



AIROXI TUBE MANUAL

INSTALLATION, USE AND MAINTENANCE GUIDE

Version 2.1

July 2018

This is a general guide for installation and maintenance of AirOxi tube and blower based aeration system.

For specific queries or suggestions please contact us on www.airoxitube.com with details about the pond and culture

Introduction

This installation manual is a reference guide for installing AirOxi tube with a root blower (either twin lobe or tri lobe) in aquaculture ponds. AirOxi tube and system is a blower based aeration system to provide aeration, and hence increase Dissolved Oxygen (DO) in the water.

This is not a technical manual, only a guide for proper installation of the machinery and system. The basis for the suggestions are the empirical results and good practices followed by aquaculture farmers and technicians, as well as secondary research in the field of aeration. The scope is limited to blower and aeration tube based aeration system (diffused aeration) using AirOxi Tube.

The benefits expected from high DO are also based on aquaculture farmer feedback. However the benefits of good DO and of using diffused aeration are widely and easily available and we recommend that you go through them.

Since each pond and DO requirement of each species requirement is different, and the practices differ from place to place, there are some assumptions made while recommending the specifications and design in this manual.

Assumptions

- *L. Vennamei* and its dissolved oxygen requirement is considered for calculations
- Temperature, salinity and other parameters are considered as per standard brackish water conditions available for aquaculture in India
- Similarly, average stocking density, culture period, bio mass and average ecological conditions are considered to exist in the pond
- Blower specifications considered are – 3 phase twin lobe blower operating at 1440 rpm. Please refer to the blower manufacturer technical data sheet to get air flow rates. The power rating of the blower is given only for ease of use and as a substitute for air flow, based on common blower specifications.
- Average % dissolution of air is considered to be 8%. This is a conservative estimate. However actual dissolution can be higher depending on the depth of installation, salinity, air pressure, etc.

For a more accurate installation assistance, please contact a qualified aquaculture technician or write to us on contact@airoxitube.com

All information provided here is in good faith but without warranty

Frequently Asked Questions (FAQs)

1) What are the benefits of using Aeration Tube over paddle wheel aerators or other methods?

- ✓ Using the diffused aeration method gives upto 3 times higher Dissolved Oxygen (DO) because of higher Standard Oxygen Transfer Rate (SOTR). Another way to see this is that you can get similar DO with 3 times lower power consumption.
- ✓ It provides good DO at pond bottom also where other methods fail. This leads to better immunity and higher survival rate. Higher Stocking density is possible because of higher DO. Better and faster growth of species and probiotics, better organic conversion of waste due to good growth of probiotics and a better autotrophic cycle are other benefits of diffused aeration.

2) How is AirOxi tube different from using other submerged methods like jet aerators

- ✓ The tube is made of a special elastomeric compound that gives it the property of micro holes with very small bubble size. This ensures that the bubble size is very small and oxygen transfer is very high. Other methods of aeration are not able to get this level of oxygen transfer.

3) What is the air flow rate of the tube?

- ✓ The designed air flow is 0.5 m³/hr for high efficiency but since the burst pressure of the tube is very high, the range of air flow is very high - upto 3-5 m³/hr depending on the size of tube selected. Actual working flow rate will depend on many parameters like installation depth, design used to install the tube, blower type and capacity, inlet pipe size and inlet pressure. Since all these reduce the final air reaching the tube, we recommend using 30 to 40 mtr of tube per HP of blower size, as a simple thumb rule. Please get in touch with us for a site specific solution.

4) Even after installing the diffused aeration method using AirOxi Tubes, will I need to use paddle aerators?

- ✓ Once you install the AirOxi tube system, you do not need to use the paddle aerators for increasing Dissolved Oxygen. Paddle aerators, long arm aerators, jet aerators and other aerators spend more energy on water movement than in aerating. If you already have paddle aerators, you can use them in 4 corners of the pond for 2 hours a day (staggered intervals) for water movement to give directional flow to the water. If you wish to use these tubes for giving directional flow to the water, without using paddle aerators, there are simple designs available which can do this. Please contact us for more details.

5) If there are holes in the tube, do they choke up when used in the pond?

