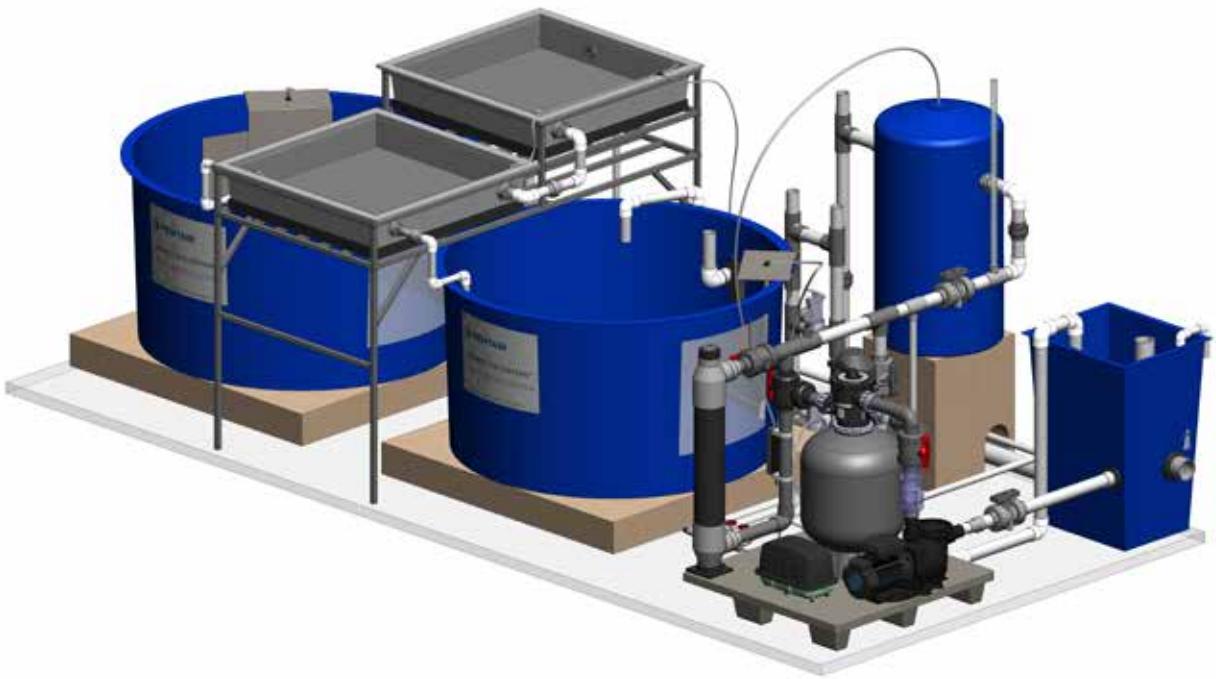
PENTAIR

AQUATIC ECO-SYSTEMS

AQUAPONICS SYSTEM 800



USER'S MANUAL

IMPORTANT SAFETY INSTRUCTIONS
READ AND FOLLOW ALL INSTRUCTIONS
SAVE THESE INSTRUCTIONS

CUSTOMER SERVICE / TECHNICAL SUPPORT

If you have questions about ordering Pentair Aquatic Eco Systems replacement parts, and products, please use the following contact information:

CUSTOMER SERVICE

8 AM to 7 PM Monday to Thursday
8 AM to 5 PM Friday
Eastern Standard Time Zone

Phone: +1 (407) 886-3939
Fax: +1 (407) 886-6787
Toll Free: (877) 347-4788

EMERGENCY CONTACT NUMBERS (24-HRS)

USA/Canada: +1.888.209.6056
International: +01.630.790.7470

WEB SITE
Visit www.PentairAES.com to find information about Pentair products.

2395 Apopka Blvd., Apopka, FL 32703, USA Phone: 407.886.3939 Web: PentairAES.com

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1.0

SAFETY AND OPERATING SYMBOLS

SAFETY MESSAGES

Safety is important to us. We have included safety messages throughout this manual for your protection. Please read and follow all directions.

A safety message has an alert symbol followed by an explanation of what the hazard is, what has happened and what you should do to avoid injury.

This is the safety alert symbol: ⚠

The safety alert symbol and "WARNING", "CAUTION", or "DANGER" we'll precede all safety messages:

⚠ CAUTION Caution notices apply to hazards or unsafe practices which could result in minor personal injury or property damage.

⚠ WARNING Warning notices as used in this manual apply to hazards or unsafe practices, which could result in personal injury or death.

⚠ DANGER Danger notices as used in this manual apply to hazards or unsafe practices, which can result in personal injury or death.

