses.

WT6

- Connectable hose sizes (OD)
  6mm (Note: ID size)
- Available pump tube sizes & pump series
  WP1000: 1/8"(3.2mm), 4mm, 3/16"(4.8mm)
  WP1100: 3/16"(4.8mm),1/4"(6.4mm)

Barbed type.
Inserted directly into hose and used.

N or Blank

- Connectable hose sizes (OD)
  N/A
- Available pump tube sizes & pump series
  WP1000: 1/8"(3.2mm), 4mm, 3/16"(4.8mm)
  WP1100: 3/16"(4.8mm),1/4"(6.4mm)

No fitting. For the case in which a customer connects their own original fitting, or when using a special length pump tube.
Note: If the pump tube has a large diameter, the flow rate tolerance should be increased.

■ Selection methods for tube pump model numbers

WP10	-	P	1/8	S	4	-	W4	-	C	P
①		②	③	④	⑤		⑥		⑦	⑧

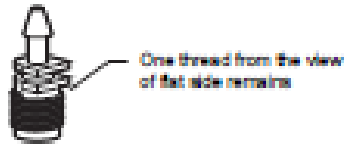
① Series name : WP10 / WP11
② Pump tube type : S / X / Y / L / P / N / F / W
③ Pump tube size : 1/16"(1.6mm), 3/32"(2.4mm), 1/8"(3.2mm), 4mm, 3/16"(4.8mm), 5mm, 1/4"(6.4mm)
④ Gear motor type : S / M / L / DS / DM /CM / CL / FA / FB / EE / EF / B(not included)
⑤ Number of rollers : 2 / 4
⑥ Tube fitting type : W4 / WM3 / WM4 / J8 / J4 / WI6 / WT6 / N or Blank
⑦ Color variation : B...Blue / C...Clear / R...Red / G...Green / Y...Yellow
⑧ Optional panel : P...with optional panel / N or Blank...without optional panel

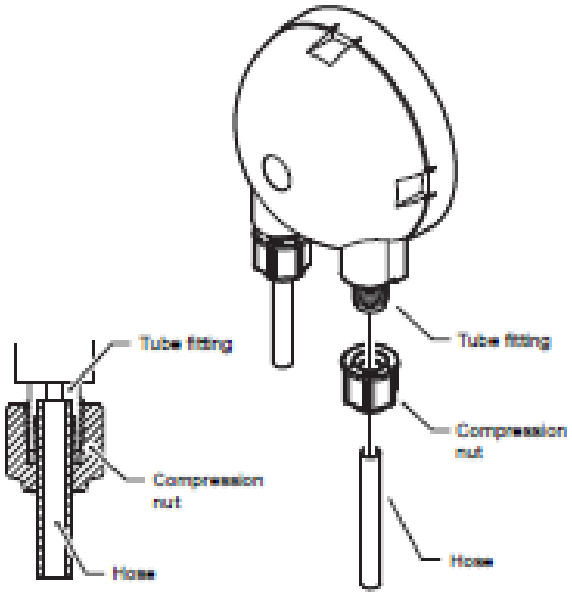
Connecting hose and Pump

■ Tube fitting type J8 / J4 / WI6

1) Set hose into compression nut.
The edge of hose must be flat.

2) Tighten compression nut with pressing hose to Tube fitting. Compression nut should be tightended until one thread (view from flat side) of Tube fitting is remained.



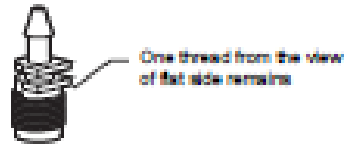


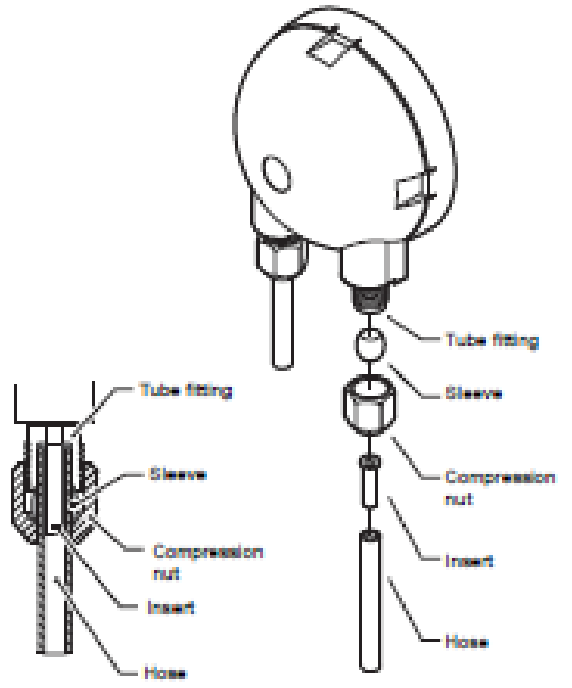
■ Tube fitting type W4 / WM3 / WM4

1) Set hose into compression nut, sleeve.
Set insert to the hose.
The edge of hose must be flat.