✓ The tube is designed with micro holes to maximize efficiency of oxygen transfer. But since it will be in water all the time, the quality of the water will affect the tube condition and it may have blocked holes. Besides that, it is always better to clean it between cultures. However what is important to customers is that at least through the length of the culture, there is no need to clean the tube. For this many preventive actions can be taken.

6) What kind of preventive actions will prevent blocking of tube

Blocking or clogging of holes may happen depending on how proper is the installation, how often is it used and the conditions in the pond. There are few simple ways to ensure that the holes do not block

- Installing the tube 12-18" above pond bottom will prevent sludge from sticking to the tube. The tube should remain above the pond bottom, even when air is not flowing through it
- Continuous use to give high aeration will also not allow any waste to stick to the tube
- Installation in lengths of less than 3 mtrs. Contact our representative for advice on which designs work best and can avoid such problems.
- Ensuring large size inlet pipe from header pipe to the tube so there is minimum pressure drop and sufficient air is available as per the designed air flow of the tube. Consider 1 tube inlet of 16 mm lateral pipe or ½" pipe for every 2 mtrs of AirOxi Tube
- Using large size header pipe. The main header should at most be 1" less than blower outlet. If the blower outlet is 5", then the minimum size header pipe you should use is 4" / 100 mm, etc.

7) So how often is it required to clean the tube?

✓ How frequently the tube has to be cleaned depends on pond water conditions. In some ponds cleaning is not required for 3-4 months (and so it is done after the harvest). And in some cases it needs to be done once in 10 days.

✓ The difference is because of water conditions and also how often the air is blown and if installation is as per recommended length and inlet pipe size used for air flow. For proper installation and continuous use the tube will not be normally required to be cleaned during culture.

8) I do not want to clean the tube during the culture. What is the best way to ensure that cleaning is not required during the culture and I can do it after the harvest?

- ✓ Select the right size of the blower and quantity of tube
- ✓ Install AirOxi tube at a height of 12 to 15"

- ✓ Keep length of tube around 2 mtrs in single length or 5 x 1 mtrs in a grid
- ✓ Ensure good size of inlet pipe – 16 mm for 2 mtrs and 32 mm for 5 mtrs
- ✓ Use continuously, 24 x 7

9) How do we know if the holes are getting blocked and how do we clean it?

- ✓ Even before the air flow is visibly reduced, the pressure gauge will show an increase in operating pressure. Which means you can take up preventive cleaning rather than waiting for the air flow to visibly reduce.
- ✓ Cleaning is simple using a rough cleaning surface tool (like AirOxi cleaning clamp) that will pull out the sludge sticking on the surface (e.g.: A rough scraper that will not push the sludge deeper in the tube). You can also dip the tube in solutions that will clean organic waste like bleaching powder or hydrogen peroxide or strong industrial acid. You can also contact our representative for more information on which tools and methods are most effective.

10) What is the warranty on the product and what is the expected usable life?

AirOxi tube has a 1 year warranty against manufacturing defect. The tube can be used for many years with simple and proper maintenance. It is however recommended that you change the tube once it is used for a few seasons, to ensure good flow rate and oxygen transfer

11) What are the different types of tubes that I can choose from and how do I decide which is best suited for my farm or nursery?

AirOxi has many sizes of tubes, each with different specifications. The performance and high quality material is same for all sizes. The different sizes are made for various markets and applications. The three sizes that are most common for aquaculture, and we recommend that you choose from are

- a) AirOxi high performance aeration tube. Size 12.5 x 25 mm (1/2" x 1") marked with a blue line.
- b) AirOxi Algae resistant tube Size 12.5 x 25 mm (1/2" x 1") marked with a green line.
- c) AirOxi Hi-Flow tube of size 25 m x 38 mm (1" x 1.5") designed for 1" inlet and giving very high flow rate, especially recommended for hatcheries and nurseries where higher air flow per meter is required.