⚠ WARNING

DO NOT INSTALL, OPERATE OR MAINTAIN THIS SYSTEM AND EQUIPMENT WITHOUT READING, UNDERSTANDING AND FOLLOWING THE PROPER PENTAIR AQUATIC ECO-SYSTEMS, INC. INSTRUCTIONS. OTHERWISE, SERIOUS INJURY, DAMAGE TO EQUIPMENT, OR LOSS OF AQUATIC LIFE MAY RESULT.

Note: highlight procedures and information which assists the operator and understanding the information contained in this manual.

DAMAGE PREVENTION MESSAGES

A damage prevention message has **"ATTENTION"** with an explanation of what the equipment hazard is and what you should do to avoid damaging your system or equipment.

ATTENTION

Your equipment may be damaged if you do not follow these instructions.

2.0 INTRODUCTION TO AQUAPONICS SYSTEMS

Thank you for purchasing the Aquaponics System 800. The System has been carefully designed and engineered to provide a stable and healthy environment for fish and plants while also being easy to install and maintain.

Your particular system has been selected to accommodate a variety of fish species you may want to culture and your overall husbandry goals.

The Aquaponics System 800 is comprised of the following main components: pump, sump, biofilter, particulate filters, air pump and ultraviolet sterilizer. A diagram and specifications of these components is shown on succeeding pages.

Please note that aquatic holding systems, of any kind, are complex biological systems. Routine monitoring and maintenance of water quality is a critical part of the management of such systems. Aquaponics Systems are designed to minimize the labor requirements and complexity of these tasks, but they cannot be altogether avoided. We strongly urge that the system operator monitor and maintain a daily record of important water quality and system operating parameters as a means to ensure the health of the animals and provide data for facility inspections or cases where troubleshooting may be required.

Pentair Aquatic Eco-Systems also provides an array of water quality monitoring and control packages that automate many of these tasks. Please contact us at any time to learn more about these labor saving options.

This manual is written as a generic guide.

Additional manufacturer information may be supplied to supplement this manual for equipment not described. Please store all the equipment's owner/ operating manuals in a safe place as a reference in the future.

If, at any time, you have questions regarding your system that you are not able to answer by referring to this manual, please feel free to contact us.

2.1 General Theory

Note: It is strongly recommended that you read the following information before proceeding. This information is provided to give the user an idea of general design and operating principles and background relating to this Aquaponics System.

Aquaponic systems are becoming increasingly popular, and more people are finding innovative ways to produce more than one crop in their recirculating systems. Aquaponic systems are recirculating aquaculture systems that incorporate the production of plants without soil. In typical recirculating aquaculture systems, the goal is to produce large quantities of aquatic biomass in small amounts of space and small volumes of water. In such a system, waste products can accumulate if not physically removed or otherwise filtered via mechanical and biological means. The metabolic byproducts can be reused in aquaponics system by a secondary crop: plants.

While aquaponic systems may require less extensive biofiltration than conventional recirculating aquaculture systems, adequate filtration is still necessary to make sure the nutrients released from the fish waste are available to the plants. Typically, you need to incorporate solids separation and biofiltration with media with a high surface area for further microbial mineralization.

Plants can grow rapidly with dissolved nutrients that are excreted directly by the aquatic species or generated from the microbial breakdown of the fish waste by the various species of bacteria in the system. In closed recirculating systems with very little daily water exchange, dissolved nutrients accumulate creating a dilute hydroponic nutrient solution that is maintained because fish feed is input daily. These dissolved nutrients are taken up by the plants, allowing for more efficient use of the fish feed. Source : Recirculating Aquaculture Tank Production Systems: Aquaponics-Integrating Fish and Plant Culture. SRAC publication No. 454. Rakocy, J.E, Masser, M.P., Losordo, T.M. November 2006.

3.0 TERMS AND CONDITIONS

LIMITED WARRANTY Pentair Aquatic Eco-Systems ("PAES") warrants that its products shall, at the time of delivery and for a period of twelve (12) months thereafter, except for filters, be free from all defects in materials and workmanship; and, if any such product shall prove to be defective in material or workmanship under normal intended usage and maintenance during the warranty period, upon examination by PAES or its authorized representative, then PAES shall repair or replace, at its sole option, such defective products at its own expense; provided, however, that the Purchaser shall be required to ship each such defective product, freight prepaid, to PAES' designated facility. The warranty on products and/or components not manufactured by PAES, is limited to the warranty, if any, provided by the original manufacturer of said product or component. PAES sole warranty in regard to any components or products that are not manufactured by it shall be limited to the repair or replacement of the product, as set forth herein, with the condition that the Purchaser first return such defective item, freight prepaid, to PAES' designated facility. After PAES has made an inspection of the product, and has confirmed that there is a defect in the manufacture of the product, a credit will be issued to Purchaser's account. PAES HAS MADE NO AFFIRMATION OF FACT AND HAS MADE NO PROMISE RELATING TO THE GOODS BEING SOLD THAT HAS CREATED OR AMOUNTED TO AN EXPRESS WARRANTY OR THAT THE GOODS CONFORM TO ANY AFFIRMATION OR PROMISE. PAES DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTIBILITY AND FITNESS. PAES SHALL NOT BE RESPONSIBLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM ANY PRODUCT DEFECT. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

