MOLEAER

ADVANCING NANOBUBBLE TECHNOLOGY

MOLEAER KINGFISHER NANOBUBBLE GENERATOR

Owner's Manual

IMPORTANT: READ, FOLLOW AND SAVE THESE INSTRUCTIONS

CUSTOMER SERVICE / TECHNICAL SUPPORT
If you have questions or need to order replacement parts, please contact:

CUSTOMER SERVICE:
Monday to Friday: 8:00 a.m. to 5:00 p.m. PST
Phone: +1 (424) 558-3567
Email: info@moleaer.com

WEBSITE:
www.moleaer.com

Table of Contents

Safety

This guide provides operation and maintenance instructions for this product. Consult Moleaer with any questions regarding this equipment.

The Kingfisher unit is designed to deliver a micro-dose of Ozone nanobubbles to the waterbody. Depending on the local regulations and restrictions, customers may be required to bypass the Ozone system. Please review the manual to bypass ozone generation if needed.

Attention Installer

This guide contains important information about the operation, maintenance, and safe use of this product. This information should be given to the owner and/or operator of this equipment after installation.

Attention User

This manual contains important information that will help you in operating and maintaining this product. Please retain it for future reference.

READ AND FOLLOW ALL INSTRUCTIONS.

This is the safety alert symbol. When you see this symbol on your system or in this manual, look for one of the following signal words and be alert for potential injuries.

⚠ DANGER Warns about hazards that can cause death, serious personal injury, or major property damage if ignored.

⚠ WARNING Warns about hazards that may or can cause minor personal injury or property damage if ignored.

NOTE Indicates special instructions not related to hazards. Carefully read and follow all safety instructions in this manual and on equipment. Keep safety labels in good condition; replace labels if missing or damaged.

When installing and using this electrical equipment, basic safety precautions should always be followed.

Risk of Electrical Shock

Connect only to a branch circuit protected by a ground fault circuit interrupter (GFCI). Contact a qualified electrician if you cannot verify that the circuit is protected by a GFCI.

General Warnings

Never open the inside of the pump motor enclosure. There is a capacitor bank that holds an electrical charge even when there is no power to the unit.

Code requirements for the electrical connection differ from location to location. Install equipment following all applicable local codes and ordinances.

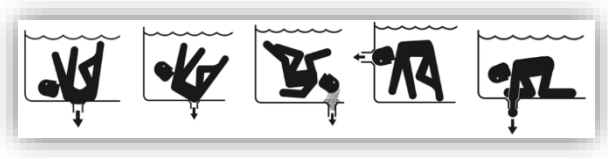
Before servicing the pump, remove power from the system by unplugging the unit from the outlet.

This equipment is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge unless they have been given supervision or instruction concerning the use of the appliance by a person responsible for their safety.

⚠ DANGER **RISK OF ELECTRICAL SHOCK. INSTALLERS, OPERATORS, AND OWNERS MUST READ THESE WARNINGS AND ALL THE INSTRUCTIONS IN THE OWNER'S MANUAL BEFORE USING THIS UNIT. THESE WARNINGS AND THE OWNER'S MANUAL MUST BE LEFT WITH THE PRODUCT OWNER.**

Suction Entrapment Hazard

Stay off the main drain and away from all suction outlets!



This generator produces high levels of suction and creates a strong vacuum at the main drain (located at the bottom of the body of water). This suction is strong enough to trap adults or children underwater if they come in close proximity to a drain, a loose or broken drain cover, or a grate.

NOTE: All suction plumbing must be installed in accordance with the latest national and local codes, standards, and guidelines.

DANGER

Install all electrical equipment, such as ON / OFF switches, timers, and control systems, etc. to allow the operation (startup, shutdown, or servicing) of any pump or filter so the user does not place any portion of his / her body over or near the pump strainer lid, filter lid, or valve closures. This installation should allow the user enough space to stand clear of the filter and pump during system startup, shutdown or servicing of the system filter.

DANGER

Hazardous pressure. Stand clear of pump and filter during startup. Circulation systems operate under pressure, when servicing any part of the system, air can enter the system and become pressurized. Pressurized air can cause any part of the pump, filter or valves to violently separate which can result in severe personal injury. Filter lid must be properly secured to prevent separation. Stand clear of all circulation system equipment when starting pump. Before servicing equipment make note of system pressure before opening filter basket.

General Information

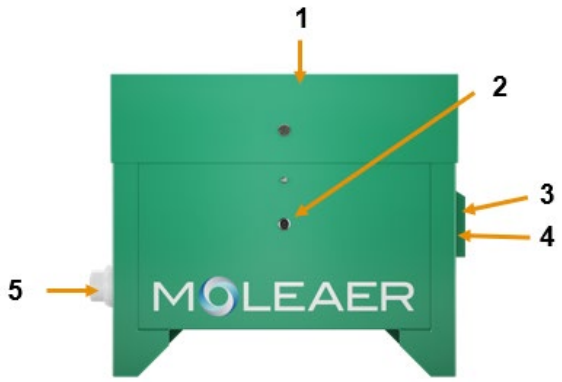
Read instructions thoroughly prior to installation and use. **All Kingfisher products are factory adjusted for optimal nanobubble production.** *Note that the actual unit sold may differ slightly from the description in the manual without any difference in the functionality and performance of the unit.*

Increasing DO levels increases the aerobic conditions in water, promoting beneficial bacteria that digest sediment muck, improve water clarity, and enhance the aquatic ecosystem to help foster clearer, healthier water bodies.

The Moleaer Kingfisher product is a nanobubble gas-injection technology tailormade for the hard-to-treat water bodies like golf course ponds and waterways, HOA and condo lakes and ponds or even residential lakefronts and small irrigation reservoirs. Its principal function is to improve the quality of water by increasing the aerobic conditions in water body, promoting beneficial bacterial that digest sediment muck, improve water clarity, and enhance aquatic ecosystem. With simplicity and near-perfect efficiency, the Kingfisher nanobubble generator super saturates water with dissolved oxygen and trillions of negatively charged nanobubbles. These tiny bubbles, about 100x smaller than a red blood cell, have several unique physical properties that make them behave differently from normal bubbles. Nanobubbles are neutrally buoyant and remain stable in solution for prolonged periods of time, creating a healthier water body.

