



MINI-PLANT

OPERATION AND MAINTENANCE MANUAL

MODEL: 54291-230V

500 to 1500 GPD Mini-Plant

AquaO2 Wastewater Treatment Systems, Inc.

5800 Prillaman Switch Road, PO Box 579, Ferrum, Virginia, 24088 USA

Phone: 540-365-0154 Fax: 540-365-0155 Toll Free: 800-927-8304

email: info@Aqua-O2.com web: aqua-O2.com

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INTRODUCTION

Whereas the basic principle of operation remains constant understanding the treatment system is an engineered product and subject to design changes or upgrades is essential. Constant and conscience efforts are made to ensure component and component operation are in keeping with or ahead of the industry standards to provide minimal maintenance and trouble free operation.

The AquaO2 treatment system is a very versatile system. The basic system and original design was conceived for simple installation by constructing a pre-assembled system in fiberglass tanks and providing the necessary control system; the installation was a matter of installing the tank, providing power to the control panel and piping to and from the system. Through climate changes, soil conditions, discharge requirements the system has met all demands beginning with the mini-plant kit which was adapted for use with concrete tanks to the use of biological filtering, to ultra violet and chlorine cleansing. The demands were made and the needs have been met as part of the ongoing changes and keeping with our dedication to the preservation of our environment.

It is not our desire or intent to provide a detailed listing or instruction for each version available but to provide you a basic understanding of the principles of operation which will help you in the use and maintenance of the system.

We strongly recommend you seek out a qualified or licensed operator to establish maintenance and monitoring program to perform the system checks as outline in this manual. **It is important that the operator be fully trained.** A quarterly maintenance inspection will enhance the success of a long trouble free system operation.

Should you have trouble locating a qualified operator; sources available are the installer, local health department and the manufacturer.

The Mini-Plant produces no offensive odors because it is a natural biological process that utilizes the free oxygen from the surrounding atmosphere. Located in the aeration tank, energy-efficient air compressors force oxygen-rich air through pipes to foam diffusers located just off the tank floor. This process forces oxygen to the mixture, stimulating the growth of millions of naturally existing microorganisms that biologically purify the wastewater. Small organisms such as bacteria, protozoa, rotifers, and nematodes are not present without oxygen. In the presence of oxygen they change the pollutant molecules, composed of Carbon (C), Oxygen (O), Hydrogen (H), Nitrogen (N), Sulfur (S), Phosphorous (P), into CO₂ (Carbon dioxide), H₂O (water), NO₃ (Nitrate), SO₄ (Sulfate), PO₄ (Phosphate), and release energy in the form of heat. AquaO2 utilizes a sequential batch reactor (SBR) process in order to achieve optimum clarity of the treated effluent whereby daily flows are held in the aeration tank and a predetermined volume of effluent is treated. It is important to note that periodic surges or peak flow periods do not affect an SBR process as it would in a flow-through system. Mini-Plants continuously provide aeration to the treatment chamber. Tanks and disposal beds are designed for a specific daily flow.; exceeding that flow on any given day by more than 30% may cause the high liquid level sensor to activate. The high water alarm may be silenced with a switch located on the control panel. Please note the red light will stay on until the water level drops below the sensor. If the high level alarm stays on for more than 24 hours, contact your service representative.

Should the blower or pump alarm activate, open the panel door, and reset the circuit breaker. If the procedure does not correct the fault, refer to the non-schedule maintenance section, or contact your service provider or electrician. The purpose of this manual is to guide the operator/service person on technical answers to questions that may arise pertaining to the operation and maintenance of the AquaO2 Mini-Plant™ system. This manual lists the required maintenance to keep the system operating to achieve optimum performance.

DEFINITIONS AND TERMINOLOGY

SS Suspended Solids

Solids that either floats on the surface of, or are in suspended in water, sewage, or other liquids, and which are removable by laboratory filtering.