2) Tighten compression nut with pressing hose to Tube fitting. Compression nut should be tightended until one thread (view from flat side) of Tube fitting is remained.

Note : WM3 and WM4 do not use Insert.





⚠ Caution

Above mentions are in case of first-time connecting operation. Multiple connecting / disconnecting operations may occur liquid leak or looseness due to distortion of parts and hose.
When compression nut can not hold hose absolutely, replace each parts

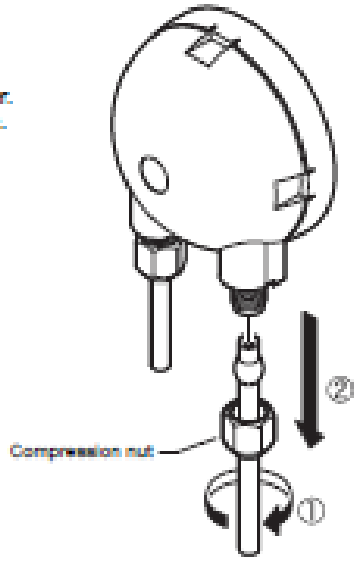
Replacement of Tube assembly

■ Disconnecting hoses

Before replacement...
- Buy correct replacement tube assembly based on Pump model number.
- Grease is specified by each Tubing materials. Do not use other grease.

1) Disconnect the Inlet / outlet hoses.

2) Run Pump shortly to squeeze out liquid in the Tubing.

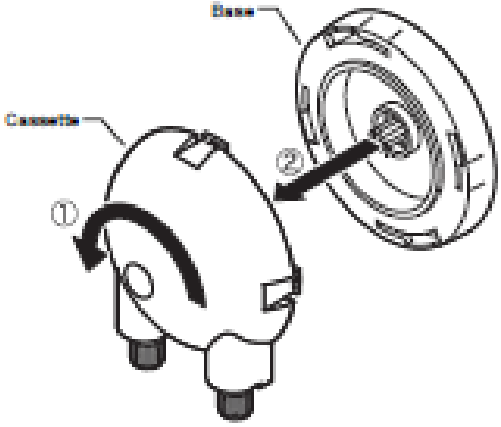


⚠ Caution

- Be careful for spilling or remaining liquid in the Tubing while operating replacement of Tube assembly.
- Do not recycle connecting parts (e.g. compression nut), use attached new parts.

■ Remove Pump cassette

Twist Cassette to counterclockwise until it stops, and pull out Cassette.

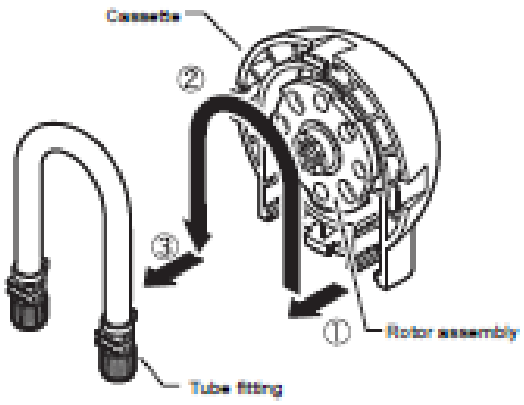


■ Remove Tube assembly

1) Remove the one Tube fitting from Cassette, by pulling out vertically.

2) Pull out tubing from Cassette.
Take care not to lose Rotor assembly.

3) Remove the other Tube fitting from Cassette.

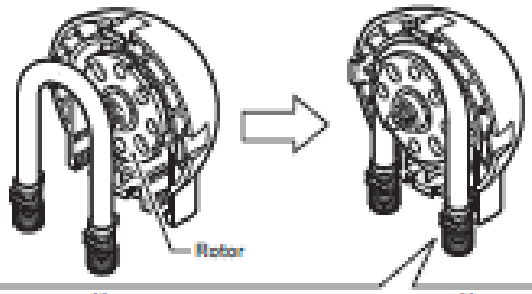


■ Install new Tube assembly

1) Apply the grease attached with Tube assembly set.
(See gray area of below illustration)