This Warranty does not extend to any Equipment that has been subjected to:

1.Damage caused by careless handling, improper repackaging, or shipping.

2.Damage due to misapplication, misuse, abuse or failure to properly operate equipment as specified to the owner's manual.

3.Damage caused by improper installation or storage as specified to the owner's manual.

4.Damage due to unauthorized product modifications, repairs or failure to use Pentair original replacement parts.

5.Damage caused by negligence, or failure to properly maintain products as specified to the owner's manual.

6.Accidental damage, fire, acts of God, or other circumstances outside the control of PAES.

4.0 SYSTEM INFORMATION

4.1 Fish Health Management

Every morning each tank should be monitored for fish health. Visually inspect fish in each tank throughout the day to assess their general well-being to see if they are exhibiting symptoms of stress. Remove dead or dying fish as quickly as possible placing them in an appropriate container for disposal. Record the number of mortalities from each tank. Disease conditions may be indicated by a gradual increase in mortality. Visual cues can identify when water quality parameters are sub-optimal. Fish will go off feed and swim slowly when oxygen and temperature levels are low. If oxygen levels continue to decrease fish will often gather near the surface with their backs out of the water. They may appear to be "gulping" air at the water surface. They will also group tightly near the tank water inlet where oxygen levels are higher.

4.2 Culture Tanks with center drain

The system consists of (2) two, 5.0 foot diameter x 2.8 foot deep circular tanks of approximately 440 gallon capacity. The hydraulic loading was designed to operate at 7 to 10 gallons per minute for each fish tank and result in a hydraulic retention time of approximately 45 to 60 minutes, respectively.

The tanks will operate using a center drain. The rotational flow pattern developed will induce tank self-cleaning and provide appropriate speeds to promote good fish heath and stamina. An additional emergency drain was plumbed through the tank sidewall and into the standpipe in case the bottom center drain becomes clogged or is restricted for unforeseen reasons. This emergency overflow will accept the normal flow rate, but result in increased water level in the fish tank until the center drain is cleared of any blockage. The overflow inlet pipe should be positioned at a 45 to 60 degree angle.

4.3 Diffuser Manifold

The two-diffuser manifold with deflector is designed to induce circular flow in each tank while assisting with the self-cleaning effect. The diffuser manifold will also be adding oxygen to the water. The diffusers will need to be submersed continuously to produce a uniform bubble in the water column and ensure oxygen concentrations remain optimal for fish health. Oxygen is transferred from the bubble into the water column as the bubble rises. Periodically the diffusers will need to be removed and cleaned with either a pressure washer or weak acid solution. It is recommended extra air diffusers be purchased to ensure the manifold can operate continuously during the cleaning period.

4.4 External Standpipe

The External standpipe sets the water level in each fish tank and can be used to manipulate the water level as desired for stocking and harvesting the fish tank. The effluent from each culture tank will exit its assigned standpipe into a common drain line. Prior to the filtration system, the water from the drain line will converge into a sump and then be redirected to the filtration system.

4.5 Sump

The sump allows the two waste streams from each fish tank to converge before being sent to the mechanical filtration components. In the event too much water is in the system the sump has been equipped with an emergency overflow. High water levels in the sump often result from operator error such as leaving inlets from makeup water on too long. It can also result from mechanical failure of a float valve, if present. For warmwater systems requiring heating during cooler months the sump is an appropriate area to locate a properly sized axial style electric immersion heater to maintain water temperature.

4.6 Float Valve

A float valve is used to maintain water at a pre-determined level. When adjusted and working properly a float valve is very accurate and extremely reliable. The float valve is located in the sump and controls the flow of make-up water to the system to replace water lost throughout the day from waste removal, evaporation and plant transpiration. You will need to check to make sure the float valve is allowing water to refill the tank as needed and then shuts off to prevent overflow of the system. If the float valve needs to be serviced close the ball valve just prior to the float valve, remove the unit and service or replace as needed.

