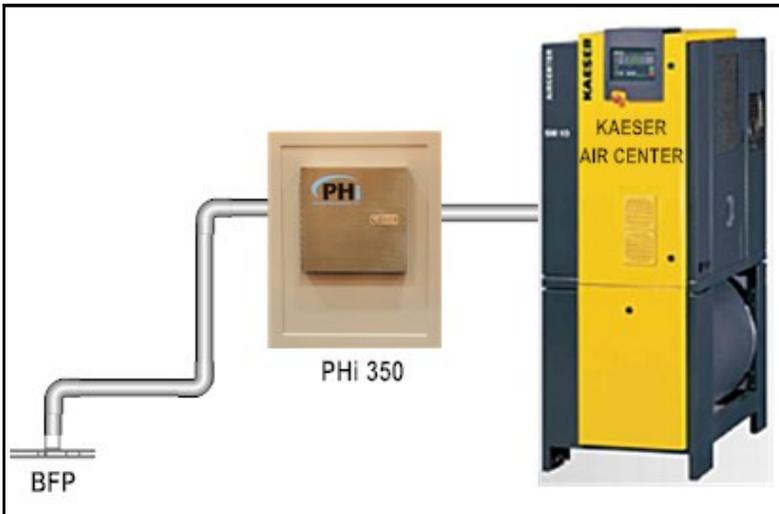


How does the PHI system work?

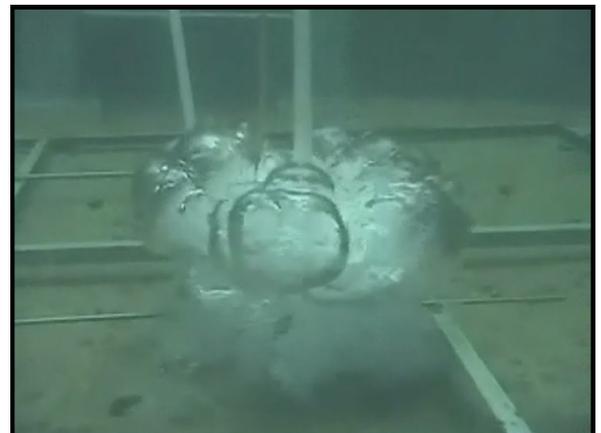


The system consists of an air compressor (minimum size 5HP), a valve enclosure containing one to eight one inch electro-pneumatic poppet valve(s) which are opened by air pressure using a small electric pilot valve, opening the pneumatic circuit that pushes the poppet valve open in under 80 milliseconds. The valve is held open for 500 milliseconds (1/2 second) by the valve controller. When the pilot valve is de-energized, a spring in the valve closes the poppet shut. (The valve is rated for 20 million of these cycles.) With the air pressure set at 50 psi in the valve enclosure the air flow through the valve will be about three cubic feet. This pulses

of air is sent through a one-inch pipe or hose to the Bubble Forming Plate (BFP) located in the wet well/lift station. The BFP consists of two eight-inch stainless steel plates separated about 3/8 of an inch by three spacers. The plate has a one-inch pipe with NPT threads that is four inches high, and the air pipe or hose is connected to it. When the air enters the plate, it is squeezed and exits in a 360-degree circle around the BFP which create the 24-inch bubble that rises to the top of the liquid at a rate of four feet per second. The controller is set to have these pulses of air sent to the BFP every 15 to 20 seconds.

How does this air bubble remove grease and reduce odors in a Lift Station/ Wet Well?

The rising bubble lifts up the water below it and brings it to the surface. With each sequenced bubble more water is lifted up to the top of the well. If there is a grease blanket on the surface the rising water will break the blanket apart. The water on the surface which keeps increasing will run into the side walls and start moving back down to the bottom of the well. This is the key to grease removal. When the water travels to the bottom, it takes the grease with it. When the grease reaches the pumps, it is removed from out of the station. Running the system once a day during the morning flush will keep the grease from forming a blanket which normally requires the utility to vacuum the grease from the station. If the station is the cause of odors because of the top grease layer going septic, then the mixer will have moved this material to the pumps, and the odors would be removed as well. If the odor is being generated from an up stream source, then the mixing would have no effect in removing odors. If an additive is being applied, then it will be more effective as it will be mixed well into the sewage.



Large Bubble Mixer for Grease Removal and Odor Reduction in Lift Stations

Does the mixer need to operate 24/7?

No. In fact the system works best when the pumps are active. The mixer will bring material to the pumps to be removed from the station. The timers should be set to operate the mixer during high flow times. Each lift station has high activity periods mostly in the morning and in the evening. The system should be set only to operate during these high-flow periods when the pumps are the most active.

Will the air from the bubble mixer entrain into the pumps and cause cavitation?

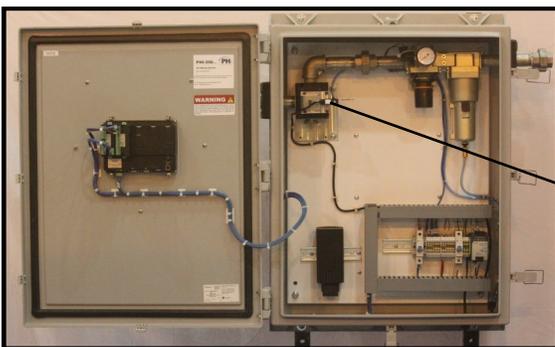
No, unless you put the plate under the pump. Our standard instructions are to mount the bubble forming plate two feet or more from the pumps. When the plate needs to be closer due to space restraints, the installation of an air diverter is recommended to allow the plate to be within one foot of the pump intake. As stated before, the system removes the grease by pushing it down to the pumps to remove it from the station.