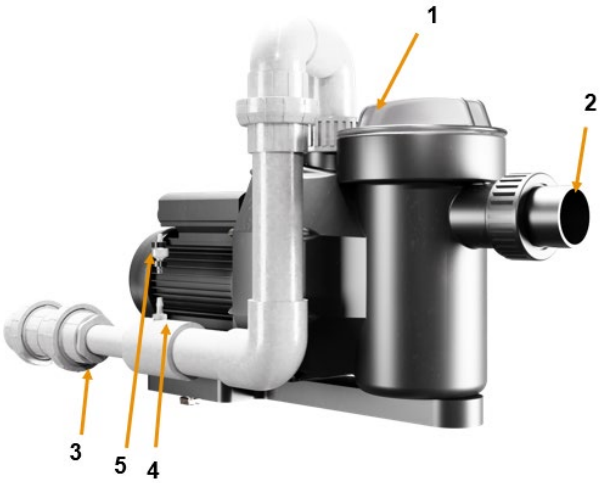
Key System Components

Figure 1. Kingfisher Weather-Proof Steel Cabinet



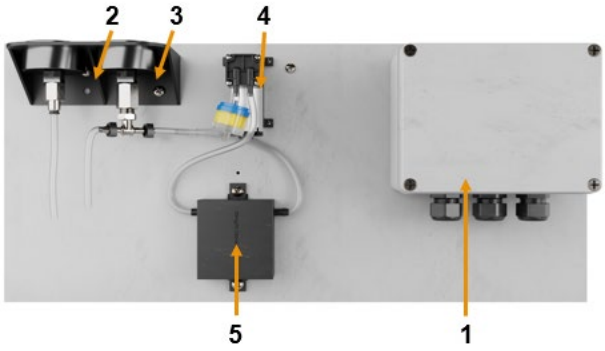
1. Cabinet
2. On/Off indicator light
3. Cooling air discharge
4. Water pump inlet
5. Water pump outlet

Figure 2. Kingfisher Pump & Piping



1. 1.5HP self-priming pump with strainer basket
2. Water Inlet
3. Nanobubble generator
4. Gas injection fitting
5. Check valve

Figure 3. Kingfisher Panel



1. Electrical box
2. Water pressure gauge
3. Gas pressure gauge
4. Compressor
5. Ozone Generator

Quick Startup Guide

1. Review detailed location and piping installations prior to installing the Kingfisher unit.
2. Open the lid of the Kingfisher and hand-tighten any loose fittings.
3. Plug the unit power cord into the GFCI outlet.
4. Loosen the strainer basket lid from the pump by turning it counterclockwise.
5. Using a bucket, prefill the pump basket with approximately one gallon of water.
6. When the pump strainer fills with water, tighten the pump strainer basket lid by turning the lid clockwise.
7. Turn the Kingfisher on by pushing the start button.
8. Check that water is flowing through the pump by verifying that the strainer basket is filled with water.

If the pump does not prime after several minutes, turn the Kingfisher off, review all suction pipe field connections to ensure airtight connections, all valves are open, and try again. Wait five minutes before re-priming to allow the pump seals to cool.

Once primed, large bubbles or a large air pocket should not be visible in the strainer basket. Any visible large bubbles or an air pocket in the strainer basket is an indication of a suction pipe leak. Check suction pipe for leaks and ensure all pipe connections are airtight.

Once the pump is primed and the system is pumping water, visually check for leaks inside the unit and hand tighten any fittings that may be leaking, if hand tightening doesn't stop leaks, shut the unit down, close any isolation valves, and disassemble the connections to inspect for any pinched O-rings and that pipes are aligned properly and reassemble.

Suction and Discharge Verification

Observe the suction and discharge locations in the waterbody. The intake should not create a vortex at the surface. If a vortex is visible, the intake screen is not properly submerged. Verify that the intake screen is resting on the floor of the waterbody and extend the suction pipe as required to position the intake screen in a deeper location of the waterbody. The bubble pattern visible at the surface of the water above the discharge should consist primarily of small bubbles, roughly the size of a pea or smaller.

Typical Operating Parameter Ranges

The typical operating parameter ranges for the Kingfisher are shown in Table 1.

Table 1. Kingfisher Typical Operating Parameter Ranges

Parameter	Kingfisher
Gas Pressure (Gauge)	10 –20 psig (0.7 – 1.4 barg)
Liquid Pressure (Gauge)	10 –20 psig (0.7 – 1.4 barg)

Specifications

Failure to install the Kingfisher within the limits specified in these specifications may void the system warranty and result in poor nanobubble production and pump cavitation.

Power Input Requirements

Table 2. Kingfisher Power Input Requirements

60 Hz (North America)	Single Phase, 115 VAC
50 Hz	Single Phase, 230 VAC

Pipe lengths and unit elevations can play an important role in the performance of the pump. Refer to the Appendix for additional detail regarding the recommended operating envelope for this unit.

Gas Connection

Moleaer Kingfisher generators come with an air compressor that feeds into a (40 mg/hr) micro-dose ozone generator. Depending on the local restrictions, the ozone generator can be bypassed as described in this manual.

Technical Specs

Table 3. Kingfisher Technical Specifications

Temperature Tolerance, F	40-140
Solids, inches	<3/8
Voltage	120
Phase	1
Running Amps (Standard Household 15 Amp Outlet)	8.2

Piping Specifications

Table 4. Kingfisher Piping Specifications

Nominal Pipe Size	1.5 in (63 mm)
Maximum Suction Pipe Length	20 feet/6 meters
Maximum Total Pipe Length (Suction + Discharge)	40 feet/12 meters
Recommended maximum Suction Lift	6 feet (2 m) above water surface

Pump Specifications

Table 5. Kingfisher Pump Specifications

Equipped Pump Brand:	Anbull SP-1100A or equivalent
Power	1.5 HP / 1.1 kW
Start Amperage	11.5 A
Voltage	115/230 VAC
Hertz	50/60 Hz
Capacitor	50 µF/250V
Flow Rate	40 GPM / 9.2 m^3/h
Head	50 ft / 15.5 m
Temperature (Max)	120˚F / 50C˚

Installation & Startup

Customers are responsible for meeting all installation guidelines recommended in this section.

Upon delivery, unbox and inspect the Kingfisher for any damage or loose parts that may have occurred during transport. Hand-tighten any loose unions.

Parts and Accessories

The parts and accessories shown in Table 6 are shipped loose with all Kingfisher products.

