LAKESIDE
Water Purification Since 1928

Bulletin #1218
Revised June 1999

Spiravac Clarifier

Peripheral Feed • Center Takeoff
Suction Sludge Removal

Spiravac Clarifier

The Spiraflo principle has been successfully applied for more than 60 years with more than 2,000 Spiraflo-Spiravac Clarifiers in operation. The Spiravac has more than 45 years of successful operation ranging from 11 feet to 130 feet in diameter. The Spiravac offers solids removal through suction orifices to ensure rapid return of active solids to the process.

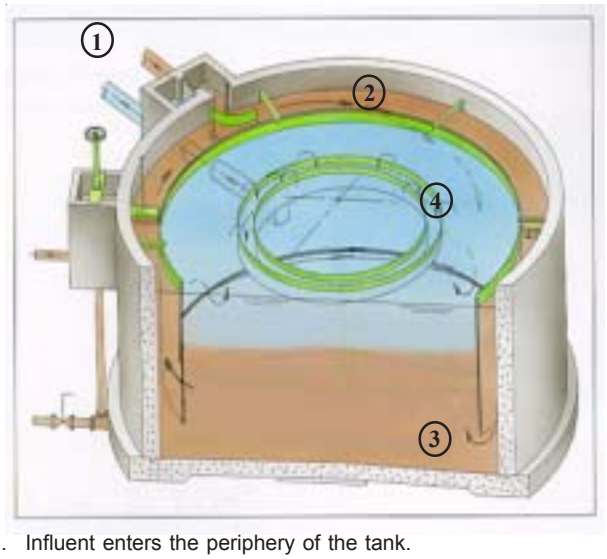
Chicago Heights, IL • 4 -115' SPIRAVACS

Design Features

Peripheral-Feed Flow Pattern

Wastewater enters the Spiravac at the outer wall (1) and is directed along the narrow raceway formed by the skirt and the outer wall (2). This flow pattern dissipates the wastewater's hydraulic energy as it flows around the raceway and eventually spirals down under the skirt (3).

Wastewater enters the main settling area from the full circumference of the skirt and slowly rises to pass over the centrally located effluent weirs (4). The inflow is prevented from flowing directly to the effluent weir by the specially designed race skirt which extends down to approximately two feet above the tank floor. The spiraling flow pattern makes use of total tank volume for effective solids settling.



1. Influent enters the periphery of the tank.
2. Influent velocity dissipates as it moves below the skirt, encouraging fine solids to drop out.
3. Flow slowly spirals to the effluent weirs.
4. Only clear liquid travels over the effluent weirs.

Scum Removal

Grease, free oils and other floatable materials separate from the flow as it slowly spirals around and down the raceway. The Spiravac's deep skirt *traps floatable material* in the raceway and the depth of the skirt helps prevent floatable material from entering the main settling area. The hydraulic energy of the influent flow then carries the floating material around the race for removal through the scum pipe.

The race skirt traps floating scum within the race and prevents flow directly to the effluent weir.

The hinged blade race skimmer
enhances scum removal within the race area.

Race Skimmer

On tanks greater than 16 feet in diameter, a race skimmer is provided to help scum removal within the raceway. Mounted on the suction arm, the skimmer travels around the tank pushing scum to the removal point. The hinged skimmer blade allows for the varying widths of the race and also pivots to travel under the influent baffle, scum pipe and effluent pipe.

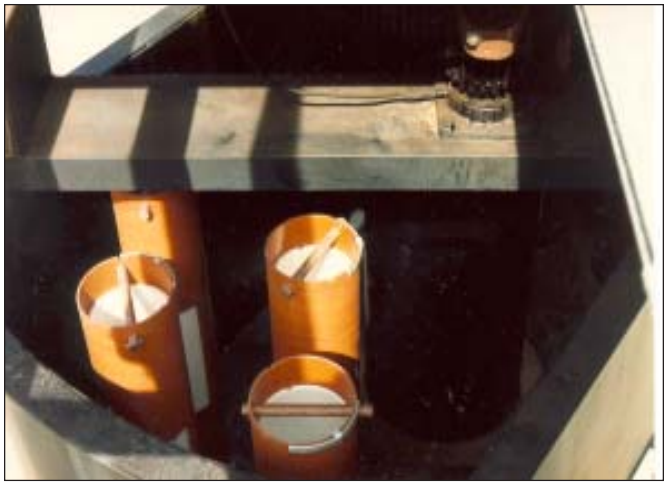
The suction sludge piping allows the operator to vary
flow from each removal point within the center well.

