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Fine Bubble Tube Aeration System O&M Manual

INSTALLATION INSTRUCTIONS FOR THE SSI™ TUBE DIFFUSER

Basic Information

SSI tube diffusers are manufactured and shipped assembled. It is the contractor's job to install and place the diffusers on the headers.
Your new tube diffusers are rubber membrane type. They may require maintenance in the form of cleaning with a scrub brush and soapy water over time. SSI recommends an annual check-up.
Please handle and store your new diffusers carefully before installation. The cartons that they were shipped in can be used for this purpose. Follow ISO-2230, "Rubber Products Storage" in case of any doubts.
Diffused aeration systems require level installation to +/- 3/8" tolerance. Aiflow per diffuser may not be uniform in case diffusers are out of level.
Please check your shipment for damage and report any to us within 10 days of delivery. Do not expose plastic or rubber materials to sunlight, and keep all products away from products known to harm plastic or rubber.

Installation

We designed the SSI™ Tube diffuser for installation on site. The headers will have 3/4" NPT outlets welded to the side center line, or on elbows or tees below the header.
When installing the diffuser, take care not to over-tighten. First tighten by hand, then grip the nipple only (not the diffuser or plastic ring) with a pliers and turn an additional half turn. For the sake of convenient maintenance, keep the ear clamp facing up.
When attaching the SSI™ Tube diffuser into stainless threads, we recommend Teflon Tape or Pipe dope.
Now you are ready to start up the system.

SSI™ COMMISSIONING INSTRUCTIONS

These instructions cover the general start-up requirements for the SSI™ diffuser system. Special start-up requirements outlined in the Engineer's specifications, contract documents, or instructions offered by SSI shall be supplementary to or take precedent over these general instructions.

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An overview of Start-up procedures is related below:
1. Confirm that piping and diffusers are level by filling the basin with water. Adjust supports for diffusers as required.
2. Continue filling the basin with water until the diffusers are 1" to 2" under water. In the event of air leaks, the diffusers are accessible.
3. Activate the blower and introduce air to the SSI™ system. Check piping and diffusers for leaks, and repair if required.
4. While maintaining air to the system, continue filling the basin until the design depth is reached.

A. Blower Components
Reference the blower installation and start-up to assure all blowers components are mounted properly and ready for operation.

B. General Air Piping
Contractor is to confirm the cleanliness of the air piping. If existing header piping is used, the air purge or water flush cleaning procedure is recommended prior to installation of SSI™ units to remove any internal debris that may have accumulated in the header piping. Inspect air piping and diffuser connections for loose fittings or damaged pipe. Damaged piping sections and connections should be repaired prior to commencing system operations. Refer to cleaning procedures in this Section.

(Optional) Water Flush and Air Purge Cleaning of Piping

General: These instructions cover the general procedure, which may be utilized to clean the piping in a fine or medium bubble diffuser system. Special pipe cleaning requirements outlined in the Engineer's specifications, contract documents, or instructions offered by SSI shall be supplementary to or take precedent over the general instructions outlined below. Note: Diffuser should not be installed during cleaning procedure. Debris may dislodge and plug units.

A.Water Flush Cleaning
1. Water flush cleaning is the recommended method to clean assembled piping systems where pipe segments are too long for manual cleaning. This procedure can be used in conjunction with air purge cleaning and is recommended when fine

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debris is not removed prior to assembly of piping. When both water flush and air purge is used, the water flush procedure should be implemented first.

2. To water flush the system, connect a water supply to the air header or make individual connections to each lateral. If flush water is piped to the header, it is imperative that the header be valved or stubbed such that water does not flood the blowers.

3. Clean water must be employed. It is not necessary to use potable water but the hush water must be free of silt or debris.

4. Flush header assembly prior to water flushing the laterals. Header, fill it with water and open the end lateral to create a in the header of at least two feet per second (if possible).