All calculations given in this manual are for type a) and b)

Selecting the correct blower size, tube quantity and pipeline diameter

- ✓ **Selecting the right size of blower** for the pond is the most important step. Please refer table below for reference. This is for stocking of about 35 L. Vennam shrimps per square meter in mud pond (roughly 50 to 55 / sq mtr for PE lined pond)
- ✓ Continuous operation of the AirOxi system should give sufficient dissolved oxygen. And hence paddle aerators or other aerators will not be required for aeration purposes. Hence a continuous operation is considered for these suggestions of blower size and quantity of tube. Please adjust accordingly if continuous operation is not planned.
- ✓ For higher stocking, deeper ponds or other species, please adjust the blower and tube quantity according to the DO requirement and COD / BOD (Chemical Oxygen Demand and Biological Oxygen Demand) of the pond
- ✓ **As a thumb rule, you can consider 1 HP of blower for 800 - 1000 Kg biomass** for grow out ponds.
- ✓ **Consider 30 to 40 mtrs of tube for every HP of blower considered.** The actual quantity will vary from pond to pond depending on stocking density, COD / BOD, length of piping and losses in friction and turns and leakages.

For Grow out Ponds – L. Vennam				
Area	Bio Mass assumed at harvest	Recommended blower size	Recommended boundary pipe minimum diameter (PVC or HDPE)	Recommended Tube quantity
1 Acre	3 MT	3 to 5 HP	2.5" / 63 mm	100 mtrs
1 Hectare	5 MT	5 HP	3" / 75 mm	150 mtrs
2 Hectare	7.5 MT	7.5 HP	3" / 75 mm	200 mtrs
3 hectare	10 MT	10 HP	4" / 100 mm	300 mtrs
For every additional hectare	2.5 MT	Add 2.5 HP	4" / 100 mm	Add 100 mtr

Blower and AirOxi Tube Calculation for nurseries

- ✓ A similar thumb rule to consider for nurseries is 0.01 HP per 1000 ltrs of water used in the nursery. And 30 to 40 mtrs of AirOxi tube per HP of blower used.
- ✓ This calculation is considering a stocking of 1500/ per sq. mtr in the nursery
- ✓ The actual quantity will vary depending on the stocking in the nursery and the expected duration, but the thumb rule is generally useful in most nurseries.
- ✓ Some experts recommend 0.02 HP per 1000 ltrs of water as an ideal situation when considering around stocking density of 1500 per m³ in nursery. You may want to take this into account while planning for the nursery.

For Nurseries - considering 28 days and stocking of 1000/ sq mtr or 1500 / m³ of water			
Area (sq mtr)	Recommended blower size (or consider 0.02 HP per 1000 ltrs of water)	Recommended boundary pipe minimum diameter (PVC or HDPE)	Recommended AirOxi Tube quantity
800	10 HP	3" / 75 mm	300 mtr
1000	15 HP	3" / 75 mm	450 mtr
1500	20 HP	4" / 100 mm	600 mtr

These are recommended from the current market practices. A more detailed reference sheet is available in the next pages

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AirOxi Tube and Blower selection guide

Version 2.1 July 2018. Please contact by email on contact@airoxitube.com to check if you have the latest version of this calculation

This guide is for reference only. Please contact qualified technician for accurate calculations

All calculations are considering 24 hour operation. Please increase accordingly for lower hours of operation.

Approximate output	AirOxi tube + blower 1 HP	Airoxi Tube + Blower 5 HP
DO / hour	3.6 Kg	18 Kg

Thumb Rule used for calculations				
For Grow out shrimp	For Grow out Fish	For RAS system	For Nursery - outdoor	For Nursery - indoor
1 HP per 1 ton biomass	1 HP per 3 ton biomass	1 HP per 3 Ton biomass	0.02 HP per 1000 ltrs water (or per 1300 pcs)	0.04 HP per 1000 ltrs water (or per 1300 pcs)

Calculation is indicative only for Shrimp. For detailed calculation please use the AirOxi Aeration Calculation sheet

AirOxi Tube For Growout ponds - Mud

Bio Mass	Blower size - HP	Tube quantity (mtr)
1000	2	60
2000	3	90
3000	4	120
4000	5	150
5000	7	210
6000	8	240
7000	9	270
8000	10	300
9000	12	360
10000	13	390
11000	14	420
12000	15	450
13000	17	510
14000	18	540
15000	19	570

Calculation is as per 28 days only.