Sludge Removal

Rotating "V"-plows direct settled sludge to suction nozzles for removal from the tank. Heavy, gritty material too large to be withdrawn passes through the "V" apex. Succeeding plows push this heavy material to the sludge sump located at the clarifier center for removal from the tank. The spiral flow pattern also helps direct the sludge to the central draw-off point. The Spiravac offers either controlled or direct removal of activated sludge.

CONTROLLED REMOVAL allows the operator to vary the quality and quantity of flow from each sludge removal pipe. The smooth plastic sludge removal pipes and rotating valve construction help eliminate plugging problems and the hang-up of stringy material at the valve discharge. The controlled removal design allows removal of obstructions in the sludge piping without dewatering the tank.

DIRECT REMOVAL Spiravacs collect activated sludge from suction nozzles on a common header pipe rotating on the clarifier floor. The sludge is suctioned off the floor and removed from the tank through a rotating manifold at the tank center.



Smooth construction of the rotating valves reduces plugging
problems and collection of stringy material.

Spiravac Hydraulics

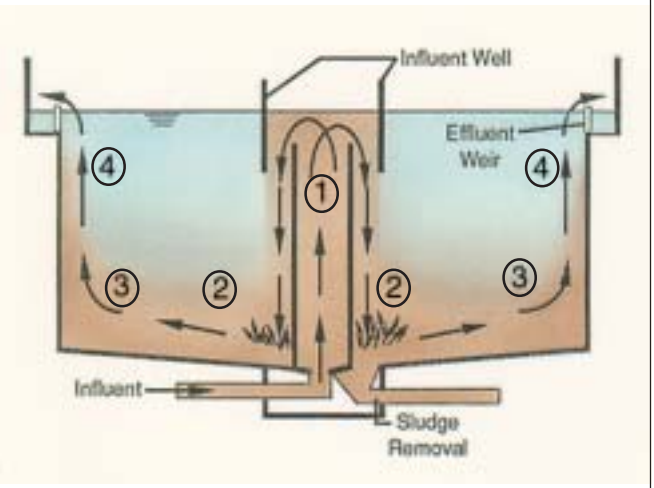
The Spiravac peripheral-feed hydraulics have several key advantages over center-feed clarifiers and minimizes many of the problems associated with center-feed hydraulics.

The Waterfall Effect

The influent well in a center-feed clarifier deflects the high velocity inflow downward creating a waterfall effect. This velocity combined with the higher density of settling solids disturbs the sludge blanket at the bottom of the tank and interferes with proper solids removal.

Because the Spiravac's incoming flow enters at the periphery, the flow spirals in the raceway dissipating the energy before it enters the main settling area. Any velocity remaining in the flow as it moves below the skirt is directed toward the center of the tank in a spiral pattern. These currents coincide with the direction of the scraper mechanism and assist in moving sludge to the central hopper.

Center-feed Hydraulics



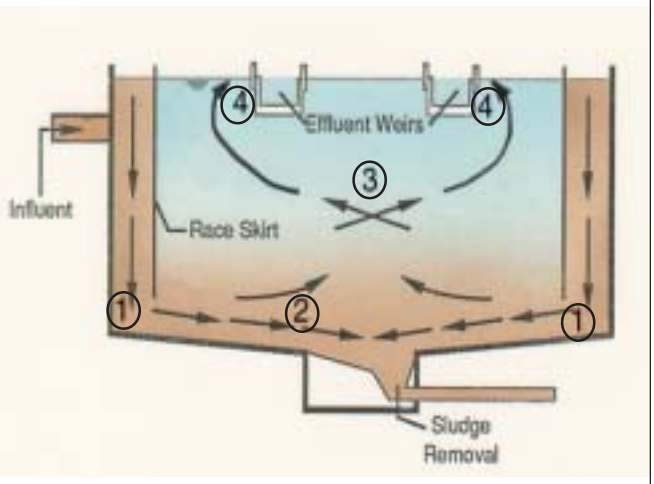
1. High velocity influent is directed to the tank floor.
2. Velocity currents disturb solids above the point of sludge removal.
3. Velocity currents push solids across sludge blanket to outer walls.
4. Sludge crawls up the outer walls and over the effluent weirs.

Sludge Wall Creep

In a center-feed clarifier, the velocity created by the waterfall effect moves solids from the center of the tank to the outer wall. This movement, known as sludge wall creep, can push solids up the outer wall and over the effluent weir thereby reducing effluent quality.