5. The laterals are to be individually flushed next. A flush velocity of five to six feet per second is recommended for lateral cleaning. Opening one isolation valve will produce a significant flushing action in the lateral as water is pumped through the header. The lateral end cap or one or two drilled air outlet holes should be uncapped to allow water and debris to be flushed out of the piping.

6. The cleaning procedure in the previous step should be completed for each of the laterals. This is done by sequentially opening and closing the isolation valves on the individual laterals.

7. As an alternate to using the main header/lateral flush procedure, the individual laterals may be cleaned independent of the main header. For this operation, the individual laterals.

B. Air Purge Cleaning

1. Remove weights and cap from the pressure relief valve during initial startup of the system. This eliminates potential damage to the blowers from blocked valves or obstructions in piping system. Cap and weights can be added back to the pressure relief valve as necessary to provide proper operating pressure capability.
Note: When a blow-off valve is provided for the blower system, it may be operated

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in lieu of using the pressure relief valve procedure listed above.

2. Open all lateral valves prior to start-up of the blowers. Provide an opening at the end of the air laterals to allow air and foreign materials to be discharged from the system. The opening may be made at the end of the air lateral by leaving the end cap off of the lateral or by removing two feeder airlines plugs at the end of the lateral.

3. In order to increase the velocity of air through the header and air laterals, it may be desirable to operate at maximum blower capacity. In addition, it may be necessary to close some of the lateral throttling valves to achieve a high velocity through the balance of the laterals that are open to the atmosphere. A high velocity is required in order to blow out any accumulated foreign matter.

4. As laterals are consecutively cleaned, the isolation valves are operated in a manner that allows the remaining laterals to be cleaned by an air purge.

5. Upon completion of the air purge, the blowers are shut down and the laterals are capped. SSI™ units are installed on laterals and all isolation valves are opened prior to filling the basin with water.

6. If only an air purge is used to clean the piping, the basins are now ready to be filled with water to check the operation of the SSI™ units.

OPERATION INSTRUCTIONS FOR AERATED BASINS

Description of the SSI™ Aeration-Mixing System

The SSI™ aeration-mixing system employs individual diffuser assemblies attached directly to the lateral piping. SSI normally designs the aeration piping system to provide uniform distribution of air without requiring adjustment of the isolation/throttling valves on the laterals with the exception in situations where water level variation exists. However, these valves are typically provided for direct control of airflow distribution on large aeration systems or for process control.

Normal Operation of the Aeration System

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The following procedures should be followed on a regular basis to assure consistent and satisfactory performance of the SSI™ aeration-mixing system.

The air rate to the system may be adjusted to maintain the desired dissolved oxygen levels in the basin. When adjusting the air flowrate, the diffusers should be operated within the normal operating range of the diffuser. Excessive air flowrates will result in high-pressure drops across the diffuser and reduced oxygen transfer performance. Low air flowrates may result in incomplete utilization of the diffuser media and reduced air distribution.

The SSI™ aeration-mixing system is designed to provide uniform aeration. Positive dissolved oxygen concentrations should be present throughout the entire system during normal operation. A dissolved oxygen profile analysis may be used to confirm the performance of the aeration system. Typically, the dissolved oxygen levels are measured at the inlet, the outlet, and the midpoint locations of each basin to determine the aeration system performance. In regulating the system airflow to control dissolved oxygen levels, the diffuser units should be operated within their minimum and maximum airflow limits.

Varying Water Level Onerations

In applications where water level variations may exist between aeration basins supplied by a single blower, the isolation valves may need to be adjusted to maintain adequate airflow distribution. This normally requires valving back the air to the basin with the reduced water level. NOTE: It is important to confirm the operating airflow range of the diffuser units before valving back any isolation valve. Damage could result to the aeration diffuser if airflow is above the recommendations enclosed herein. Please consult SSI Engineering Department to confirm operating procedure before adjusting any aeration isolation/throttling valve.

Trouble Shooting

The SSI aeration system requires very little maintenance for long term operation. Periodic visual inspection of the system should allow tile Operator to determine if the system is performing at optimum levels. For example, diffuser unit elevation

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variations greater than the design tolerance, typically ± 3/8", will reduce the uniformity of air distribution in the system. In addition, operating airflows below the design condition will also reduce the uniformity of air distribution. If operating conditions warrant air flowrates below the design condition, contact SSI for additional operational guidelines.