BOD₅ Bio-chemical oxygen demand

Since we cannot measure the strength of human solid and liquid body wastes or the organic wastes originating from food items, we take the indirect route of measuring the amount of oxygen that is required to neutralize the waste so that it can safely be disposed of without harm to the environment. This process of expediting the natural way of "rotting out" organic matter by adding air (oxygen) is affected by several things such as the exposure to oxygen (detention time), concentration of oxygen, presence of active bacteria, agitation and temperature.

With plenty of food and warm temperature, microorganisms procreate resulting in an optimal reduction of organic matter and an improved BOD₅ reduction in the plant effluent. A normal well performing sequential batch reactor (SBR) plant will reduce the BOD₅ strength by 90 to 95%.

Depending on the type of service, the raw BOD₅ will normally fall in the range from 150 mg/l to 400 mg/l BOD₅ value of 200 mg/L has been anticipated for this project. It is estimated that the BOD₅ value in the treated effluent will be approximately <5 mg/L. The reduction process will actually continue at a progressively slower rate, and the BOD reduction may be recorded over an extended period 21 days (BOD₂₁). For practical reasons, the industry has standardized on a five-day cut-off (BOD₅) this being the number, which should have been affixed to the above-mentioned BOD values. A standard septic tank may reduce the BOD by about 40% leaving the remaining BOD to enter the environment.

Ammonia and Nitrification:

Approximately ninety percent of the nitrogen present in the wastewater is in the form of urea from which ammonia is rapidly derived. The process of converting ammonia in wastewater to nitrogen may be described as two separate biological reactions, although they are frequently interrelated. The first step is designed to convert ammonia nitrogen and organic nitrogen and nitrate nitrogen. The process, nitrification is a result of certain bacteria's ability to oxidize ammonia to nitrate nitrogen. These bacteria (nitrosamines and nitrobacteria) require aerobic conditions in order to grow and multiply. This is accomplished ideally in the aeration chamber tank resulting in an 85% to 95% conversion to nitrite.

MINI-PLANT

PROCESS DESCRIPTION

A basic understanding of the principle of operation will assist you in the use and maintenance of the system. The Mini-Plant is an "aerobic" unit, which does not produce offensive odors. It is a natural biological process using the free oxygen in the surrounding atmosphere. An energy-efficient blower pumps oxygen-rich air into the air diffusers located on the bottom of the tank which produces a churning affect assisting in the breakdown of solids and infuses oxygen into the mixture, which in turn stimulates the growth of millions of microorganisms that biologically, purify the wastewater. These small organisms: bacteria, protozoa, rotifer, and nematode are not present without free oxygen, however, in its presence they change the pollutant molecules which are composed of carbon (C), oxygen (O), hydrogen (H), nitrogen (N), sulfur (S), phosphorous (P), to CO₂ (carbon dioxide), H₂O (water), NO₃ (nitrates), SO₄ (sulfates), PO₄ (phosphates) by releasing energy in the form of heat.

Once biological treatment is complete, the air supply is automatically shut off allowing the heavy solids and microbes to settle to the bottom of the tank in the form of sludge and the lighter particulates float to the

surface of the clear liquid. The discharge pump is suspended in the clear liquor between the bottom and the wastewater surface and through timed evolutions it automatically pumps the daily batch to the discharge point. A low-level sensor turns the pump off before any floating matter is able to enter the pump inlet. The air compressor then starts the aeration cycle over again and the system is ready to receive the next day's load.

The Mini-Plant tanks capacity is calculate for 3 times the expected daily flow to allow for fluctuation in usage. Exceeding the designed flow gallon per day, will cause the high-level alarm to activate and a red light for visual indication. A temporary small flow overload will self-correct overnight. The high water alarm and red light will remain on until the level drops below the sensor. A switch on the control panel and in some cases the remote house alarm can be silenced during the temporary high water level condition. Environmentally, the Mini-Plant effluent is very high quality, <7mg/L BOD₅ and <11mg/L SS (<5mg/L BOD₅ and <5mg/L SS with the add-on recirculation chamber) exceeding most permit requirements of 30 mg/l of BOD₅ and SS (see current NSFI test results).