In the Spiravac Clarifier, any flow currents generated on the clarifier floor are directed toward the tank center. The flow energy is naturally dissipated in the Spiravac race eliminating the need for special control devices to ensure effective clarification and optimum effluent quality.

Spiravac Hydraulics



1. Influent enters at low velocity around the entire tank periphery.
2. Influent velocity is directed to the center of the tank assisting sludge movement to the central hopper.
3. Flow slowly spirals to the effluent weirs.
4. Only clear liquid travels over the effluent weirs.

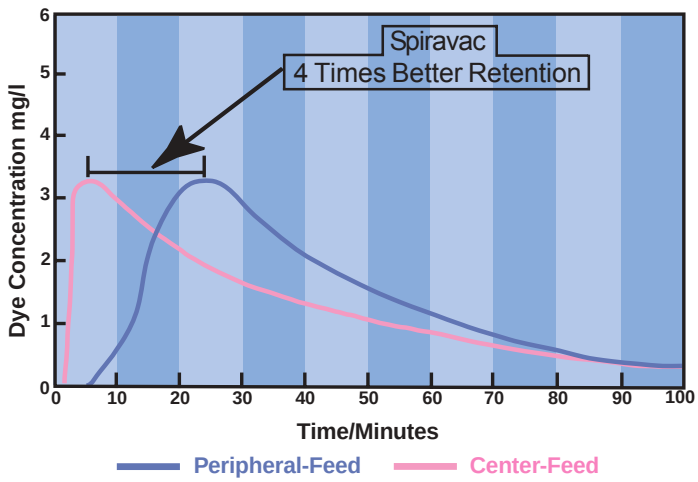
Dyersburg, TN • 2 - 75' Intermediate SPIRAVAC Clarifiers
2 - 75' Final SPIRAVAC Clarifiers

Short Circuiting

The center-feed clarifier flow pattern, created by the waterfall effect and sludge wall creep, causes influent to flow directly to the effluent weir. This short-circuiting prevents complete use of the tank volume for the settling process.

The Spiravac's spiraling flow pattern rolls around and under the skirt and up to the effluent weir. This eliminates all possibility of short-circuiting and ensures maximum use of the entire tank volume.

Dispersion Curve



Test results confirmed that the Spiravac Clarifier performs **two to four times better hydraulically** than the center-feed clarifier.

Theory and Results

Both full scale and model testing at Iowa State University confirm that by dissipating the inflow current and controlling short circuiting with the race and skirt, the Spiravac provides superior solids removal.

Full scale work consisted of dye studies of prototype Spiravac and center-feed units. Independent laboratory tests done on models confirmed that the peripheral-feed clarifier performs two to four times better hydraulically than the center-feed clarifier.

Spiravac Cost Effectiveness

The Spiravac Clarifier equipment furnished by Lakeside includes an effluent trough, effluent weirs and effluent pipe which are not supplied by other manufacturers as part of center-feed clarifiers. A true cost comparison based on the *total cost* of equipment and tank construction shows that costs for the Spiravac are equal to or lower than costs for typical center-feed clarifiers

Tank Construction

The center-feed's concrete peripheral effluent trough is a costly addition to tank construction. The cantilevered trough requires expensive formwork to construct, more steel rebar to withstand design loads and extra concrete pours to complete the tank wall.

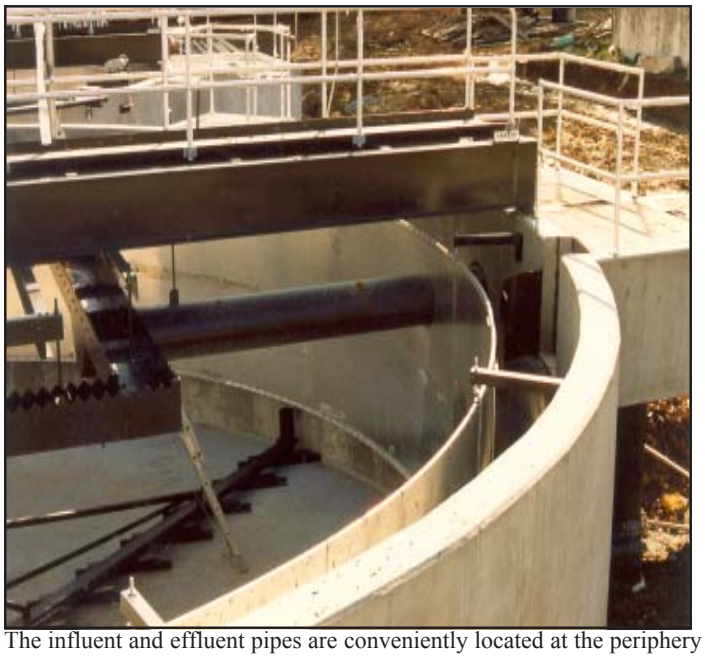
All Spiravac effluent troughs are completely shop fabricated and are bolted or welded together in the field. The trough, fitted with adjustable weir plates, is suspended from adjustable hanger rods and is relatively simple to adjust for even flow. The effluent trough is installed inside the tank and is not part of the poured concrete.