Occasionally the float valve may become stuck open or closed, for reasons including mineral build-up, or becoming clogged with debris. This can result in unwanted volumes of make-up water entering the system and diluting nutrients or affecting fish health.

4.0 SYSTEM INFORMATION

Large amounts of make- up water from a municipal source may introduce elevated levels of chlorine or chloramine which can directly affect fish health. Products such as ClorAm-X® or Prime® can be used to decrease chlorine and chloramine levels. Prime is currently not approved for food fish by the Food and Drug Administration (FDA). ClorAm-X is approved for food fish by the FDA.

4.7 Taurus 110 Pump

The Taurus 110 is a self-priming pump and moves more water with more efficiency than other comparable industry leading pumps for lower operating cost and super-quiet operation.

By performing with less effort, there is less wear and tear—and that means a longer life for a higher return on your pump investment.

Optional 3ft 115V, 20 amp power cord, model 79137800-AQ (not included), is compatible with 115V Taurus pumps.

The inlet of the pump is plumbed to the sump and will draw in waste stream water from the fish tanks. The outlet of the pump will deliver water to the bead filter for solids removal. Regular pump maintenance should be conducted in order for the pump to function at highest capacity. The pumps should be shut down and pump basket removed and cleaned a minimum of once per week. This can be done at the time the bead filter is backwashed. Please refer to the owner's manual for recommended maintenance.

4.8 Solids Removal

The solids in a fish culture system are comprised mainly of fecal wastes and uneaten food. Without a means of effectively removing organic matter from small-scale recirculating systems the production capacity is severely limited. Excessive solids result in reduced oxygen concentrations, increased concentrations of ammonia, gill damage and accumulation on plants roots. Removing solids from the fish production system is important to maintain proper water quality parameters for fish and plant growth. The bead filter is an effective device to efficiently remove solids from the waste stream down to 50 microns in size. Overtime the beads in the filter will begin to accumulate a high concentration of organic matter from the waste stream and require cleaning. In order to clean the bead filter it must be backwashed according to the owner's manual. Regular maintenance should be performed to keep the bead filter clean, as clogging of the screen will occur over time. Frequency of cleaning will be dependent on fish stocking density and feeding rate. The bead filter should be backwashed to remove organic matter when the pressure gauge reads 2 to 4 psi greater than initial pressure reading at system commissioning. In addition, it should be cleaned when water quality (i.e. total ammonia and/or nitrite) parameters are not optimal for fish growth. Backwashing the filter will also allow the bead filter to perform to its highest capacity for efficient solids removal and reduce the power requirements of the Taurus 110 to push water through the bead media; thus saving the operator money.

4.9 Low Space Bioreactor

In recirculating aquaculture systems (RAS), a biofilter is required to prevent the accumulation of un-ionized ammonia, a toxic nitrogenous waste of fish metabolism. A biofilter uses the metabolic activity of cultured bacteria to convert toxic ammonia-nitrogen to less toxic forms using a process called nitrification. The low space bioreactor (LSB) in this system is uniquely suited for this application. The LSB vessel will be partially filled with slightly positively buoyant plastic media. The plastic media provides surface area for the nitrifying bacteria to live on. The bed of plastic media is continuously mixed with aeration. Air will be introduced into the unit through diffusers located beneath this media bed. The diffused air provides oxygen to the bacteria, while agitation maintains mixing and a consistent bacteria culture. A diaphragm air pump is used to provide the required air flow to the bioreactor.

Total ammonia nitrogen (TAN) production is proportional to total feed consumed. The portion of ammonia present as the more toxic un-ionized form (NH3-N) is related to the pH and temperature of the culture water. Operators will need to manage the daily feed input and pH of the system to minimize the risk of ammonia toxicity. The LSB is also responsible for the conversion of nitrite to nitrate. Nitrite is toxic to fish and can result in fish mortality. The operator will want to measure nitrite levels as well to make sure they are optimal for fish health.

4.0 SYSTEM INFORMATION

4.10 Aeration

The diaphragm air pump provides aeration to the diffuser manifold in the fish tank, plant trough and the low space bioreactor. The air pump will operate quietly and continuously to provide required oxygen concentrations to maintain fish, bacteria and plant health. The air pump creates a high volume of air at low pressure by taking atmospheric air and increasing the pressure enough to push air through the diffusers located in the fish tank and low space bioreactor.

Having constant back pressure placed on the unit will shorten its usable life. To prevent this from occurring you should not close airlines with continuous operation (i.e. fish tanks or biofilters) for extensive periods of time. If prolonged periods will be required do to maintenance issues in the systems then the extra air volume should be bled off to the atmosphere and/or redirected to another area to prevent back pressure during continuous operation. Please refer to the owner's manual for trouble shooting and servicing the unit. A blower repair kit is available and should be purchased to do necessary repairs.