Included Accessories

Table 6. Kingfisher Accessories

Image	Line Item	QTY	KINGFISHER
	1	1	Suction Strainer
	2	1	CIP Tool
	3	1	Pump Union
	4	2	Pump Union O-Ring
	5	1	Pipe Union
	6	1	Basket Strainer O-Ring
	7	1	Cabinet Keys
	8	1	Quick Start Guide

Location Requirements

The guidelines herein are recommended for calm water bodies with intake structure depths less than 10 ft (3 m). The unique site conditions for each site should be carefully considered when identifying the Kingfisher installation location. Carefully select the installation location based on the requirements specified in this section. Locate the Kingfisher as close to the waterbody as possible in an open area of level ground. Use the guidelines shown in Figures 4 and 5 to locate the suction screen. We recommend that the unit be located no higher than 6' (2 m) above the water surface. Ensure that the suction screen location is free of weeds and debris. Do not locate the suction screen in an area where leaves or other floatable debris tend to accumulate.

Drawings

Figure 4: Kingfisher Installation Diagram

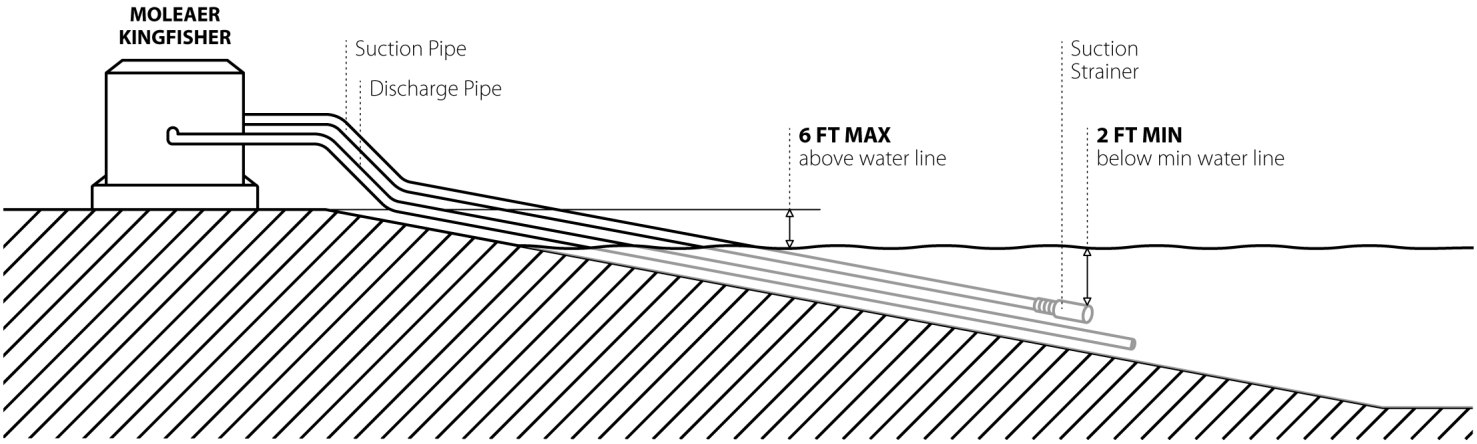
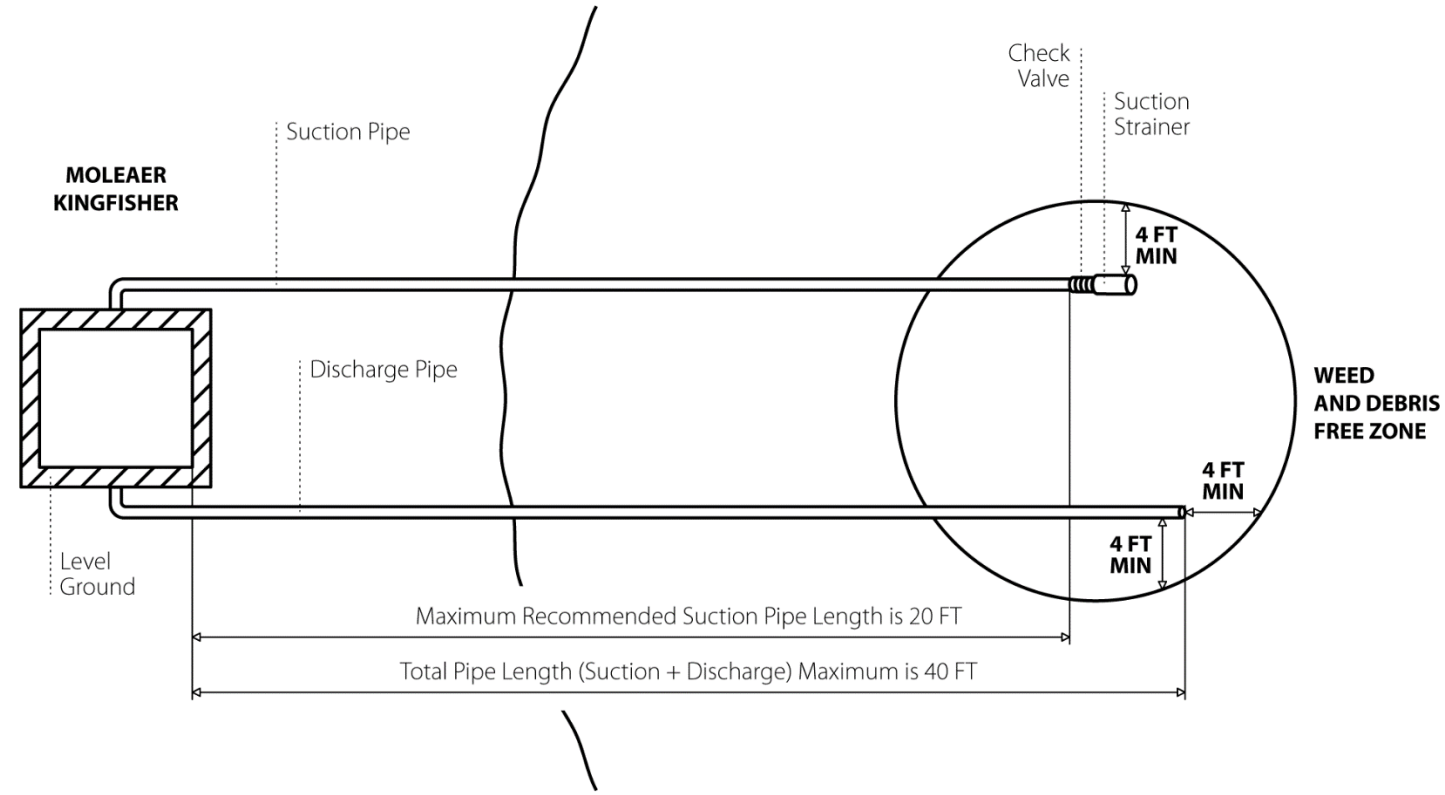


Figure 5: Kingfisher Installation Diagram from Top



Parts, Tools, and Materials

The following is a list of various parts, materials and tools required for the installation and startup of the equipment. As each installation is unique, this is not an exhaustive but a recommended list.