AirOxi tube for Nursery (outdoor)

Area of nursery (m2)	Water volume m3 (1.5 mtr deep)	Shrimp seeds in lac (2000 / sq mtr or 3000 / m3)	Blower size - HP	Tube quantity (mtr)
100	150	2.0	3	105
200	300	4.0	5	175
300	450	6.0	8	280
400	600	8.0	10	350
500	750	10.0	13	455
600	900	12.0	15	525
700	1050	14.0	18	630
800	1200	16.0	20	700
900	1350	18.0	23	805
1000	1500	20.0	25	875
1100	1650	22.0	28	980
1200	1800	24.0	30	1050
1300	1950	26.0	33	1155
1400	2100	28.0	35	1225
1500	2250	30.0	38	1330

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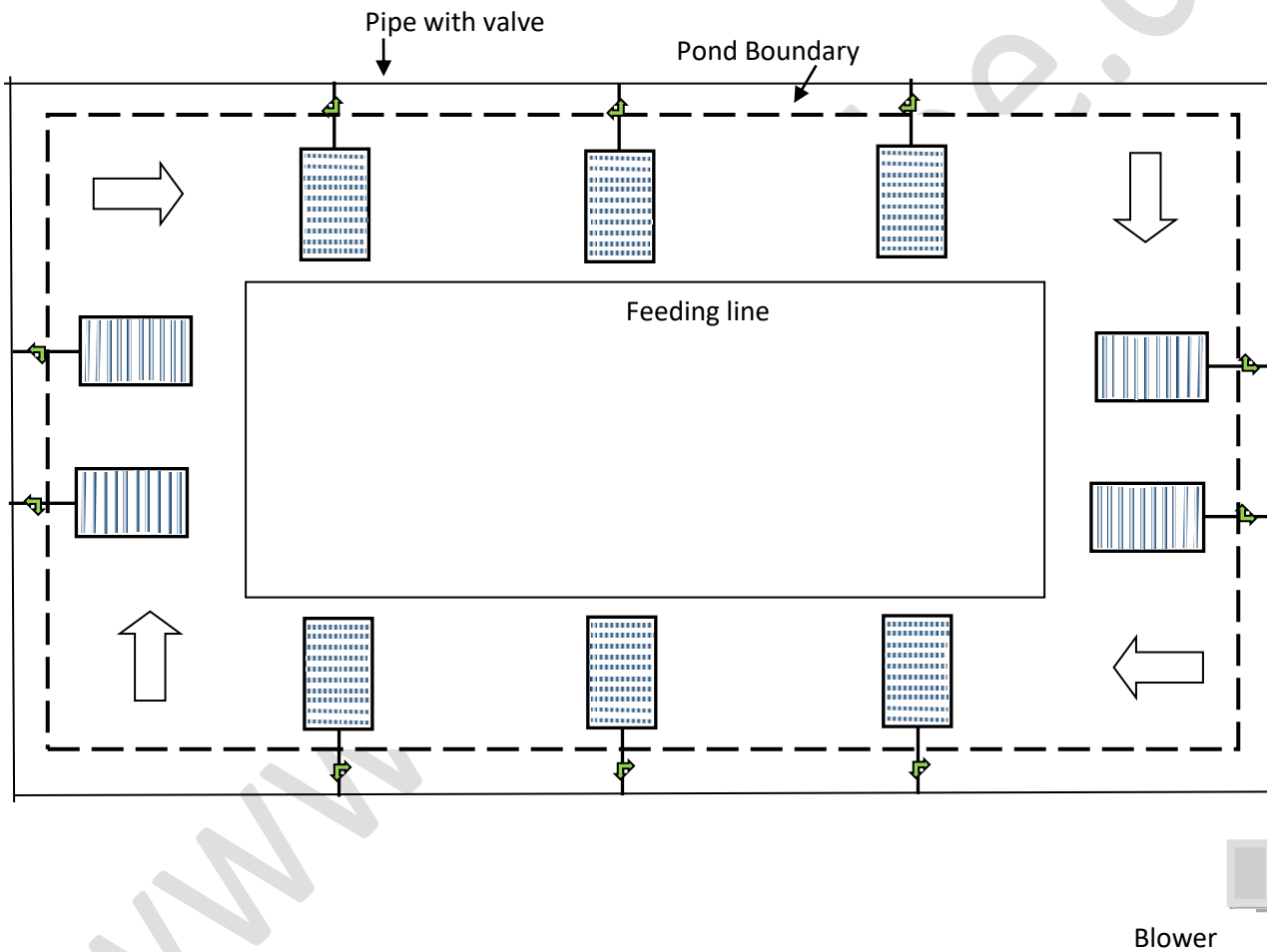
Sample Layout for 1 hectare pond