Below are symptoms and procedures to follow if inspection of the aeration system reveals abnormal operating characteristics.
1. Large volume of air in localized area
Possible Cause:
a. Air leak in aeration piping.
b. Diffuser sleeve damaged or missing.

Procedure:
a. Drain basin to access area in question.
Maintain airflow to units.
Inspect joints for evidence of breakage.
b. Inspect diffuser units for sleeve damage.
Repair as required.
2. Decreased diffuser activity and increased backpressure noted at blower.
Possible Cause:
a. Diffusers becoming fouled.
b. Reduced blower discharge air volume.
c. Restriction in air header.

Procedure:
a. Access diffusers and inspect for external fouling.
b. Confirm blower operating point and rpm reading.
c. Confirm isolation valve position on header and drops.
3. Dissolved oxygen profile not satisfactory throughout basin.
Possible Cause:
a. Increased loading to system.
b. Reduced blower discharge air volume.
c. Improper distribution of air in system.
d. Air leak in system.

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Procedure:
a. Confirm loading to system.
b. Confirm blower operations.
c. Reference items 1 and 2 above.

Normal Operation of the Blower System

The SSI™ Aeration-Mixing System normally utilizes a centrifugal or positive disp1acement (PD) blower system consisting of one or more blower units for normal operation plus one on-line spare unit. All blower units including the spare unit must be operated on a regular basis to maintain their proper working condition. SSI recommends that blower units be operated sequentially with idle blower units brought on-line weekly. SSI does not recommend the simultaneous operation of on-line and spare blowers for an extended period. This operating condition may deliver airflows exceeding the air capacity of the diffuser units. All blower components should be serviced on a regular basis. For additional information concerning proper blower operation, service requirements or service intervals, reference the Blower Operation and Maintenance manual.

Shutdown Conditions

If an interruption in air service is experienced at any time, restoration of air service should be instituted as soon as possible. When restarting positive displacement blower units, follow blower suppliers recommended procedures. Operate water purge devices if provided. If the PRV releases air for an extended period of time, the relief setting should be checked.

If the basin is to be idle for a prolonged time period, the basin should be drained and cleaned. Note, maintain the minimum airflow to the system during the drain down procedure. For maximum protection of the aeration system, refill the basin to completely submerge the aeration system. This provides thermal protection in the event of severe cold or hot weather conditions.
Contact SSI for additional operation and maintenance information if it is necessary to decrease the system airflow during cold weather.

Operation of the SSI™ Diffuser

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The SSI™ unit has no moving parts and requires very little maintenance for long term operation. SSI recommends that the air supply to the diffusers be maintained at all times for optimum performance. The airflow to the SSI™ units must be kept within the ranges summarized in Table 1 to maintain the structural and operating characteristics of the diffuser media.

Continuous application of high airflows, greater than denoted for normal operation may result in physical damage to the diffuser media. Under no circumstances should the airflows indicated as maximum be exceeded. Note: Use caution when adjusting several lateral throttling valves in the same piping system. This procedure can result in elevated airflows in sections of the basin, exceeding the maximum allowable airflow to each SSI™ unit.

TABLE 1: Recommended Airflows for SSI™ Tube units 62mm x 610mm

	Normal OperatingCondition (SCFM)	Maximum OperatingCondition (SCFM)
SSI™ Tube Unit	0 to 12	20

MAINTENANCE INSTRUCTIONS FOR AERATED BASINS

Maintenance of the SSI™ Diffuser

The SSI™ unit is a fine pore aeration device that offers maximum benefits for oxygen transfer and mixing. Proper operation and maintenance of the SSI™ diffuser can provide years of long term performance with minimum energy cost and minimum maintenance cost. For all fine pore diffusers, it is necessary to follow preventive maintenance procedures to sustain peak or optimum performance, prolong equipment life, and avoid emergency situations or a system failure. Proper maintenance procedures will also minimize the frequency of system

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interruptions. The following guidelines should be referenced in maintaining the SSI™ diffuser system and EPDM diffuser media.