- PVC Glue
- PVC saw
- PVC pipe primer and PVC pipe cement
- PVC Pipe or hose and fittings to connect to the tank.
- Wrench
- Pliers
- Level
- Smoke pen for checking leaks on the suction line
- Spray bottle of soapy water for detecting air tube leaks
- Miscellaneous items including tape measure, marking pencil, shop towels for cleaning, etc.

Pipe Assembly

Completely bury or submerge all PVC pipes and fittings to avoid ultraviolet (UV) degradation. All PVC pipe connections must be solvent welded using PVC cement. Use only Schedule 40 polyvinyl chloride (PVC) pipe and fittings. Use only PVC cement formulated for wet conditions and fast installation to connect PVC pipe to PVC fittings. Do not use black, acrylonitrile butadiene styrene (ABS) piping or mix ABS pipe or fittings with PVC pipe or fittings.

All PVC pipe connections must be airtight and leakproof. Failure to provide airtight suction pipe connections may negatively impact nanobubble generator performance. Large bubbles visible at the pump strainer basket are an indication of suction pipe leaks. Difficulty with pump priming may also be an indication of suction pipe leaks. Check and correct for all suction and discharge pipe leaks prior to burying or submerging the pipe.

Proper technique must be used when gluing PVC pipe and fittings to ensure an airtight, leakproof connection. For proper technique, refer to the Appendix. Allow for proper cure time before wet testing suction and discharge pipes.

Piping

Pipe lengths and unit elevation can play an important role in the performance of the unit. Standard Installation should be no higher than 6' above the water surface, and the total length of pipe above the water surface should be less than 10', but in no case longer than 30'. In this Standard Installation, priming of the pump is expected to require no more than 5 minutes if there are 10' of pipe above the water surface, and will be considerably longer if the length of pipe above the water surface is between 10' and 30' in length. Locate and install the discharge pipe following the recommendations detailed in Figures 4 and 5.

The intake and discharge ports on the Kingfisher are both 1.5" (63 mm) union fittings.

Locate and install the intake structure and suction pipe following the recommendations detailed in Figures 4 and 5. Use available fittings as necessary to route the suction piping from the unit to the waterbody. Do not remove the bell end of the PVC pipe. The bell end can be used as a coupling for connecting straight pipe segments.

Install the included intake screen at the suction end of the pipe to stop large debris from entering the system. Ensure that the intake screen is fully submerged but elevated from the lake bottom to avoid sediment buildup. Ensure that the suction line is continuously rising from the water body to the inlet of the unit. High spots in the suction line may trap air and prevent the pump from self-priming properly.

It is recommended to install a swing-style check valve to facilitate faster priming of the pump during start-up. If a check valve (not included) is installed on the suction line, ensure that it is installed with the flow arrow in the direction of suction flow so as not to restrict the flow of water to the pump.

Locate and install the discharge pipe following the recommendations detailed in Figures 1 and 2. Use available fittings as necessary to route the discharge piping from the unit to the waterbody. Discharge should be firmly fixed and pointed towards the center of the water body to avoid causing erosion. Do not remove the bell end of the PVC pipe. The bell end can be used as a coupling for connecting straight pipe segments.

Do not bury either suction or discharge pipe until the system has been wet tested and is free of leaks.

Power Input

Extension cord use is hazardous and should be avoided. In certain jurisdictions, permanent installation using an extension cord is not permitted. Check with your local electrical code.

Step 1. The Kingfisher requires a dedicated, weather-resistant power receptacle. After starting the Kingfisher, perform a voltage drop test to verify voltage is within normal limits.

Step 2. When all piping is installed, cure time has been met, and proper circuit operation has been verified, you are ready to start up the normal operation of the Kingfisher.

Ozone Bypass

The Moleaer Kingfisher nanobubble generator comes factory installed with a (40 mg/hr) micro-dose ozone generated. In some locations, local regulations may prohibit the use of any ozone in the waterbody. This section describes the method(s) to bypass ozone and just use ambient air for nanobubble generation.

The ozone generator must be disconnected from the inside of the electrical box.

1. Power down the unit.
2. Trace the ozone generator wires back to the electrical box.
3. Using a flat-head screwdriver, loosen the screws on the corresponding terminal blocks and pull out the ozone generator wires as shown in Figure 6.
4. Loosen the cord grip on the box and pull out the ozone generator cable.
5. Tighten the cord grip.
6. The ozone generator (the green LED light) should now be off. It is not required to change the tubing. The air flows from the compressor and into the nanobubble generator via the ozone system without generating any ozone.

Startup

1. Remove the pump basket lid by rotating anticlockwise.
2. Using a bucket, prefill the pump basket with approximately one gallon of water.
3. Reinstall the basket lid, until it is hand tight.
4. Plug the unit power cord into the outlet.
5. Push start switch to start system.
6. Wait until the pump basket fills with water, which can take up to five minutes.

A hose or bucket can be used to fill the suction line between the check valve and pump for systems that are difficult to prime. Fill the pump basket until the suction line fills completely and begins to fill the pump basket to the top. Pump priming may take several minutes. If the pump does not prime after several minutes, turn the unit off, review all suction pipe field connections to ensure airtight connections, re-prime the pump and try again. Wait five minutes before re-priming to allow the pump seals to cool. Once primed, large bubbles or a large air pocket should not be visible in the strainer basket. If large bubbles or an air pocket are visible in the strainer basket there is a suction pipe leak. Check suction pipe for leaks and ensure all pipe connections are airtight. Consider installing a swing-style check valve to stop the draining of water from the suction pipe.

Observe the suction and discharge locations in the waterbody. The intake should not create a vortex at the surface. If a vortex is visible, the intake screen is not properly submerged. Verify that the intake screen is resting on the floor of the waterbody and extend the suction pipe as required to position the intake screen in a deeper location of the waterbody. The bubble pattern visible at the surface of the water above the discharge should consist primarily of small bubbles, roughly the size of a pea or smaller.

NOTE:

1. If the pond or lake does not have an existing aeration system, the nanobubble generator should initially be run periodically over the first seven days of treatment to avoid an overabundance of bacteria causing a decline in dissolved oxygen from de-stratifying of the lake.
2. Expect to see algae float to the surface within the first few weeks. This is normal. It may foul the intake screen during this period; therefore, periodic inspections are necessary until the algae float has subsided.

Maintenance

Intake screens should be cleaned periodically, along with the pump basket. Inspect the intake multiple times per week during the first month of operation and every three weeks thereafter.