Pond Size -120 mtr x 80 mtr

Blower – 5.0 HP – operating continuously

Paddle aerators – 1 HP x 4 nos at 4 corners – for 2-3 hours daily water circulation only

AirOxi Tube – 200 mtrs. 40 **grids of 5 mtrs each**. Each Grid has 5 nos x 1 mtr long tube



INSTALLING THE BLOWER

- ✓ For detailed instructions on blower installation please refer to the blower manufacturer manual.
- ✓ However some pictures are given here to understand the piping to be done from the blower to AirOxi tubes.
- ✓ When multiple ponds are supplied by multiple blowers, making a common receiver is a preferred way to install.

This will help carry the air to various ponds while keeping the blowers in one location. This also gives the flexibility of starting blowers as needed – less operation during day time and when the size is small. And more blowers at night and closer to harvest.

Videos of AirOxi tubes and blowers installed in various types of ponds are available on www.youtube.com/airoxitube



Note: It is important that sufficient pipe size is used all the way from the blower to AirOxi Tube, so as enough air volume and pressure is available in AirOxi Tube to resist choking.

Header pipe should be at most 1" less than blower outlet and border piping should be at most 1.5" less than blower outlet. For 4" blower outlet, header pipe should be 3" / 75 mm and border piping should be 2.5" / 63 mm

RECOMMENDED INSTALLATION DESIGN FOR BEST RESULTS

- ✓ **Install AirOxi Tube on stand which is at least 12" to 15" (12 to 15 inches) above the pond bottom. (see pictures) in case of mud ponds and 6" in case of PE lined ponds.**
- ✓ When air flow stops, the tube should not touch the pond bottom, else it will choke very fast. Use any of these various designs to ensure the tube is 12"-15" above pond bottom even when no air is flowing through the tube.
- ✓ It is strongly recommended that the AirOxi tube is installed in a maximum continuous **length of 2 mtrs or less. 1 mr rings are also recommended for good performance**
- ✓ For best results, make a grid of PVC pipe of diameter 1.5" – 1mtr x 1 mtr. Make holes in it to attached the grommet with take off as shown. And space them 4-5" apart.
- ✓ The inlet pipe from the header HDPE or PVC pipe must be 1.5" suction hose. Suggested best layout is given below in pictures.



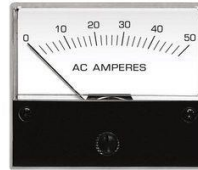
OTHER INSTALLATION METHODS DEPENDING ON CUSTOMER CONVENIENCE

- ✓ For all designs, ensure that the air flow throughout the piping from the blower to AirOxi tube has sufficient diameter for the air to flow freely.
- ✓ Ensure all joints are properly sealed and there are no air leakages.
- ✓ PVC rectangular grid should be of maximum upto 10 mtrs, each AirOxi tube of 1 mtr length. In such a case, the PVC grid must be made up of 1.5" (40mm) PVC pipe
- ✓ If installation is in 1 mtr ring, you can use inlet of 16 mm lateral pipe.
- ✓ For PVC rectangle grids of upto 5 nos x 1 mtr of AirOxi tube, if using 16 mm lateral pipe, ensure you give at least 2 points of air inlets in the grid.
- ✓ If it is in a 3 mtr spiral, inlet must be given from both sides using Tee and you can use 16 mm lateral pipe connected to the periphery HDPE pipe.



