



START-UP PROCEDURE

Systems with multiple diffusers such as Bubble Tubing® and OctoAir™

Once the compressor is in place and ready to operate all tubing lines can be placed as per the installation plan. It is ideal to install diffusers in place when air flow is available to see where aeration lines are and to make adjustments on layout with a visual of the bubble pattern. To start, make sure all operating valves (manifold if any) are fully open and do not provide any restrictions. Restrictions will be needed after all lines are in place if adjustments are needed (see further).

At start-up or if the system was turned off for a long time, we assume a little water might have percolated into the diffusers through the holes. This is normal and expected, a purge period should be considered before starting to adjust the airflow distribution in the network/lines. A purge is done by using air pressure to blow the water out of the diffuser pores. This purge is over within a few minutes unless a single compressor is feeding many lines or multiple manifolds. In this case, you need to wait for the air to be distributed and balanced in all lines of the network. Let's say you have already installed your lines and you are on day #1 of testing and adjusting the system:

Start by turning off the compressor for 15 minutes to allow for the first measurements of pressure: After 15 minutes, turn the compressor on and note the pressure level shown on the pressure gauge after the first 30 seconds of operation.

Let the system work for 15 minutes and wait before doing any adjustments and corrections you may observe. After that time you will be able to see if any sections are bubbling more aggressively or less strictly by a visual observation.

After the first 15 minutes, note which lines and diffusers are working or not, then review the reading on the pressure gauge, compare notes of before and after this will help you understand the next steps. Understand that pressure readings should be lower after 15 minutes as water has been replaced by void or air in the diffuser lines.

Lesson #1: The air will go where there is the least amount of resistance.

If all lines are bubbling evenly, then you are set but likely you will see some bubbling and some not so much. In that situation, the lines that are working well and show a full bubble pattern are lines that are:

- In the shallowest area of the basin or with the least back pressure caused by the airline length, in other words they are close to the compressor or in shallower zones. It is assumed that due to the 15 minutes of operation, they have already been purged of any water or condensation in them.
- Distance is also a factor that create the effect of increased depth.

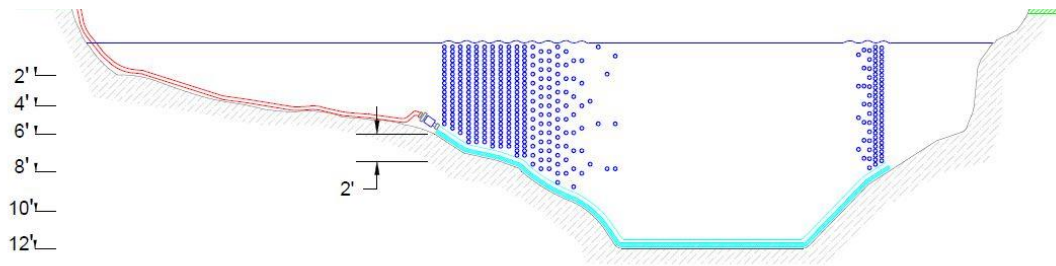


Fig. 1 – Improper installation (variable depth)

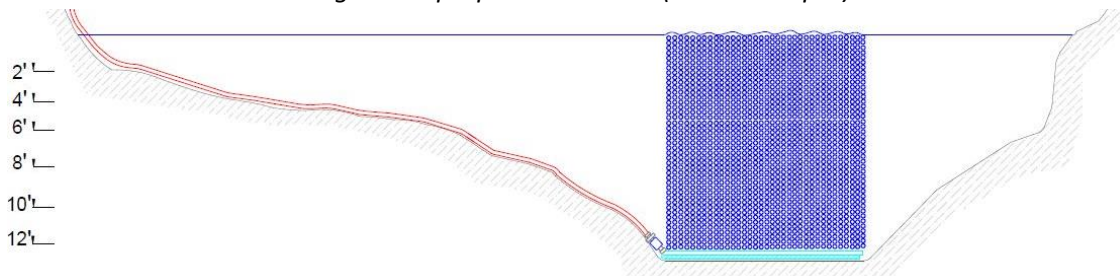


Fig. 2 – Correct installation

If any line is not bubbling evenly or simply not bubbling at all follow target the lines that are working well, take note of which ones are doing best and which ones are not on the manifold and try the following:

- Restrict the air flow (close partially the valve) on the lines that works best
- You might also need a few minutes to purge water out of the remaining lines that are not bubbling well.