A drop in water pressure is most likely the result of a clogged intake or check valve (if installed). If a drop in water pressure is observed, inspect the intake and check valve.

Moleaer recommends monthly inspection (see Operation Checklist in this manual) followed by quarterly cleanings of intake screens and piping.

The gas injection zone (nanobubble generator) may require periodic cleaning due to biofouling inside the piping. If the gas pressure gauge is above 20 Psi and the visible bubbles from the discharge pipe are significantly reduced a cleaning is necessary. Refer to the clean-in-place procedure for more information.

Pump Maintenance

CAUTION Do NOT open the strainer basket if pump fails to prime, or if pump has been operating without water in the strainer pot. Pumps operated in these circumstances may experience a buildup of vapor pressure and may contain scalding hot water.

WARNING Opening the pump may cause serious personal injury. To avoid the possibility of personal injury, make sure the suction and discharge valves are open and strainer pot temperature is cool to touch, then open with extreme caution. To prevent damage to the pump and for proper operation of the system, clean pump strainer and system every two weeks.

WARNING To prevent damage to the pump and for proper operation of the system, clean pump strainer and system regularly.

Pump Strainer Basket Care

The strainer basket must be kept clean and free of debris. Inspect the basket through the lid on the top of the housing.

Be sure to visually inspect the strainer basket regularly. Dirty strainer baskets reduce filter efficiency and put abnormal stress on the pump motor. Bacterial fouling could cause the lid not to be clear.

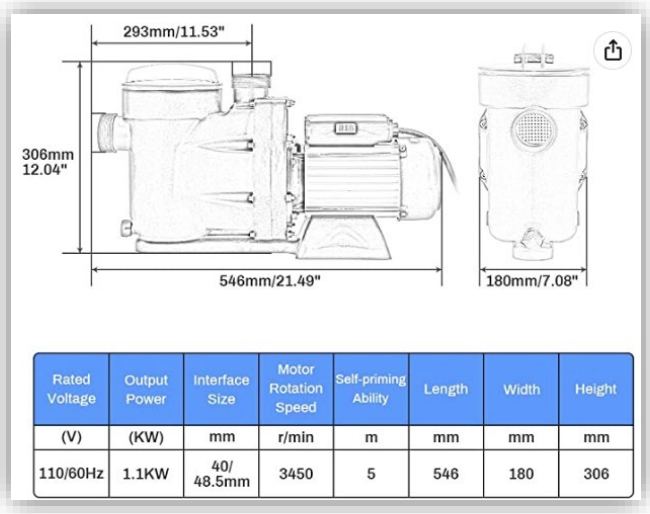
Cleaning the Pump Strainer Basket

1. Flip the switch to the OFF position and confirm the red light turns on.

2. Relieve pressure in the system.
3. Close system isolation valves
4. Turn the lid counterclockwise and remove it from the pump.
5. Remove debris and rinse out the basket.
6. Put the basket back into the housing. Be sure to align the notch in the bottom of the basket with the rib in the bottom of the housing.
7. Fill the pump basket up to the inlet port with water.
8. Clean the lid and clamp, O-ring, and sealing surface of the pump basket.

NOTE: It is important to keep the lid O-ring clean and well lubricated.

Figure 7. Pump Specifications



Rated Voltage	Output Power	Interface Size	Motor Rotation Speed	Self-priming Ability	Length	Width	Height
(V)	(KW)	mm	r/min	m	mm	mm	mm
110/60Hz	1.1KW	40/ 48.5mm	3450	5	546	180	306

9. Reinstall the lid by placing the lid on the basket. Be sure the lid O-ring is properly placed. Seat the lid on the pump then turn clockwise until tight.
10. Press the switch to the ON position. Confirm the green light turns on.

11. Wait until a steady water flow is observable through the pump basket lid.

Winterizing

In mild climate areas, when temporary freezing conditions may occur, run your equipment all night to prevent freezing.

You are responsible for determining when freezing conditions may occur. If freezing conditions are expected, take the following steps to reduce the risk of freeze damage. **Freeze damage is not covered under warranty.**

To prevent freeze damage, follow the procedures below:

1. Shut off electrical power for the pump at the circuit breaker.
2. Drain the water out of the pump housing by removing the one twist drain plug from the housing. Store the plug in the pump basket.

NOTE: Do not wrap the motor with plastic or other airtight materials during winter storage. The motor may be covered during a storm, winter storage, etc., but never when operating or expecting operation.

Figure 8. Pump Head Curve

WARNING

PUMP SERVICE

Always disconnect power to the Kingfisher generator and / or pump at the circuit breaker before servicing the pump. Failure to do so could result in death or serious injury to service people, users or others due to electric shock. Read all servicing instructions before working on the pump.

WARNING

Do NOT open the strainer basket if pump fails to prime or if pump has been operating without water in the strainer basket. Pumps operated in these circumstances may experience a build-up of vapor pressure and may contain scalding hot water. Opening the pump may cause serious personal injury. In order to avoid the possibility of personal injury, make sure the suction and discharge valves are open and strainer basket temperature is cool to touch, then open with extreme caution.

CAUTION

Be sure not to scratch or mar the polished shaft seal faces; seal will leak if faces are damaged. The polished and lapped faces of the seal could be damaged if not handled with care.

Motor Care

Protect from Heat

Do not block the fan intake and the louvers. Provide ample space around the unit to allow free airflow. This is normally accomplished by giving about 2 feet (0.5 meters) easement around the cabinet.