COMPONENT PARTS

Tank

The tank has been sized at three times the daily-specified load. The equipment is installed into a fiberglass tank or concrete tank with a mini-plant kit.

In-Tank Components

The diffusers are secured onto PVC pipes that are connected to the airline manifold. The diffusers are suspended off of the tank floor and weighted by concrete blocks. A side intake submersible pump is suspended from the manway and located just above the air diffusers. The pump is connected to the outlet piping by a flexible rubber hose and quick disconnect.

There are three level sensors suspended from the junction box:

- FLS #1 Enabling float switch which is a low level pump cut off is adjust to secure pump operations at 2/3-3/4 from top of pump to keep out any SS and floating debris from entering pump inlet. This switch also prevents pump operation during low or no usage i.e. vacation so as not to burn out the pump motor.
- FLS #2 High liquid level alarm sensor and is adjusted to activate 2/3 up from the tank floor but not to exceed 38-40 inches from centerline of diffusers. The high water level sensor comes on at 40" from the diffuser. This liquid level sensor shuts off the blower and activates the alarm.
- FLS #3 Emergency pump on (EPO) sensor is adjusted to activate below the inlet piping. If the liquid level reaches the activation depth it will turn on the effluent pump to prevent the system from flooding. The effluent pump will pump down to the high water alarm sensor until the alarm condition is clear.
- FLS #4 (where applicable) provides and inside or remote house alarm to give the homeowner and audible indication that a high water level condition exists.

The Electrical Supply

The standard Mini Plant model runs on 230 volts, 60 hertz, and can be single or three phase power. The control panel schematic will allow the qualified serviceman or electrician to troubleshoot any part of the system. A 30 amp service is adequate.

The Manways

The tank, manways and blower housings are manufactured from heavy fiberglass reinforced polyester. They protect and provide access to the blower, electrical junction boxes and the mechanical connections. Inside the manway or blower housing an energy efficient blower is mounted. The level sensors and submersible pump are also wired to the junction box. The installing dealer interconnects the junction box to the control panel, seals the manway and pipes to the tank, fastens the diffusers and manifolds in place, and connects the pump discharge

pipng to the pump. The junction boxes have connector terminal blocks plus ground connectors and are interconnected to their respective terminals in the control panel.

The Control Panel

The panel box is both a UL and CSA approved type 3 enclosure suitable for outdoor/indoor mounting. A separate incoming power circuit breaker and box is attached. There is a 230-volts supply line, 115 volts control circuit, and a neutral and ground wire. The outside of the panel provides a visual indication of system's operation. Red lights indicate a fault, Amber lights indicate a component is in the standby mode and green indicates power to the controls or component running condition. Pump(s) or blower(s) operating condition is indicated in a vertical column and high water, alarm silence and power available in the last column. During daytime operation, the green power light is "on". The blower(s) operating green lights are "on" and the pump(s) yellow light is "on standby". At 2:00 AM the blower(s) are programmed to turn off and yellow light is "on standby", therefore at that time all mechanical components are in the standby mode and yellow lights are "on" for the next three (3) hour period. At 5:00 AM the pump green light comes "on" and runs until 6:00 AM or FS #1 turns it off, pump goes "on standby" and the blower(s) come back on "green lights" for the next twenty (20) hours. The panel should only be opened after disconnecting the circuit breaker and when the green power light is off. There are manual motor starters and switches, one for each pump and blower with overload protection.

The motor starting switches should be "on". If they are tripped "off", wait two minutes to reset. Continuous tripping can signal a wiring problem or motor malfunction. A buzzer alarm complete with silencing switch is also supplied. The switch may be turned "off" to silence the alarm buzzer, but the red alarm light will remain "on" until the problem is corrected. The Mini-Plant is controlled by a dual-function 24-hr timer. The basic program is 20 hours of aeration from 6:00 am until 2:00 a.m. the following morning, followed by three hours of a quiescent period. This allows the solids to settle to the lower portion of the tank. After the three hours of settling the decant pump operates from 5:00 am to 6:00 am pumping the effluent to its discharge location usually supplied by the installer.