1. The diffuser sheaths should be protected from petroleum products, ie; mineral oils and aromatic hydrocarbons. Contact with such substances will degrade the membrane.

2. Good air filtration is required with all fine bubble diffusers including SSI™ units. The blower system should be equipped with paper inlet filters having a performance efficiency of 99.5% removal of 2 micron particles to prevent clogging of the diffuser media. SSI is available to evaluate existing filtration efficiencies to confirm acceptability withSSI™ diffuser units.

3. Some evidence of increased headloss through the diffuser unit may be experienced over a long period of operation. This pressure build-up is often the result of biological and/or inorganic materials building up on the media surface. The propensity for this condition is job specific and is a function of the type of waste, and the specific operating characteristics of the system. To restore media performance and decrease the operating headloss, refer to the following sections.

Accessing the SSI™ Diffuser Assembly

SS™I recommends that the SSI™ units be accessed on a regular basis (annually) to visually inspect the units. The SSI™ aeration system is designed to allow the diffuser units to be accessed by dropping the water level in the basin being serviced. The air to the basin being serviced should be turned off to prevent the possibility of excessive airflows to the units or damage to the blower unit.
The following items may be helpful in servicing theSSI™ diffuser assemblies during periodic inspections or maintenance procedures:

1. Ladder to access the de-watered basin
2. Protective gloves and clothing
3. Crimping or nipper pliers
4. Long-handled bristle brush for cleaning assembly for observation

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5. Spare SSI™ sheaths and crimping clamps

Insitu Cleaning of Media

Typically rubber membrane diffuser units will require cleaning because of two common types of surface build-up; biological and inorganic scaling. The recommended cleaning procedure for both types of build-up are detailed below.
1. Biological build-up is characterized by a moss like growth. The recommended cleaning procedure is to physically dislodge the growth either through gently brushing the substance off or using low or high pressure hosing. The hosing method is effective in removing loose surface deposits on the diffuser media. Maintain minimum air rate to the diffuser during hosing operation. The length of time required to remove deposits is dependent on the type of surface foulant, water pressure, distance from unit, etc. Typically, 5 to 10 seconds is required per unit.
2. Inorganic scaling is characterized by a granular mineral like precipitate that can form on the membrane surface. If brushing and hosing the diffuser media does not remove the scaling, contact SSI for further instructions.

Replacing SSI™ Diffuser Sheaths

If routine inspections reveal the need to replace a rubber sheath, the following guidelines should be followed.

1. Remove the stainless steel (SS) crimping clamps. This is easily accomplished by bending back the small tab on the clamp with a crimping tool or screwdriver. The operator should not attempt to snip or cut the ear of the clamp. The SS material is very strong and excessive force is required to shear the material.

2. Gently pull the rubber sheath off the PVC support. Care should be taken not to break or damage the PVC support during this removal operation.

3. Installation of the new sheath is done by reversing the above procedure. SS crimp clamps should be fully compressed with an all-purpose crimper. Outside edge of the stainless steel clamp should be located 1/4" from the edge of the sleeve.

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NOTE: The 1" non-perforated portion of the membrane should be installed on the bottom of the diffuser and centered over the air discharge holes to provide check valve action. The 3/4" non-perforated zone is located at the top of the diffuser.

Replacing SSI™ Diffuser Assembly

If it becomes necessary to remove an entire SSI™ assembly, the general procedures outlined below should be followed.
1. Shut off air supplies to unit.
2. Remove Super Saddle from pipe using a Rubber Mallet.
3. Reinstall the diffuser unit following installation details in Section 3.
Properly operated and maintained, the SSI™ aeration and mixing system will provide years of high efficiency treatment with minimum operator attention. Questions regarding SSI™ system operation, maintenance, etc. should be forwarded to the Engineering Department.

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