IMPORTANT ACCESSORIES TO BE USED

- ✓ Always use **ampere meter** for blower so you know the load of the motor. Operating load should be the rated load of the motor. If it is higher then you may need to increase the quantity of tube or change the installation design



✓

- ✓ Ensure that the **pressure gauge** on the blower is installed and working correctly. Operating pressure should be in the range of 3 - 5 PSI (0.2 – 0.4 Kg/ cm²) and if it is higher or lower, you need to decrease or increase the quantity of tube or size of the blower.



- ✓ **Check the filter of blower** is of good quality and at least 100 mesh size or paper filter. This will avoid tube choking through dust taken from the atmosphere



- ✓ When using diesel engine directly with the blower – keep the exhaust of the engine at least 2 feet higher and away from the blower. Otherwise the tube will get choked with carbon particles. And carbon monoxide, carbon dioxide and other gas levels in the pond will be increase, affecting the growth of the livestock.



- ✓ **Provide release valve in front of blower.** This is necessary because the tubes will have water in them, when the blower is turned off. Every time the blower is started, the valve is to be kept open and then slowly closed over 2 to 3 minutes, to reduce load on motor.



- ✓ **Ensure that every line going from header pipe to AirOxi Tube ring / spiral / grid has a valve.** This is needed to compensate air flow at different places in the pond. Air flow will be different at different places because **water depth is different at different places** in the pond. The water pressure will make a difference which needs to be compensated. Wherever water depth is high, open the valve more.

Also the **distance of tube/ ring / grid from the blower will cause drop in air pressure.** The valves are to be used to compensate for this drop in pressure. The further away the grid is from the blower, the more you need to open the valve.



- ✓ **Provide Non Return Valve (NRV) in the blower.** When the blower is switched off, the no return valve will prevent the water from entering the blower.



- ✓ **If possible, install the blower at a height of 2 to 3 feet above the water level.** This will also prevent the water from entering the blower when the blower is switched off. There is a vacuum created when the blower is turned off and water will enter through the tubes and rise up in the pipes. The height difference will ensure water does not go in the blower. The maintenance of tubes will also be reduced because of this.

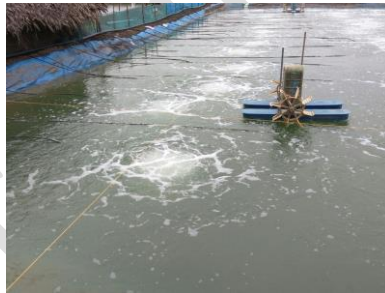
INDICATORS TO KNOW WHETHER THE SYSTEM IS INSTALLED PROPERLY

- ✓ **Ampere meter shows rate load** when blower is working.



- ✓ **All tubes should aerate with proper bubbles. The air should not come out very fast like boiling.** Nor should it be very less air.

If air is coming out very fast like boiling then the blower is too big or the tubes are very less. So you need to increase number of tubes. As a temporary solution you can release extra air, but you will need to increase tubes. **(See picture)**



- ✓ **Pressure Gauge shows reading of approximately 3 to 4 PSI Or 0.2 – 0.3 Kg / cm².** The Root blowers generally work at 0.3 Kg/cm² pressure. If this is higher than operating pressure, you need to increase number of tubes. Or reduce size of blower. Or open air release valve



- ✓ **Individual valves used for each grid / ring / spiral are open at different angles.** This ensures every place gets proper aeration. If they are all fully open, adjust them to compensate for water pressure at different pond depths and also for distance of AirOxi tube from the blower.

PROPER USE OF TUBE TO MINIMIZE MAINTENANCE AND BREAKDOWN

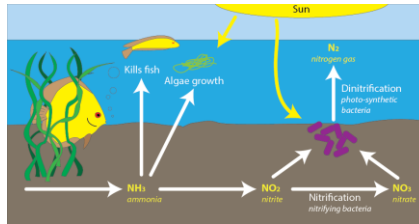
- ✓ **Use the tube from day 1 of installation or stocking.** This will ensure that the micro holes are kept free of any particles.