Protect Against Dirt

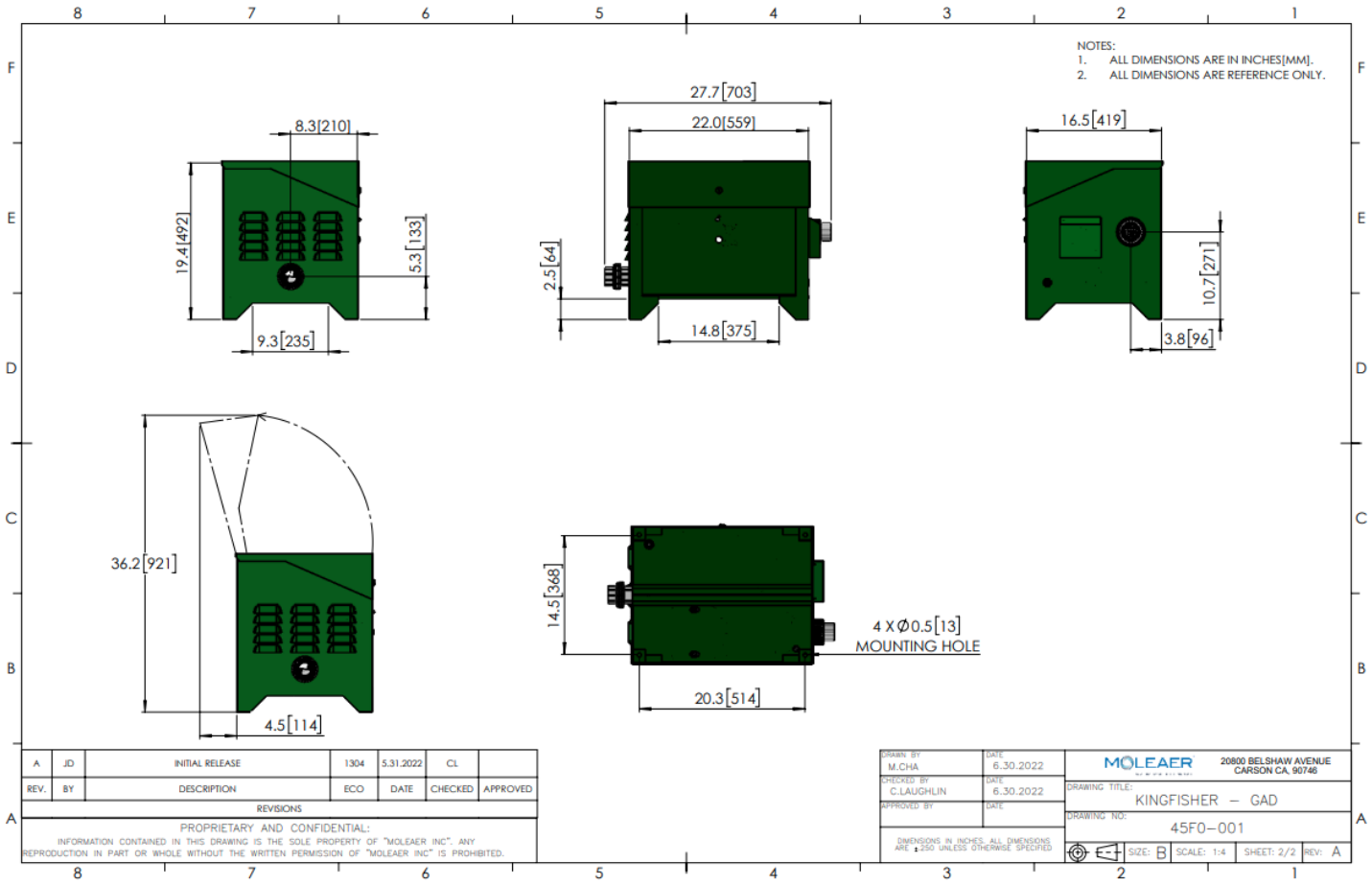
1. Protect from any foreign matter or splashing water.
2. Do not store (or spill) chemicals on or near the motor.
3. Protect from any foreign matter or splashing water.
4. Avoid sweeping or stirring up dust near the motor while it is operating.
5. If a motor has been damaged by dirt it voids the motor warranty.
6. Clean the lid and clamp, O-ring, and sealing surface of the pump basket.

Protect Against Moisture

1. If a motor has become wet, let it dry before operating. Do not allow the pump to operate if it has been flooded.
2. If a motor has been damaged by water the motor warranty is voided.

General Arrangement Drawing (GAD)

Figure 9: Kingfisher Dimension Drawing



Solvent Welding PVC Pipe

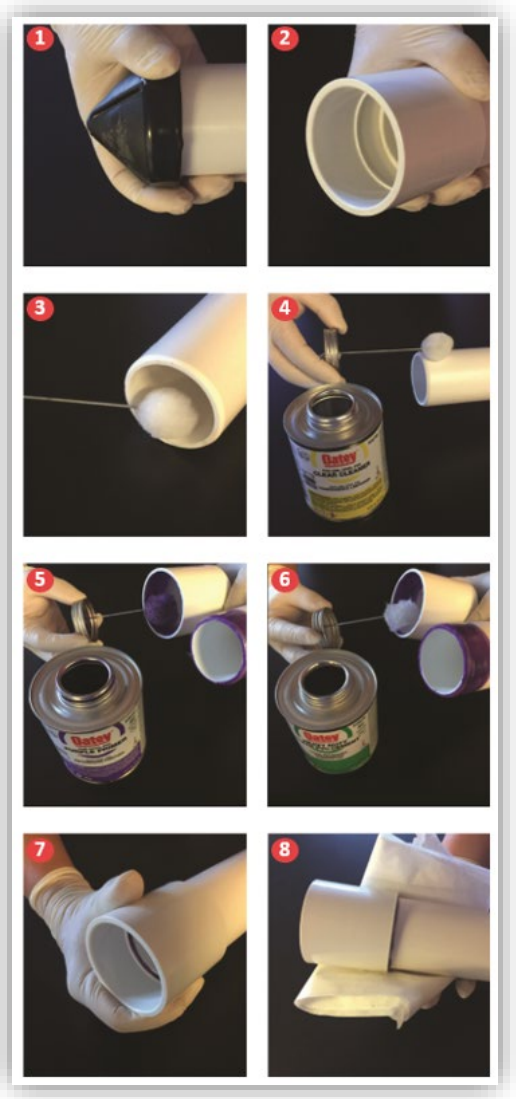
- Once the primer has been applied to both surfaces, the cement must be applied within 5 minutes. If not, you MUST prime the surfaces again before applying cement.
- Do Not use primer on ABS pipe and fittings.
- Remember that a thin coating of cement is recommended inside the fitting hub to prevent puddling. Puddling can cause weakening and lead to joint failure.
- Assembly parts QUICKLY. Cement must be fluid. Dried cement CANNOT be re-coated.
- Lower temperatures and larger diameter pipes may need a little extra hold time
- Allow 15 minutes for good handling strength and 2 hours cure time. Longer cure times may be required at low temperature. DO NOT TEST WITH COMPRESSED AIR OR GAS.