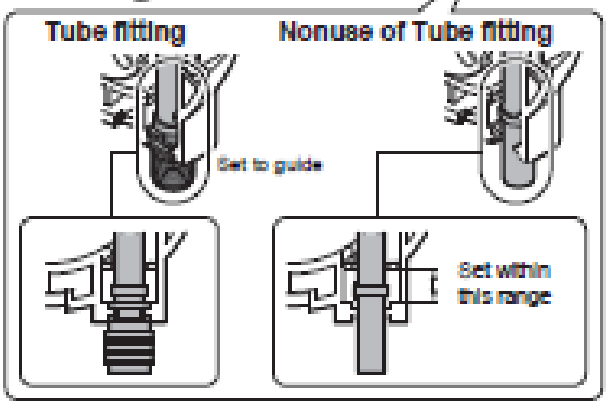
2) Pull up Rotor a little and insert Tubing between the inside of Cassette and Rotor.
(See right illustration)

3) Insert Tube fittings to the guides of Cassette until the end. (See lower - right illustration)



⚠ Caution

Grease is specified by each Tubing materials.
Do not use other grease.

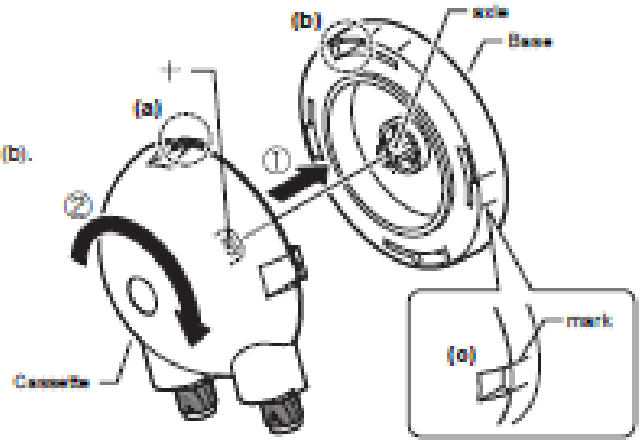


■ Install Cassette to Base

1) Rotate Rotor so that the axle of geared motor connect smoothly to the central mark "+".

2) Attach Cassette onto Base with placing (a) and (b).

3) Verify all (a) tabs set into (b) holes.
Twist Cassette clockwise until the end.
When installation is correct, the edges of (a) conform to the marks on Base as (c).

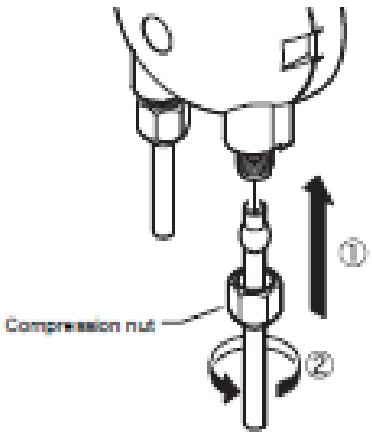


■ Connecting hose to Pump

Connect hoses to Pump same as Page 12.

⚠ Caution

Do not recycle connecting parts (e.g. compression nut), use attached new parts.



Appendix I - Brine Pump

Welco Peristaltic Tubing Pump Instruction Manual -

WPX1 Series

Pump Your Needs

WELCO

NOTE: **The following has been taken from the Welco Peristaltic Tubing Pump Instruction Manual. The whole manual has not been included. Only the pages that relate to the part/equipment used are included below.**

Instruction Manual
Peristaltic Tubing Pump

WPX1 Series

⚠ Caution	This symbol indicates information that, if ignored or applied incorrectly, creates the possibility of minor or moderate personal injury or property damage.

■ Tube fitting type: Descriptions & Sizes

W4

- Connectable hose sizes (OD)
  1/4"(6.4mm) or 6mm
- Available pump tube sizes & pump series
  1/8"(3.2mm), 3/16"(4.8mm)

Fitting consists of compression nut, sleeve and insert. Supports various hose hardnesses.

WM3

- Connectable hose sizes (OD)
  3mm
- Available pump tube sizes & pump series
  1/16"(1.6mm), 3/32"(2.4mm),1/8"(3.2mm)

Fitting consists of compression nut and sleeve.
Supports various hose hardnesses
Nut and sleeve will vary according to hose size.

WM4

- Connectable hose sizes (OD)
  4mm
- Available pump tube sizes & pump series
  1/16"(1.6mm), 3/32"(2.4mm),1/8"(3.2mm)

Fitting consists of compression nut and sleeve. Supports various hose hardnesses
Nut and sleeve will vary according to hose size.