- ✓ **Use the tube Regularly and continuously.** Even if DO levels are sufficient, using the tubes at night will ensure that you get high DO levels (and not just sufficient levels needed for survival). Good DO levels lead to better growth, higher survival, higher immunity. Use it for as long as possible to avoid choking. AirOxi tube is designed for continuous use and its purpose is to ensure high DO at lowest power consumption. Hence using it regularly and for long hours will ensure it does not clog



- ✓ Regular use of 20 hours or more will not just increase DO, but also **release the trapped ammonia gases** into the atmosphere. And it will give a good **growth to the other good organisms** in the pond, hence the **Autotrophic cycle** will ensure higher number of good bacteria and other organisms. This will **breakdown the sludge and other waste of the pond in an organic manner and encourage growth of probiotics**.



- ✓ **Each time, before starting the blower, keep the air release valve open.** The tubes will have water in them, when the blower is turned off. So when restarting, keep the release valve open to reduce load on motor. And then slowly close it, as bubbles increase. When load is within limits and all tubes have bubbles coming out, close it completely.
- ✓ **Every week – clean blower filter.** If dust enters from outside through a bad filter, it will choke up the tube.
- ✓ **Check pressure gauge everyday.** The pressure gauge should be working properly. If it shows an increase in the rating as compared to when installed, it maybe time to do a quick surface cleaning of the tube using the *AirOxi cleaning clamp*
- ✓ **Clean tubes when pressure gauge shows higher pressure. Or when you see reduced flow of air.** Please refer to recommend cleaning method document for the cleaning procedure
- ✓ **Keep extra 10% grid / spiral / rings –** for use when you are cleaning the tubes.
- ✓ **Check fittings every week.** Make sure there are no leakages in the piping.
- ✓ Even if tubes are working perfectly, it is advisable to clean them once a month as preventive maintenance

RESULTS TO EXPECT IF TUBE IS BEING USED PROPERLY

- ✓ **Faster growth. Saving of 10-15 days in growth.** (Measured by increase in feed, etc.) Compared to traditional methods used for aeration, the larvae to harvest time should decrease by 10-15 days approximately (for similar stocking density and considering weight of 30-35 gram at harvest)



- ✓ **Higher stocking density and biomass at harvest** if you increase stocking seed stocking since DO can be made available without proportionate increase in power consumption.
- ✓ **Higher survival rate** (measured by increase in feed, etc.). If survival was under 80% earlier, then with proper use of this aeration method, and using it for 20 hours a day, you can expect a survival rate increase by 5-10%, (good pond management and other factors also need to be taken into account). For **mud ponds 85% survival** is quite common with good practices and good aeration and for **PE lined ponds this can increase to 90-95%**



- ✓ **Lower power consumption.** If the customer is using blowers for aeration, and using paddle only for water circulation (2 hours a day at most), **then power cost for aeration should go down by 40-60%**



If you find that the tubes are not used, and paddle aerators are being used, then check for the above benefits. With irregular use the customer may not be getting the full benefit of using this system

CLEANING PROCESS SUGGESTED FOR AirOxi TUBE

TO MINIMIZE THE CLEANING REQUIRED DURING THE CULTURE, USE 1 MTR X 5 NOS GRID METHOD OF INSTALLATION AND USE THE SYSTEM FOR 22 TO 24 HOURS A DAY

AirOxi Tube is going to remain in water for 2-3 months. So it is possible that algae, food, fecal matter, waste particles, salt and other elements stick to the tube. The procedure for cleaning is very easy and this will make the tube as good as new, without compromising on life or quality of the product. The following is one of the procedures one can use and it will ensure proper cleaning even in the most extreme cases of clogging/ choking.

We have suggested different solutions to clean the tube with, because each pond has different elements to it. There are various things that we add to the pond like minerals, feed, probiotics, etc. which make each pond unique.