For any Emergency situations please contact the manufacturer or service provider
AquaO2 International, Inc.
800-WASTE-04
1-800-(927-8304)

ROUTINE MAINTENANCE

NOTE: All maintenance procedures are meant to maintain optimum performance of the system and should be performed by qualified personnel only.

Routinely

- Check light functions. Power available (green light), blower operating (green light) and pump stand by (amber light) are the normal indications. No red lights should be on.
- Observe any unusual noise such as a high pitch whine from the blower.
- Be contentious as to the disposal of non-biodegradable products such as paper towels, surface or baby wipes, feminine applicators, male contraceptives. Inform your guest and teenagers friends and parents. Small children like to watch the toys go round!
- Leaky toilets are the number one cause for high water alarms and cause a hydraulic overload to the disposal area.

Quarterly Routine (Scheduled 3rd & 9th month maintenance)

BELOW BY SERVICE TECHNICIAN

- Perform a visual indication for controls and check watertight integrity of control panel and system. Check clock settings and visual indications of terminal connections for an overheating condition this or may have occurred.
- Check the values of power supply and equipment power usage and record your readings.
- Replace the intake air filter for the blower it operates roughly 1800 hours between maintenance intervals.
- Check for foul odors and observe for any unusual noise. With the blower secured listen for water entry and determine the source.
- Wash the level sensors with garden hose (if available) and remove debris.
- Check for water marks inside the tank for repeated high level conditions.
- Check for foreign objects that are non-biodegradable products.
- Check for proper and even aeration.
- Check level sensor operation.
- Check temperature of air compressor. If very hot check voltage at terminals 09 & 10 which should be 230 V + -10%.
- Check for any loose connections and tighten.
- Note any maintenance performed and any indications that future problems may exist and provide the homeowner with a copy of your report.

Bi-Annual Routine (every 6 months and annually)

BELOW ITEMS BY SERVICE TECHNICIAN ONLY

- Perform the quarterly inspection
- Lift and clean discharge pump making sure inlet is clean and unobstructed.
- Back-wash pump with garden hose (if available)
- Replace pump & level sensors if needed
- Remove any large foreign floating objects.
- Sludge level in the tank should be measured.

Note: A settable solid testing is an inaccurate method due to the batching method of an SBR system. Concentration values will fluctuate with volume throughout the day.

Ideally a full 2-3 hours would provide for actual discharge conditions however in the essence of time shut the blower off for 30 minutes to allow for settling. During this time clarity and separation should be observed at the rate of 1-2 inches. Should a scum layer exist create an opening using a gentle swirling action. If a sample port is provided it should be utilized. If the level is greater than 6" to 8" a pump-out is required.

The disposal area:

The disposal area should be routinely checked for leakage, soft spots or any indications of breakout. Pending the disposal method used testing and evaluations must be performed by a certified individual as recognized by your local and state health officials at the intervals required.

This area could be custom-designed by your dealer in accordance with the local regulations for which an approval application to the health or environment authorities was made and you should obtain a copy of this approval and installation drawing and maintained for your records.

EMERGENCY OPERATION

High water alarm

An audible alarm is provided in the control panel and remotely where applicable. This is the first indication a possible problem exist. The condition may exist due to high volume usage i.e. entertaining guest, heavy wash loads etc. The alarm should be silenced and the situation evaluated for possible cause. This is normally not a concern through fail safe features as described below the system will pump down should the level continue to rise. At no time should the high water level condition exist beyond 6:00 AM the following morning. Notify your service provider and a verbal assessment can be attained.

Flood Emergency and Fail-safe Features

FLS #3 Emergency pump on (EPO) sensor is adjusted to activate below the inlet piping. If the liquid level reaches the activation depth it will turn on the effluent pump to prevent the system from flooding. The effluent pump will pump down to the high water alarm sensor until the alarm condition is clear.