J8

- Connectable hose sizes (OD)
  1/8"(3.2mm) (Nylon or Polyethylene)
- Available pump tube sizes & pump series
  1/16"(1.6mm), 3/32"(2.4mm),1/8"(3.2mm)

Nut and sleeve are integrated. Excellent workability.
Suitable for polyethylene, nylon and other plastic hoses.

J4

- Connectable hose sizes (OD)
  1/4"(6.4mm) (Nylon or Polyethylene)
- Available pump tube sizes & pump series
  1/8"(3.2mm), 3/16"(4.8mm)

Nut and sleeve are integrated. Excellent workability.
Suitable for polyethylene, nylon and other plastic hoses.

WI6

- Connectable hose sizes (OD)
  6mm (Nylon or Polyethylene)
- Available pump tube sizes & pump series
  1/8"(3.2mm), 3/16"(4.8mm)

Nut and sleeve are integrated. Excellent workability.
Suitable for polyethylene, nylon and other plastic hoses.

WT6

- Connectable hose sizes (OD)
  6mm (Note: ID size)
- Available pump tube sizes & pump series
  1/8"(3.2mm), 3/16"(4.8mm)

Barbed type. Inserted directly into hose and used.

N or Blank

- Connectable hose sizes (OD)
  N/A
- Available pump tube sizes & pump series
  1/16"(1.6mm), 3/32"(2.4mm),1/8"(3.2mm), 3/16"(4.8mm)

No fitting. For the case in which a customer connects their own original fitting, or when using a special length pump tube.
Note: If the pump tube has a large diameter, the flow rate tolerance should be increased.

■ Selection methods for tube pump model numbers

WPX1	-	P	1/8	S	4	-	W4	-	C	P
①		②	③	④	⑤		⑥		⑦	⑧

① Series name : WPX1
② Pump tube type : S / X / Y / L / P / N / F / W
③ Pump tube size : 1/16"(1.6mm), 3/32"(2.4mm), 1/8"(3.2mm), 3/16"(4.8mm) Note: Internal diameter
④ Gear motor type : S / M / L / DS / DM /CM / FA / FB / B(not included)
⑤ Number of rollers : 2 / 4
⑥ Tube fitting type : W4 / WM3 / WM4 / J8 / J4 / WI6 / WT6 / N or Blank
⑦ Color variation : B...Blue / C...Clear / R...Red / G...Green / Y...Yellow
⑧ Optional panel : P...with optional panel / N or Blank...without optional panel

Replacement of Tube assembly

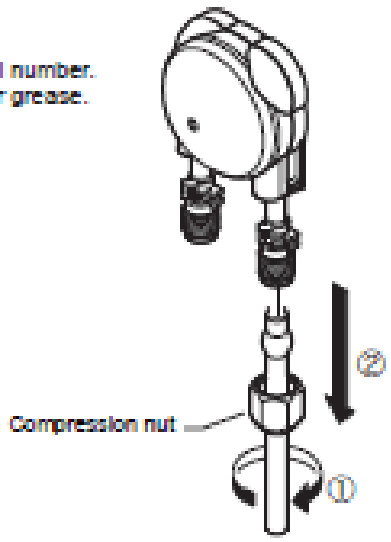
■ Disconnecting hoses

Before replacement...

- Buy correct replacement tube assembly based on Pump model number.
- Grease is specified by each Tubing materials. Do not use other grease.

1) Disconnect the inlet / outlet hoses.

2) Run Pump shortly to squeeze out liquid in the Tubing.



⚠ Caution

- Be careful for spilling or remaining liquid in the Tubing while operating replacement of Tube assembly.
- Do not recycle connecting parts (e.g. compression nut), use attached new parts.

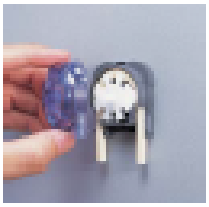
■ Remove Pump cap

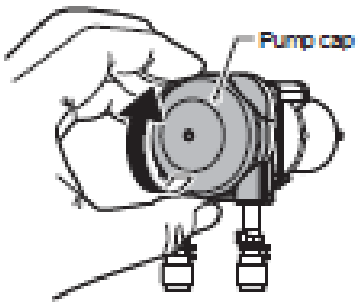
Hold and open Pump cap from the bottom side by the pressure of finger. (Recommend thumb holds bottom side.)
Then Rotor assembly and Tube assembly may be removed and dropped together. Take care not to lose these parts.