When to clean - Whenever your pressure gauge reading has increased by 0.5 to 1.0 PSI from the reading when tubes were newly installed. OR when bubbles seen on top seem reduced from earlier. Also definitely clean the tubes between two cultures

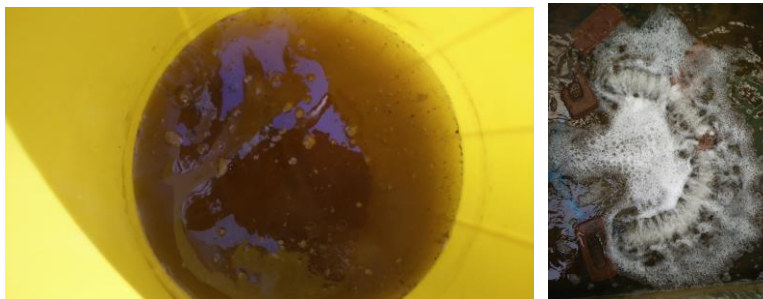
Step 1 – Remove AirOxi Tube from water and let it dry. Use the AirOxi cleaning clamp OR a rough water proof emery / sand paper (picture below) to thoroughly scrub it. This will remove all dried solid particles. You can use wire brush also but it should be used in a manner where it pulls the dirt and scrubs it outside, rather than pushing it in the micro holes



Step 2 Option A – In a large drum (big enough to fit the whole frame), take Hydrogen Peroxide and dilute it in the ratio 1:3 – 1 part acid to 3 part water. Dip the tube in this mix for 2 hours. This will remove all salts and other particles that are choking the tube.

Step 2 Option B: You can use bleaching powder as an option to Hydrogen Peroxide. Add 100 gram of bleaching powder to 1 ltr of water and keep tubes dipped in this mixture for 4 hours

Step 2 Option C: If hydrogen peroxide and bleaching powder are not to be used or you do not get required result, you can industrial grade acid or cleaning acid. (HCL or H_2SO_4) Dilute it depending on the concentration of the acid, for safety of use. The acid will not damage the tube but dilution is recommended for safety reasons



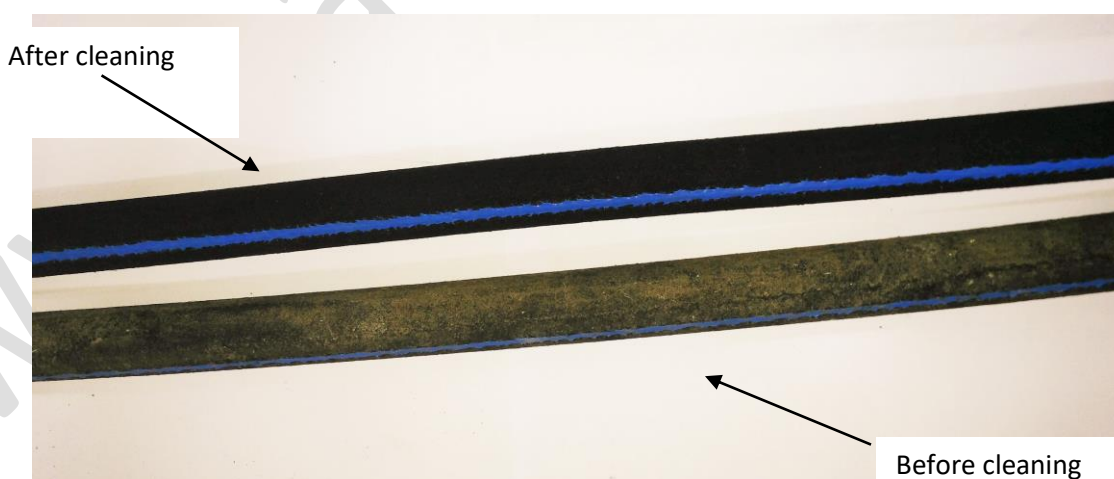
Step 3 – Take out the tube and rub it with the AirOxi Cleaning Clamp (picture in previous page) to clean loose particles

Step 4 – Wash the tube in clean water.

Step 5 – If convenient, push some air in the frame / tube for a few minutes to remove any particles that are dissolved and remaining inside. And then let it dry totally.

Step 6: Put the tubes back in the water **only after they are totally dry**. This will improve results. And the performance will be as good as new

You can see the picture before and after cleaning here



******* END OF INSTALLATION MANUAL *******