What type of air compressor does PHi recommend?

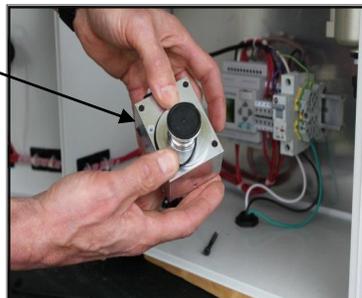
PHi recommends using a rotary screw type compressor with a dryer. These systems come packaged with the receiver and required filters. PHi supplies Kaeser compressors if requested. The advantages of the rotary screw compressors are they are longer lasting, and have a low noise factor which is required when the lift station is located in populated areas.

How much maintenance is required to keep the system operational?



PHi 350 Interior View

The good news is there is no maintenance for the bubble forming plates located in the wet well. The PHi mixer uses valves that are rated for 20 million cycles and do not require any routine maintenance.

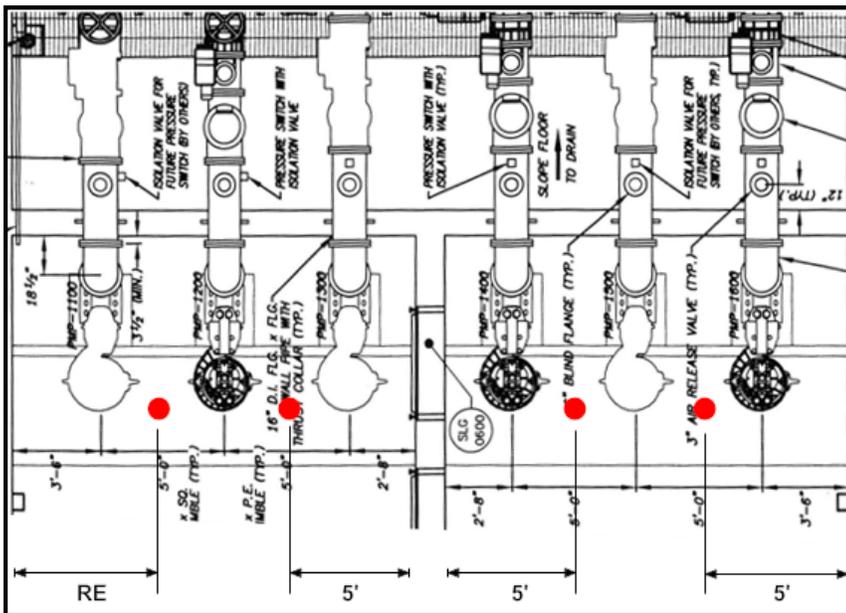


If one should fail, the valve can be repaired in the enclosure using a valve rebuild kit, which takes about 15 minutes to perform. The only routine requirement is to check the air filter monthly and check the pressure regulator by increasing the air pressure by 20 psi

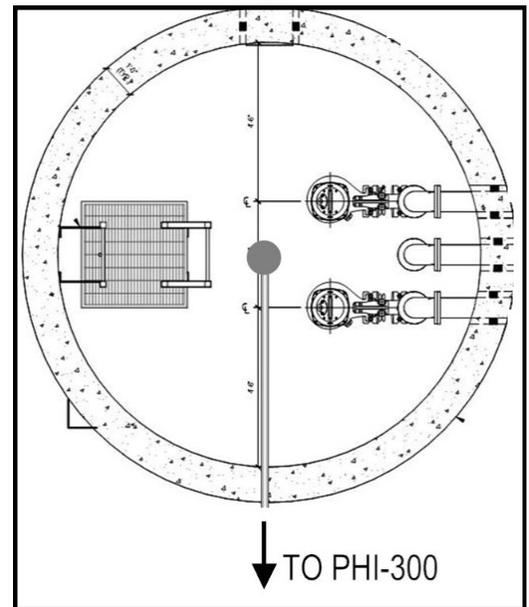
and then back to the operating pressure setting. The compressor will require maintenance as outlined in the compressor service manual.

Is there a size limitation for the mixing system?

No. Larger lift station mixing systems may require additional valves to drive more plates. Each valve can be attached to a plate or in some cases two plates, where the air is divided to influence more area of the station. As a rule of thumb, 5 HP of compressor energy is required for each valve installed. In many cases, lift stations with medium loading have been fitted with 7.5 HP compressors to drive two valves and have been operating successfully keeping the grease and odors at bay. (See examples below for BFP layout.)



Dimension = 18' x 30'



Dimension = 10' Diameter

● = BFP's

The use of sequenced bubbles in lift stations for the purpose of removing grease is a patented process held by Pulsed Hydraulics, Inc. (U.S. Patent No. 7,763,173). Other patents may apply.

Granted U.S. Patents Include: 7,524,419; 7,374,675, 7,282,141; 8,303,161; 8,192,069; 8,147,117; 9, 073,024 (Others Pending)



Plate Installation in 30' x 20' Lift Station
BFP = 6