1

2

3

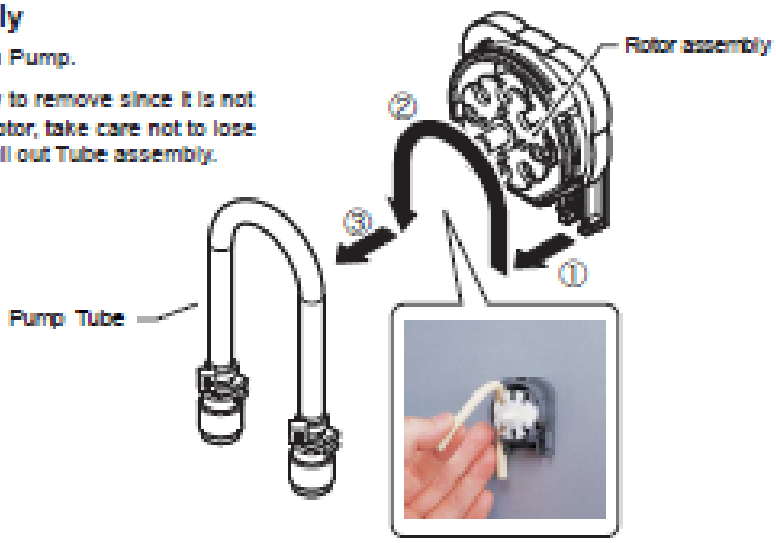




■ Remove Tube assembly

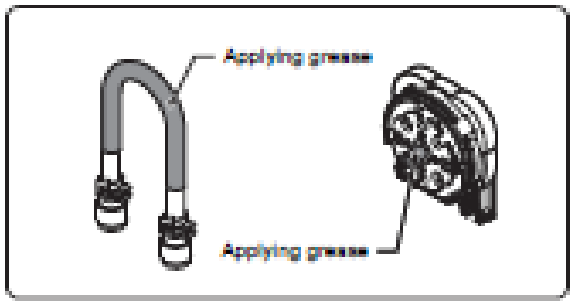
Remove Tube assembly from Pump.

Note: Rotor assembly is easy to remove since it is not fixed to the axle of geared motor, take care not to lose Rotor assembly when you pull out Tube assembly.



■ Install new Tube assembly

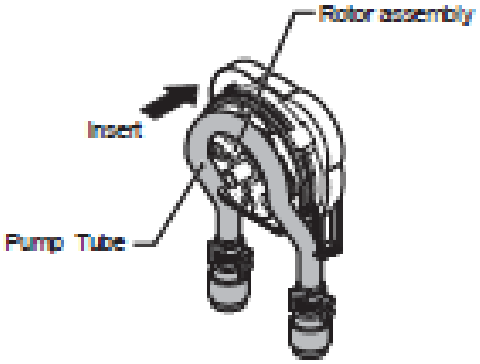
1) Apply the grease attached with Tube assembly set.
(See gray area of right illustration)



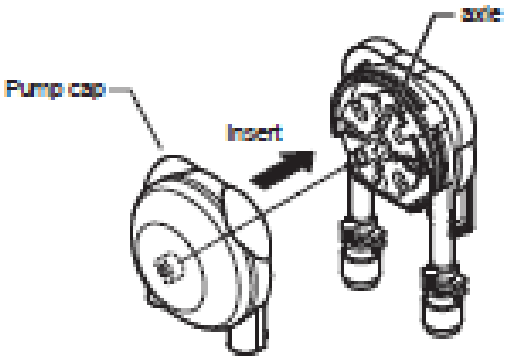
⚠ Caution

Grease is specified by each Tubing materials.
Do not use other grease.

2) Hold Rotor assembly and Insert Tubing between the inside of Base and Rotor.



3) Position both central axes of Rotor and Pump cap, Install Pump cap to Base.

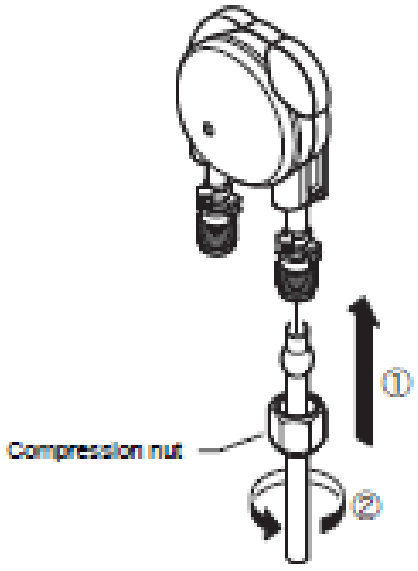


■ Connecting hose to Pump

Connect hoses to Pump same as Page 9.

⚠ Caution

Do not recycle connecting parts (e.g. compression nut),
use attached new parts.



Pour plus d'informations contacter votre agence régionale au 0 825 00 07 26 *(0,15€ TTC / mn)*

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For You and Planet Blue.

BWT
BEST WATER TECHNOLOGY