SPIRAVAC effluent troughs are completely shop fabricated and easily assembled in the field.

Excavation Savings

Both center-feed and Spiravac tanks require excavation, but for a center-feed unit excavation is more expensive and time consuming. Influent pipes for larger center-feed clarifiers are installed under the tank floor requiring deeper excavation for gravel bedding or concrete encasement of the influent pipe below the tank.

When tank bypassing is required, the peripheral-feed clarifier can have stop gates installed in its influent and effluent box. Whereas additional piping, valves, valve boxes and fittings must be added to a center-feed clarifier to accomplish tank bypassing.



The influent and effluent pipes are conveniently located at the periphery of the tank for ease in tank bypassing.

Spiravac at Work

Excerpted from CPE Services, Inc., "Report of Clarifier Studies at the South Kingston Wastewater Treatment Facility."

Lakeside Equipment Corporation retained CPE Services of Albany, New York for the purpose of conducting hydraulic field studies at South Kingston, Rhode Island WWTP, an installation with both center-feed and peripheral-feed clarifiers. These tests illustrate the superior performance of peripheral-feed clarifiers versus center-feed clarifiers.

Figure 1 shows the physical dimensions of each clarifier. Even though the center-feed clarifiers (numbers 3 & 4) were 33 percent larger in diameter, 78 percent greater in surface area and 40 percent deeper, the peripheral-feed clarifiers (numbers 1 & 2) still performed almost two times better.

In comparative tests, the flow in the center-feed units followed the classic short-circuiting motion by moving directly towards the effluent weirs, while the flow in the peripheral-feed units showed a broadly spiraling motion.

The study suggests that the peripheral-feed design is more efficient than the center-feed design in regard to flow characteristics. Dye tracer flow curves from the center-feed clarifier rose sharply to a peak in only 40 minutes indicating a high degree of short-circuiting. (Figure 2)

The center-feed clarifier's 90 minute actual detention time was 23 minutes less than the actual detention time for the much smaller peripheral-feed clarifier at the same hydraulic overflow rate. (Figure 3) Theoretical detention times were calculated in order to evaluate each clarifier's efficiency. The peripheral-feed clarifier has a statistical hydraulic efficiency of 39 percent compared to the center-feed's 23 percent.

Figure 1

Clarifier #	Diameter	Area	Water Depth	Volume
1 & 2 Peripheral-feed Center overflow configuration	60 ft	2826 sq ft	10 ft	0.21mgal
3 & 4 Center-feed Peripheral overflow configuration	80 ft	5024 sq ft	14 ft	0.53mgal
Ratio #3 : #1	1.33	1.78	1.4	2.52