How To Solvent Weld

Prior to Use:

1. Read all product labels carefully.
2. Stir or shake cement before using. If gelled, do not use. Keep container closed when not in use. Avoid eye and skin contact. Wear safety glasses with side shields and wear rubber gloves.
3. Cut pipe ends square, Deburr the inside and chamfer the outside of pipe ends, remove all dirt from pipe ends and fitting hubs.
4. Pipe should easily go 1/3 to 2/3 the way into the fitting hub.
5. Clean pipe and fitting hub with a listed cleaner.
6. First apply primer inside the fitting hub, then the exterior of the pipe end.
7. First apply a liberal coat of cement to the exterior of the pipe end beyond fitting hub depth, then inside the fitting hub.
8. Turn the pipe ¼ of turn as you push the pipe end into the fitting hub.
9. Make sure pipe end bottoms out inside the fitting hub and hold for 30 seconds to prevent push-out.
10. Wipe off excess cement

Figure 11. How to Glue Piping



Set Up & Curing Times

The setup/cure time is dependent on several factors. The pipe size, socket fit, ambient temperature, relative humidity, solvent cement used and the system operating pressure should all be considered when determining set up/cure times.

DO NOT test PVC piping systems with compressed air or gas.

NOTES: Cure schedule is the time required before pressure testing the system - This chart can be used as a guideline to determine joint cure

Cleaning and Sanitizing

Nanobubble Generators (NBGs) can become contaminated after they have been used for some time. Pollutants such as colloids, biofilms, mineral scale, and biological matter build up over time. Contaminants can result in decreased performance. Periodic cleaning is thus very important and essential to optimal system performance.

Cleaning of an NBG system when one or all of the following operating conditions occur:

- Visible bubble from the discharge pipe are significantly reduced.
- The pressure of the gas injection required to maintain gas flow exceeds the max operating pressure of 20 Psi

If none of the above conditions apply, Moleaer recommends the cleaning every 6 months for optimal performance. If cleaning is delayed too long, complete recovery of the unit may not be possible.

Safety Precautions

Maximum Temperature: 100°C (212°F.)

pH Tolerance Range: 2 to 14.

Each cleaning situation is different; therefore, specific cleaning recommendations are dependent on the type of foulant. Consult the general cleaning instructions for information that is common to all types of cleaning, such as suggested equipment, pH and temperature limits and recommended flow rates; then apply the specific recommendation as needed.

1. When using any chemical, follow accepted safety practices. Consult the chemical manufacturer for detailed information about safety, handling and disposal.
2. When preparing cleaning solutions, ensure that all chemicals are dissolved and well mixed before circulating the solutions through the system.
3. It is recommended that the system be flushed with good-quality water (20°C minimum temperature) after cleaning. City water quality is recommended. Flush the bulk of the cleaning solution from the system before resuming normal operation. Cleaning chemicals may be present on the treated water side following cleaning, to avoid contamination, the treated water can be diverted to a drain for a few minutes or until the water is clean when starting up after cleaning.
4. Ensure the system power is disconnected during cleaning procedures to avoid accidental startup of the pump or gas production system.

NOTE: The maximum temperature limit during cleaning is 45°C (113°F) for all PVC systems.

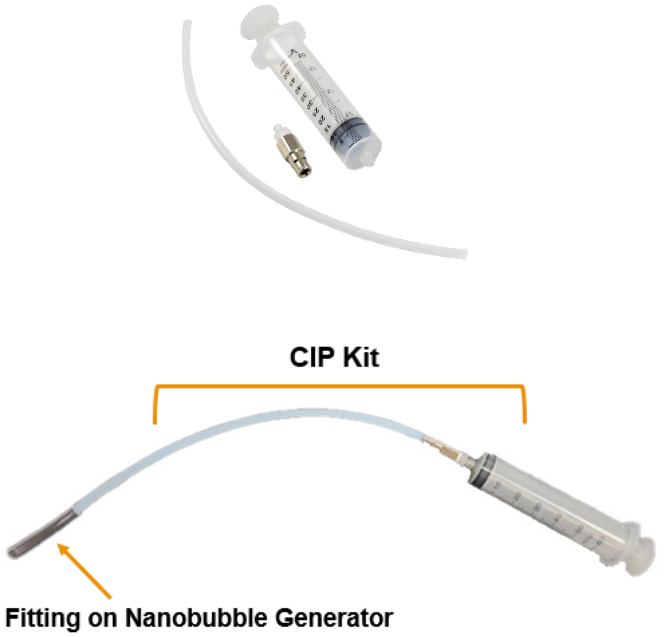
NOTE: The minimum and maximum pH limits for all PVC systems are 1 and 13, respectively.

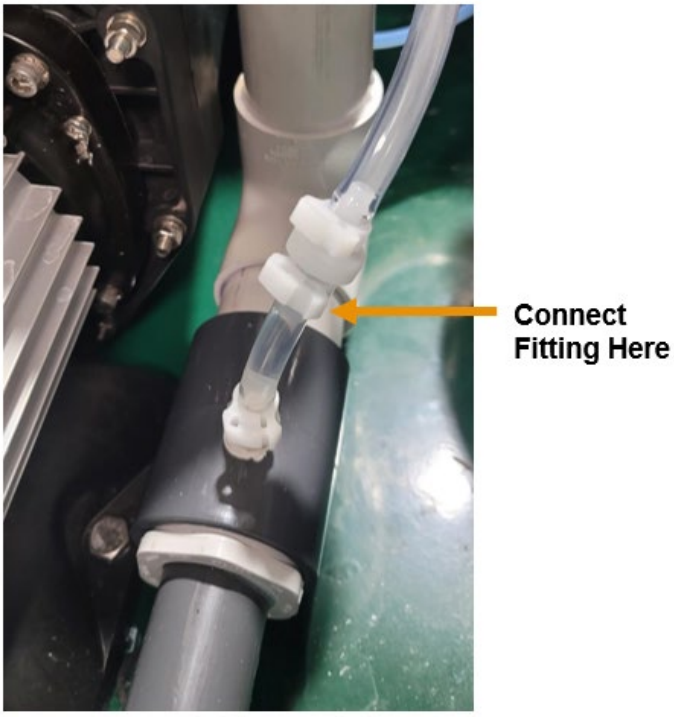
General Cleaning Procedures

The cleaning procedure of an NBG system consists of the following process steps:

1. Turn off the unit and isolate the Kingfisher from the waterbody and drain any water in the system.
2. **Prepare the cleaning solution.** The chemicals used for the cleaning process must be dissolved and mixed before the cleaning fluid is added to the NBG. Household Bleach, Lysol, CLR or other commonly available cleaning chemicals will remove any biological growth from the Kingfisher internal mechanism.
3. **Introduce the cleaning solution.** Disconnect the gas tube at the upper side of the check valve as shown in figure 10. Use the syringe and the CIP tube provided to inject the cleaning solution into the NBG.
4. **Soak the cleaning solution.** Allow the cleaning solution to soak the NBG for a minimum of 10 minutes.
5. **Rinse the system**. Using tap water, thoroughly rinse out the system until all the cleaning solution is flushed out of the system and the water quality is satisfactory.
6. **Restart the system.** Reconnect all the tubes and pipes. Follow the startup process as described in the start-up section of this manual.