- c. Once those lines are bubbling correctly, go back to the lines you have closed and start opening them again slowly until their bubble pattern is similar to the deeper lines
- d. Evaluate the performance of each individual line in your notebook. The bubble pattern will be telling you where the tubing is shallow (aggressive bubbles) and where the water is deeper (less bubbles visible)
- e. Tweaking the valves until you achieve the most homogenous pattern can be tricky but that is similar to tuning a guitar, each string affects the others.
- f. Go back to your measures of pressure on your manifold to see if it makes sense and how different it is from the original reading.
- g. Don't forget it is important not to overall air flow but only restrict the air escaping in the most aggressive lines, that air flow will then want to escape through the other lines that were not doing as well.
- h. Be patient, try again from the beginning if it doesn't work the first time.

Lesson #2: Too much air flow in a line will create back pressure creating a pressure loss caused by velocity of the air molecules.

Imagine an installation designed for 10 lines of 30 m each of Bubble Tubing®. It will not be possible to push the entire air flow for 10 lines into one single line. The velocity of the air molecules will be too great and the resulting friction created will cause a pressure loss that will exceed what the compressor can provide, or what is required to achieve the water depth.

IMPORTANT: if the compressor has air volume to operate 10 lines, all 10 lines must be working at the same time. At the same time if the compressor is capable of operating 20 lines and only 10 are available, the compressor output will have to be reduced to match the capacity of the tubing (see chart for maximum air flow accepted in tubing).

Chart – Pressure and air flow according to diffuser

Code	Bubble Tubing®	PARAMETERS			
		PRESSURE		AIR FLOW	
		Min.	Max. *	Aeration **	Deicing Bubble Curtain
BUB12NW	½" (15 mm) non-weighted	20 PSI – 1.4 BAR	50 PSI – 3.4 BAR	0.02, 0.05, 0.1 ou 0.15 CFM/ft 1.9, 4.6, 9.3 ou 13.9 LPM/m	TBD
BUB12	½" (15 mm) weighted	20 PSI – 1.4 BAR	50 PSI – 3.4 BAR	0.02, 0.05, 0.1 ou 0.15 CFM/ft 1.9, 4.6, 9.3 ou 13.9 LPM/m	TBD
BUB34NW	¾" (20 mm) non-weighted	20 PSI – 1.4 BAR	50 PSI – 3.4 BAR	0.02, 0.05, 0.1 ou 0.2 CFM/ft 1.9, 4.6, 9.3 ou 18.6 LPM/m	TBD
BUB34	¾" (20 mm) weighted	20 PSI – 1.4 BAR	50 PSI – 3.4 BAR	0.02, 0.05, 0.1 ou 0.2 CFM/ft 1.9, 4.6, 9.3 ou 18.6 LPM/m	TBD
BUB1.0	1" (25 mm) weighted	20 PSI – 1.4 BAR	70 PSI – 4.8 BAR	0.15 ou 0.25 CFM/ft 13.9 ou 23.2 LPM/m	TBD
BUB1.25	1 ¼" (30 mm)	20 PSI – 1.4 BAR	70 PSI – 4.8 BAR	N/A	TBD
OctoAir™-10	100' BUB12NW	20 PSI – 1.4 BAR	50 PSI – 3.4 BAR	0.02, 0.05, 0.1 ou 0.15 CFM/ft 1.9, 4.6, 9.3 ou 13.9 LPM/m	TBD
OctoAir™-60	300' BUB34NW	20 PSI – 1.4 BAR	50 PSI – 3.4 BAR	0.3 ou 0.6 CFM/ft 27.9 ou 55.7 LPM/m	TBD
(*) Maximum back pressure reading not to exceed during operation					
(**) Air volume tested by GSEE Environmental Consultants					