Blower or pump fails (Service Tech Only)

Check power breaker and motor starter making sure there are 230-volts going to the blower terminal 09 & 10 and 115V to contactor coil. Check power breaker and motor starter making sure there are 230-volts going to the pump motor starter and terminal 07 & 08 (when contactor is engaged) and 115V to contactor coil. If relay contactors are not engaging, check that the manual motor starters are in the "on" position and then check that there are 115 volts to the contactor magnetic coil. Check if the timer is running, and is set for proper time. If the timer, motor starter or contactor is malfunctioning, replace them.

For any Emergency situations please contact the manufacturer or service provider

AquaO2 International, Inc.

800-WASTE-04

1-800-(927-8304)

AquaO2 do's and don'ts (Quick Check List)

AquaO2 do's

- Use your system for disposal of all normal household wastewater.
- Your system has extra capacity to accept the temporary additional loading of parties, guests, etc.
- Leave power connected when leaving for a few days. System must be operating to maintain odor free, efficient operation.
- Your system will accept normal quantities of household cleaners, detergents, soaps, bleach, bluing, and toilet and sink cleaners, etc.
- Contact your AquaO2 dealer if you have any questions.

AquaO2 don'ts

- **Do not** let roof water; sump pump water or surface run-off water enters your system.
- **Do not** allow leaky taps to discharge into the system. The additional load can be very large and will reduce the life of the disposal area.
- **Do not** remove protective covers or tops from your system unnecessarily.
- **Do not** use excessive quantities of bleach. Bleach is a disinfectant and in large quantities can upset the bacteria balance in your system.
- **Do not** put paintbrush cleaner, paint, motor oil, water softener chemical or caustic chemicals into your system. They should be disposed in an approved manner.
- **Do not** use septic tank chemicals i.e. Rid-X etc.
- **Do not** flush paper towels, disposable diapers, sanitary napkins, male contraceptive, surface or baby wipes, cigarette butts, dental floss, rubber, or plastic products down the ***toilet***. The system will not digest them and they will cause blockage in the system piping.
- **Do not** be alarmed if an occasional item is discharged into the system.
- **Do not** shut off system during week if weekend cottage user.
- **Do not** discharge backwash from a water softener into the system.
- **Do not** turn the power off and continue to use system for a prolonged period of time.

Seasonal Shut down & Start-up (Where applicable)

- Do not shut off power if absent for a few days or a few weeks. Since there is no incoming flow, only the air compressor will operate consuming very little power. For an extended absence, simply turn off the power. When returning simply turn the power back on, give the system a visual check, make sure system is running. (Clock will remain set with battery backup)

AQUAO2 INTERNATIONAL INC.
FILTER BED RECOMENDED WATER LOVING
TREES / SHRUBS / GROUND COVER

Trees for Wet Soil

Alder, European Ash, white
Birch, river
Buckeye, Ohio
Hackberry
Linden, American
Magnolia, sweet bay
Oak, pin
Oak, swamp white
Sycamore
Walnut, black
Willow Trees (BEST)
Holly

Shrubs that Thrive in Wet Soils

Alder
Arrow wood
Billiard Spirea
Buttonbush
Chokeberry
Dogwoods (various)
Elderberry
Golden elder
Hardhack
Hydrangeas (various)
Nannyberry
Spicebush
Swamp rose
Willow

Winterberry holly

Ground Cover For moist Soil

Forget-me-not
Galax
Lily-of-the-valley
Partridgeberry
Phlox
Plantain-lily
Sandwort, moss
Siberian tea
Star violet
Swamp dewberry
Wild Sweet William
Wintergreen