4.11 Water Quality Parameters and Chemical Additions

Temperature and oxygen levels can have a significant effect on fish health and should be monitored on a continuous basis. The dissolved oxygen and pH should be tested daily. Water chemistry including macronutrients and micronutrients should be tested a minimum of one time per week, but can be done three times a week or even daily until familiarity with water quality parameters is established. Recommended tests to be conducted are un-ionized ammonia, nitrite, nitrate, calcium, magnesium, potassium and iron. Rising un-ionized ammonia and nitrite levels can quickly result in toxicity and fish death.

Potassium hydroxide, potassium bicarbonate, calcium hydroxide or calcium carbonate can be manually added in the sump. These chemicals will provide alkalinity to the system required by bacteria in the conversion of ammonia to nitrate and adjusts the system pH to levels suitable for fish and plant health. Caution should be used by the operator when using potassium or calcium hydroxide to prevent large increases in pH; thus affecting TAN toxicity. For every 1 unit increase in pH, un-ionized ammonia has the potential to increase tenfold. Plants generally prefer a lower pH (less than 7.0) while fish generally prefer a higher pH (greater than 7.0); in order to maintain a balance the recommended pH range is 6.7-7.2 mg/L.

Large water exchanges with city water are not recommended as this will decrease nutrient concentrations for optimal plant growth; however small water exchanges or water exchanges using a dechlorinating agent such as Chloram-Ex® or Prime may be necessary for emergencies in order to lower high un-ionized ammonia and nitrite concentrations. See table below for recommended ranges of warmwater water quality parameters.

Parameter	Sufficient Concentration
Total Ammonia	1.0 mg/L
Un-ionized Ammonia	<0.25 mg/L
Nitrite	1.0 mg/L
Nitrate	10-150 mg/L
Iron	1.0 mg/L
Calcium	50 mg/L
Potassium	50 mg/L
Alkalinity	50-150mg/L
pH	6.7-7.2

4.12 Temperature Control

Temperature control is critical to maintain optimum temperatures. Below are suggested temperature ranges for common cool water and warm water fish species. A customer service technician can assist with properly sizing a heater or chiller for the system.

Fish Species	Temperature Range
Tilapia	70-85F
Hybrid Striped Bass	65-75F
Koi	60-85F

4.0 SYSTEM INFORMATION

4.13 Raft System

The raft hydroponic system component, also known as deep water culture, is a common technology to integrate hydroponic plants with aquaculture. It provides the versatility to grow a variety of leafy plants and herbs and requires minimal maintenance. With the raft system plants are floated on a polystyrene board and positioned in pre-cut holes with a specific spacing based on the crop. The raft system is the last component in the design to ensure the fish waste stream is filtered before it reaches the unit. Accumulation of solids in the raft system will clog up the root systems of the plants and will inhibit their ability to take up oxygen and nutrients.

4.14 Water Quality Monitoring and Fish Health

Become familiar with the sound of your life support in operation (i.e. water pump and air pump). Oxygen failures in fish culture facilities are often accompanied by silence when the air pump is off. Respond to an emergency as calmly as possible by first stabilizing the fish, then identifying the source of the problem (failed water line, broken aeration pipe, etc.) and correcting it as quickly as possible. A daily log book of maintenance activities keeps track of equipment status for different components and allows others who weren't present at the time of maintenance to become aware of potential, on-going issues.

5.0 CONSTRUCTION MANUAL FOR AQUAPONICS SYSTEMS

5.1 Site Selection and Considerations

Site selection is one of the biggest influences on the aquaponics system design. Site selection is not just a factor of local climate and weather, it also encompasses availability of a clean water supply, power supply, waste line, ease of drainage. The climate and weather will have a huge influence on crop selection and design.

5.2 Power requirement

Water Pump : ½ HP 115V/208-230V 60 hz

Air pump: 115V 60 hz

Bead filter blower: 1 HP 115V 60hz

5.3 Tools/Supplies needed

- Philips Head Screw Driver
- 2" Pipe cutter
- Hand Saw
- Spirit Level
- Adjustable wrench
- Sharpie
- Clear primer and Glue for PVC pipe
- Paper towels
- Gloves
- Tape measure
- PVC pipe (Amount will vary depending on customer set up. Estimated length is 100 ft.)
- CMU blocks (80 each of 8" X 8" X 16")
- Flexible hose for bead filter waste line
- Knife
- Teflon tape

(All unions, elbows, valves etc. are provided with the system)