Figure 10. CIP Tubing





Operation Checklist

Line	Component	Instructions
1	Power light	Check the light. Green: Running; Red: Powered but not running, No light: No power
2	Gas Leakage	Use soap water to check the gas leakage on the joints and fittings. Check for signs of cracking on the tubing
3	Water Pressure	Check water pressure gauge (8-20 Psi). Compare value with the historical values on the checklist (included below)
4	Gas Pressure	Check gas pressure gauge (8-20 Psi). Compare value with the historical values on the checklist (included below)
5	Fan	Make sure fan is clean and running. Make sure louvers are not clogged. Wipe down the louvers if necessary.
6	Pump basket	Stop the unit. Close isolation valves, remove the pump lid. Inspect and clean the basket.
7	Pump Visual inspection	Inspect the pump body. Look for signs of leakage, water, or heat marks on the junction box
8	Intake Screen	Visually inspect the intake screen and check valve (if installed). Shut down the unit and clean if necessary.
9	Compressor	The compressor must run continuously and without strong vibration.
10	Power interruption test	Shut down the unit and power back on after 30 seconds. Monitor the unit until it goes back to normal operation

Preventive Maintenance Checklist

	Item	Description	Frequency
1	Pump	Check the motor for overheating and pump for proper operations	Monthly
2	Tubing	Check tubing for leaks and for any damage due to heat/sun.	Monthly
3	Strainer	Check for debris collected at the strainer and remove/clean as required.	Monthly
4	Compressor	The compressor is designed for 15000 hours of operation. Inspect and replace the filters frequently.	Every 6 months
5	Ozone Generator	Check to ensure that the green LED light on the ozone generator is on.	Monthly
6	Clean in Place	Perform CIP as described in the manual on an as needed basis. Recommend at least every 6 months	Monthly

Troubleshooting Guide

Problem	Possible Cause	Corrective Action
Pump Will Not Prime	• Air being drawn into pump suction. • Air pocket in suction line.	• Check suction piping and valves on suction line. • Secure lid on pump strainer basket and be sure lid gasket is in place. Check water level to make sure suction port. • Check Pump strainer is full of water. Be sure the valve on suction line is working and open. • Consider installing a swing-style check valve to stop water from draining from the suction pipe. • Disconnect the air tube at the compressor and ensure that the check valve remains connected to the nanobubble generator to avoid allowing the water to spray inside the enclosure.
Pump Motor Not Running	• Motor thermal protector tripped. • Open circuit breaker or a blown fuse. • Defective pump.	• Check thermal protector. • Check the circuit breaker. • If all above are in good condition, the pump is defective and should be replaced.
Reduced Capacity	• Air pockets or leaks in the suction line.	• Check suction piping
Pump Flow Too Low	• Voltage too low. • NPSH too high – excessive suction lift or losses. • Pump back pressure too high.	• Ensure the shortest possible distance to the outlet. • Check suction lift and loss. The maximum suction lift is 6 feet (2 meters). • Check discharge pipe, maximum length 20 feet (6 feet).
Pump Back Pressure Too High	• Discharge piping obstructed. • Discharge height too high.	• Check discharge nozzle and piping. • Ensure the discharge head is 10 feet (3 meters) or less
Low Gas Pressure on System Gauge	• Feed gas pressure too low.	• Check for leaks in tubing with a soap water test.
Large Bubbles	• Suction pipe leak	• Check suction piping for any leaks.

Excessive Noise and Vibration	• Pump is not fully primed. • NPSH too high	• Completely flood intake piping by pouring water in the inlet pipes to prime fully.

Limited Warranty

Limited Warranty

Moleaer warrants that the Goods will be free from defects in material and workmanship for a period of twelve (12) months from the date of first purchase (provided, however, that if Buyer is not able to provide proof of the date of purchase, the warranty period will run for eighteen (18) months from the date of manufacture) (the "Warranty Period"). Moleaer shall in no event be liable for defects or damage attributable to modifications performed or repair work done other than by Moleaer personnel or to abuse, accident, negligence, catastrophe, force majeure event, shipment, improper use including but not limited to circumstances where pumps and / or compressors included in the Goods are not operated in accordance with the original pump or compressor manufacturer's specifications, maintenance, storage or application or any other external cause. EXCEPT FOR ANY WRITTEN PERFORMANCE WARRANTY THAT MOLEAER HAS EXPRESSLY INCORPORATED IN THIS CONTRACT, THE GOODS ARE PROVIDED BY MOLEAER "AS IS" AND WITH ALL FAULTS, AND MOLEAER SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW. ANY IMPLIED WARRANTY THAT CAN NOT BE DISCLAIMED BY LAW IS LIMITED TO THE DURATION OF THE WARRANTY PERIOD. MOLEAER DOES NOT WARRANT THAT THE GOODS WILL MEET THE BUYER'S REQUIREMENTS OR ACHIEVE ANY SPECIFIC RESULTS. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, THE BUYER ACKNOWLEDGES AND AGREES THAT BUYER IS SOLELY RESPONSIBLE FOR THE USE OF THE GOODS IN COMPLIANCE WITH APPLICABLE LAWS, RULES, AND REGULATIONS.

Claims; Exclusive Remedy

Any warranty claim must be made to Moleaer in writing within ten days of discovery of the alleged defect. After obtaining prior written authorization from Moleaer, Buyer shall return all allegedly defective Goods, freight pre-paid, for examination by Moleaer. If Moleaer finds that the Goods are defective and covered by the warranty, Moleaer's sole obligation shall be, at Moleaer's option, to repair or replace the Goods, or to refund the purchase price therefore, and to reimburse Buyer's reasonable shipping costs. Buyer shall be responsible for all charges for handling of returned items not found defective. The remedy set forth in this Paragraph is Buyer's sole and exclusive remedy for any breach of warranty or claim related to the Goods other than pursuant to any written performance warranty that Moleaer has expressly incorporated in this Contract.

PLEASE CONTACT MOLEAER AT 424.558.3567 IF YOU HAVE ANY QUESTIONS, OR TO ASSIST WITH ANY TROUBLESHOOTING AND FIELD INSTALLATION QUESTIONS.

MOLEAER
ADVANCING NANOBUBBLE TECHNOLOGY

20800 BELSHAW AVENUE
CARSON, CA 90746 USA
+1-424-558-3567
info@moleaer.com
www.moleaer.com
Revision 07052022