Parts List

Item	Description
Blower	Gast Regenerative air compressor Model R-3105-1(or equivalent)
Pump	Goulds pumps model is system dependent
80000	Complete manways & lids Manufacturer - AquaO2
81000	Complete control panels Manufacturer - AquaO2
80206	Diffuser assemblies Manufacturer - AquaO2
80205	Level Sensors
80103	Clock timer
80105	Motor Starting Switch
80106P	Heater Coil Air compressor
80106P	Heater Coil Pump
80107	Current relay
80108	Relay socket
80110	Buzzer Alarm
80111	Panel Light
80112	Toggle Switch
80113	Toggle Switch Boot Cover
80109	Breaker (15/30/50 amp.)
80200	Air compressor air filters (5x5x10) Manufacturer - AquaO2
81200	Diffusers Foam (5x5x17) Manufacturer - AquaO2
80216	Brass Locks
80210	Pipe & Fittings Manufacturer - various
80213	1½ & 2" rubber hose Manufacturer – Goodyear
80237	Blower Capacitor 20 RAD Manufacturer –Gast

SPARE PARTS LIST TO BE STOCKED BY DEALERS

<u>Quantity</u>	<u>Description</u>
1	Gast Blower Model R-3105-1 (or equivalent)
1	Goulds pump Model 1DW51C1EA
Multiple	Level Sensor Manufacturer MDI
1	Clock timer
1	Motor starting switch (Allen Bradley)
Multiple	Air Intake filter 5x5x10” (AquaO2)
1	20 RAD capacitor (Allen Bradley)

WARRANTY

AquaO2 International Inc. (AquaO2) warrants the mechanical parts in each **Mini-Plant, Maxi-Plant, and Super-Maxi** Wastewater Treatment System (systems) when such systems are installed to AquaO2's specifications, registered, and acknowledged by AquaO2 to be free from defects in material and workmanship in normal use and service.

AquaO2's sole obligation under this warranty is limited to repairing or exchanging any component parts, F.O.B. factory, that in AquaO2's judgment show evidence of defects provided that said component parts are returned through an authorized AquaO2 Dealer or representative, transportation prepaid, within twenty-four (24) months from the date of installation. NSF listed AquaO2 Mini-Plant Wastewater Treatment Systems' component parts shall be covered under these same terms for twenty-four (24) months from the date of installation.

This warranty applies only to equipment supplied by AquaO2 and does not include any portion of the household plumbing, drainage, or disposal system. In no event shall AquaO2 be responsible for delay or damages of any kind or character resulting from or caused directly or indirectly by defective components or materials.

The liability of AquaO2 is limited to the replacement of the defective component parts and AquaO2 shall not be liable for any labor involved during the removal or replacement of its equipment, nor for the subsequent transportation or handling of any component parts thereof. In no case will AquaO2 be liable for loss incurred because of interruption of service or for consequential damages, labor, or other expense required repairing defective units, nor shall this constitute a cause for the cancellation of the contract of purchase and sale.

AquaO2 reserves the right to revise, change, or modify the construction and design of the AquaO2 Wastewater Treatment Systems, or any component parts thereof without incurring any obligation to make such changes or modifications in the above mentioned equipment. AquaO2 also reserves the right in making replacements of component parts under this warranty to furnish a component part, which in AquaO2's judgment is equivalent to the parts replaced.

Occasional service may be required for systems, which is not a result of defect in material or workmanship in the product, but is due to causes beyond AquaO2's control. Service charges (parts and labor) necessitated, or damage resulting from such events, is not covered by this warranty, and is not assumed by AquaO2. Such events may include, but are not limited to **(a)** accident, alteration, improper use, abuse, or tampering; **(b)** failure to follow installation instructions; **(c)** damage due to defective power supply or faulty installation.

This warranty is, and the owner of said AquaO2 Wastewater Treatment System agrees that it shall be, in lieu of all other warranties, express or implied, including warranties of merchantability of fitness, and of all other obligations or liabilities on AquaO2's part with respect to the **Mini-Plant, Maxi-Plant, or Super-Maxi** Wastewater Treatment Systems. No dealer or any other person is authorized or permitted to make any other contract or assume for AquaO2 any other obligations or liabilities not strictly in accordance with the provisions of this warranty.