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Typical Diffuser Layout

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BULLETIN BRIEF

Selecting the proper and optimum design and layout for the aeration system installed in your plant will greatly impact the oxygen transfer efficiency and performance of your system. There are several options for diffuser layout including Single Side Spiral Roll, Center Spiral Roll, Dual Side Spiral Roll, Cross Roll, Grid and Full Floor Coverage. Final design is impacted by a variety of factors such as the process, type of wastewater, accessibility of units (i.e. fixed or retrievable), the primary design constraint (oxygen or mixing), efficiency and type of unit being used, final effluent standards, solids mixing, and number of units and airflow required for the application.

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There have been many studies evaluating the relationship between the rate of oxygen absorption and diffuser layout. Bubble velocity and retention time in the water is directly related to the system layout. The longer the bubble is in contact with the water, the greater the absorption rate.

Design decisions such as basin geometry, type of diffuser, economic considerations of capital versus operating costs all impact the decision and engineering of the system layout. Design decisions are also influenced with the type of equipment being installed. For example: If high efficiency tube units are employed in a system, the number of units, piping, supports, installation time, and maintenance costs may be only 25% of a disc system that has the same square foot area of perforated media.

**Single Side Spiral-Roll**

Single side spiral roll is marked by a line of diffusers down one side of the aeration tank. When air is applied to one side of the tank, the hydraulics of the air in the water tend to move the water in the tank up the side of the wall, across the surface, and down the opposite tank wall and across the floor in a circular motion.

**Center Spiral Roll**

Center spiral roll is marked by a line of diffusers down the center of the aeration tank. When air is applied to the center of the tank, the hydraulics of the air lifts the water and flow of water goes to each side of the basin. The movement of the water in the tank is in a double circular motion from the center of the tank floor to the surface and then to either side of the tank. At the tank wall, the water movement is down to the floor and back toward the center of the tank. Flow pattern is figure eight geometry.

**Dual Spiral Roll**

Dual spiral roll is marked by a line of diffusers down each side of the aeration tank. When air is applied to both sides of the tank, the hydraulics of the air in the water tend to move the water in the tank up each side wall, from both sides across the surface to the center point of the tank, down the center of the tank, and across the floor back to the wall. Flow pattern is figure eight geometry.
Cross Roll

Cross roll layout typically have the units closely spaced in rows across the bottom of the tank. Rows of diffusers are widely separated. Each row of units forms its own zone of influence moving the water up from the floor and outward. The outward movement of the water continues until the influence of a nearby row of units is encountered. The water typically flows down at the interface of the zone of influence and back across the floor toward the unit. Cross roll creates multiple mixing cells in the basin.

Standard Grid

Standard grid layout is typically defined as a system that covers the entire floor of the basin in a relatively uniform pattern. Typically diffusers are laid out in lateral sections or grids of diffusers with floor coverage of 5% to 15% for typical grid efficiency. The objective of a standard grid configuration is minimal directional pumpage.

Full Floor Grid Coverage

Similar to standard grid above but with many more diffuser units giving much higher area of diffuser per area of tank floor. System design is for low flux rate to maximize efficiency, i.e. floor coverage of 15% to 80%.