Figure 2

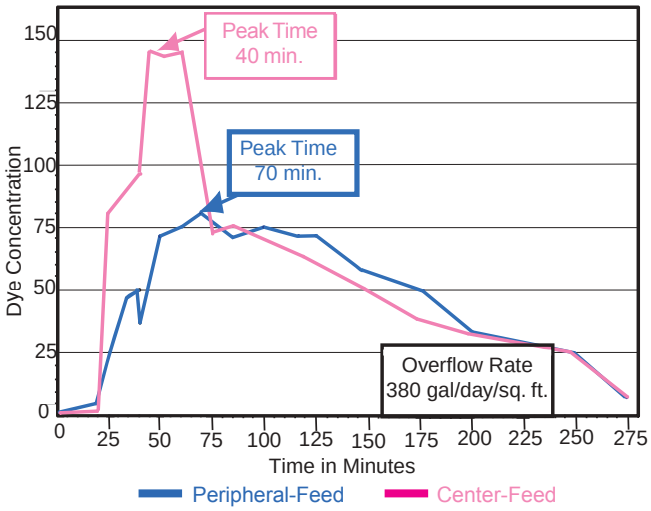
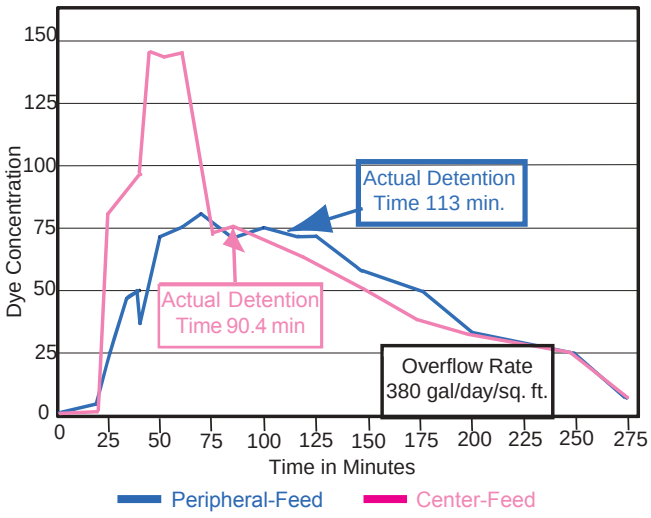


Figure 3



Applications

Especially useful for the rapid return of activated sludge, the Spiravac offers quick draw off of fresh, activated sludge while providing clear, high quality effluent. The following four systems are typical of Spiravac applications.

Conventional Activated Sludge

Return of active sludge in the short-term (6-12 hours) process is extremely important to assure the most active organisms in the aeration basin. The Spiravac provides the desired rapid return of active solids.

Contact Stabilization

The contact process depends on the prompt separation of mixed liquor from the contact tank which is assisted by the Spiravac's suction removal.

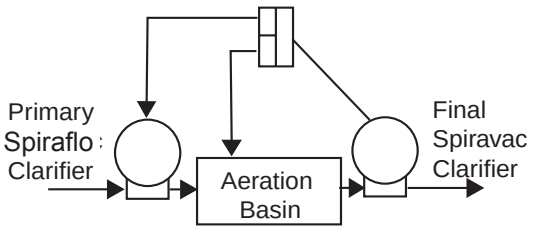
Step Aeration

This system allows raw sewage to be introduced at several points in the aeration tank returning fresh activated sludge to multiple mixing points. The Spiravac Clarifier helps guarantee the best results.

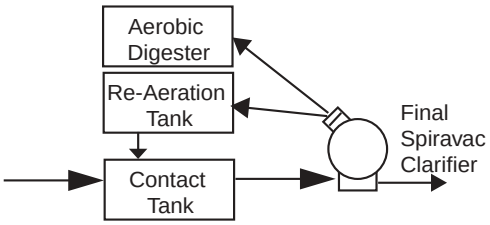
Extended Aeration

The Spiravac's quick solids return ensures the optimum mixing of seed organisms with new inflow to reseed the long term aeration basin.

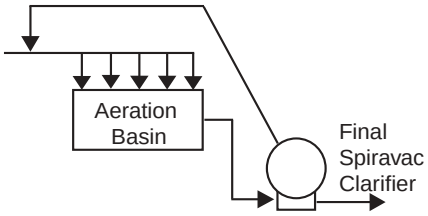
Conventional Activated Sludge



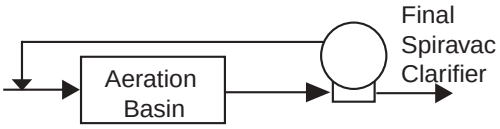
Contact Stabilization



Step Aeration



Extended Aeration



Advantages

Advantages proven by more than 60 years of clarifier experience:

- Produces the highest quality effluent
- Provides quick removal of active sludge
- Offers direct or controlled removal of active sludge
- Eliminates short circuiting
- Promotes full utilization of the tank volume
- Aids in the collection of sludge for removal
- Handles peak flow effectively
- Eliminates the waterfall effect and sludge wall creep
- Retains suspended solids in the sludge blanket
- Reduces clogging with rotating sludge removal valves

LAKESIDE
Water Purification Since 1928

Lakeside Equipment Corporation

1022 E. Devon • P.O. Box 8448 • Bartlett, IL 60103 • 630/837–5640 • FAX: 630/837–5647 • E-mail: sales@lakeside-equipment.com