To purge lines of water or to test individual lines, the lines that are providing the most bubbles should be closed first. Do this a few lines at the time. In theory 100% of the air can come out of 50% of the lines (creating a maximum airflow per linear meter, or very high air flow much like we use for Bubble Curtains). This is not a guaranteed outcome if the compressor used does not have extra residual pressure since more velocity also means more pressure loss.

Important note: The system you have has been designed for a specific application: aeration, deicing, bubble curtains, etc. The air flow can vary according to the application, so not every system has the same airflow. Be certain to use the system for the application it was designed for, consult our technicians if a problem cannot be solved by the operator. In 99% of the case, it is a question of physics and it is not always obvious.

Lesson #3: Air distribution

As an example, a single 30 m line is showing a good bubble pattern on the first 15 m but not all the way to the end. What is going on and how to fix it?

First assume the bottom of the pond is flat. If it is not flat, we have to look at other options as discussed earlier. Here is more on this topic:

- If the bottom is not flat, we automatically assume the full length of tubing not providing bubbles, is simply in a depression or just deeper under water. To fix pressure or depth variations, a maximum airflow has to be provided. This way the back pressure inside the tubing will become balanced, in a situation where the maximum air flow is not possible, the tubing will have to be changed position to follow the same depth or contour line.
- In the case of a Bubble Tubing® that starts at 1 m of water depth to end at 3 m water depth. If the airflow is evaluated for aeration only, there won't be any bubbles at the end of the tubing or past water depth of 1.5 to 1.7 m deep.
- If the system is for a bubble curtain, then the design will propose a maximum airflow per linear meter and in this case, the whole line will provide bubbles even if the depth varies. That's because back pressure was built inside the tubing to compensate for water pressure.
- Ultimately, for aeration projects, installation where the tubing can be laid flat at the same depth on all its length is ideal. In lagoons or pond lined on a flat level, that should be easy to get an even bubble pattern. In other configuration, sometimes changing the alignment of the lines can bring tubing to the same depth. If this is not possible, OctoAir™ diffusers should be considered as they can be installed in different water depths, but each will need also to be adjusted for pressure if they are fed air from a single compressor going through a multiple valve manifold.

If the bottom is flat or almost flat with variances less than 30cm of depth all you need to do is follow the start up procedure, open all valves of the system and observe the results

- If a section is not bubbling properly, it could mean the bottom is not perfectly flat even if your client says otherwise. This can be validated with the use of a depth finder like sonar.
- The bottom is flat but the bubbles are still uneven Allow 15 minutes of operation for the system to regulate before calling us.
- After 15 minutes, observe the changes (before and after pictures) and note which lines are bubbling and which are not.
- Check the pressure on the compressor gauge (note the pressure reading at the start to see if close to the maximum pressure). Create an action plan to open and close valves in a systematic way. i.e. Managers must have the ability to make modulations to validate, to purge and test the effectiveness of the lines at different times of the year. Sometimes just distance of tubing will create the effect of depth due to pressure loss along distance (air velocity and friction in tubing).



Do not hesitate to test with different air flow, air pressure or by changing patterns of your aeration system layout. Learning how to do this is not unlike playing a musical instrument, it takes a bit of practice and it is not automatically intuitive. Make a plan, write notes of your tests, learn from them and try again. Understand that the higher the number of bubbling lines, the more difficult it gets to achieve a perfect bubble pattern. Like a tuned guitar, unless something external happens, it should remain perfectly adjusted for a long time.