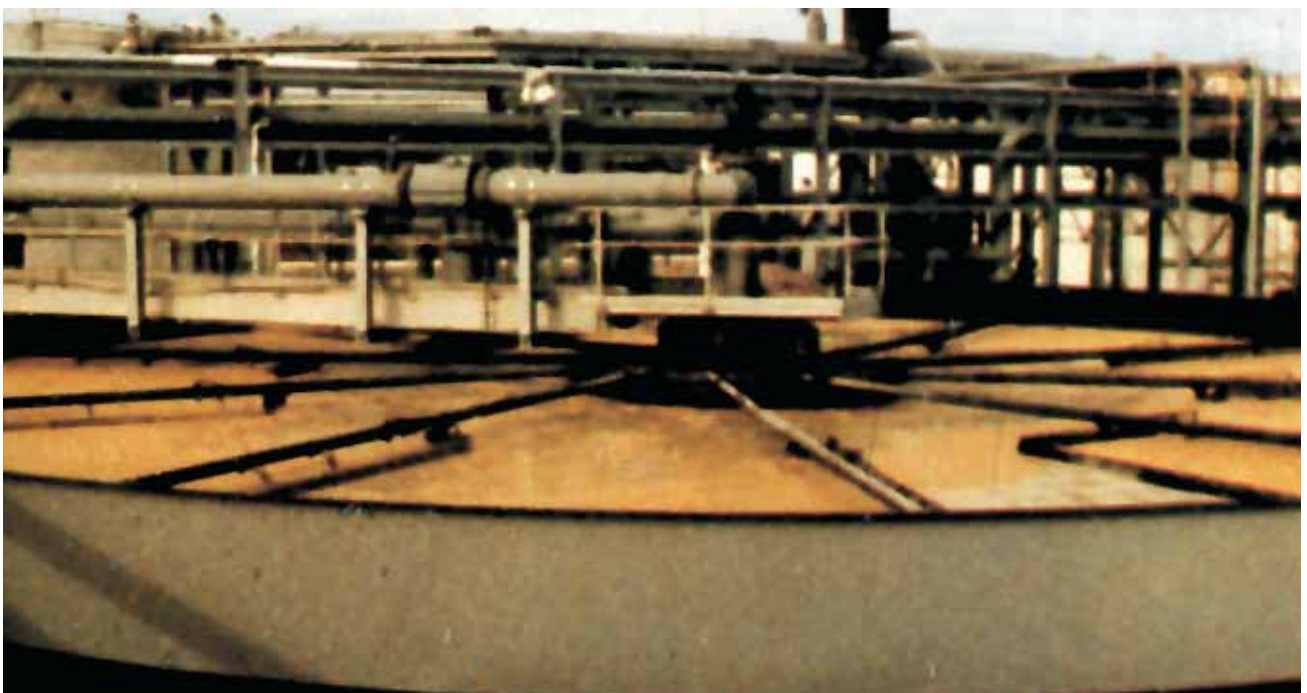


Dissolved Air Flotation

Circular and Rectangular Designs for Municipal and Industrial Waste Treatment



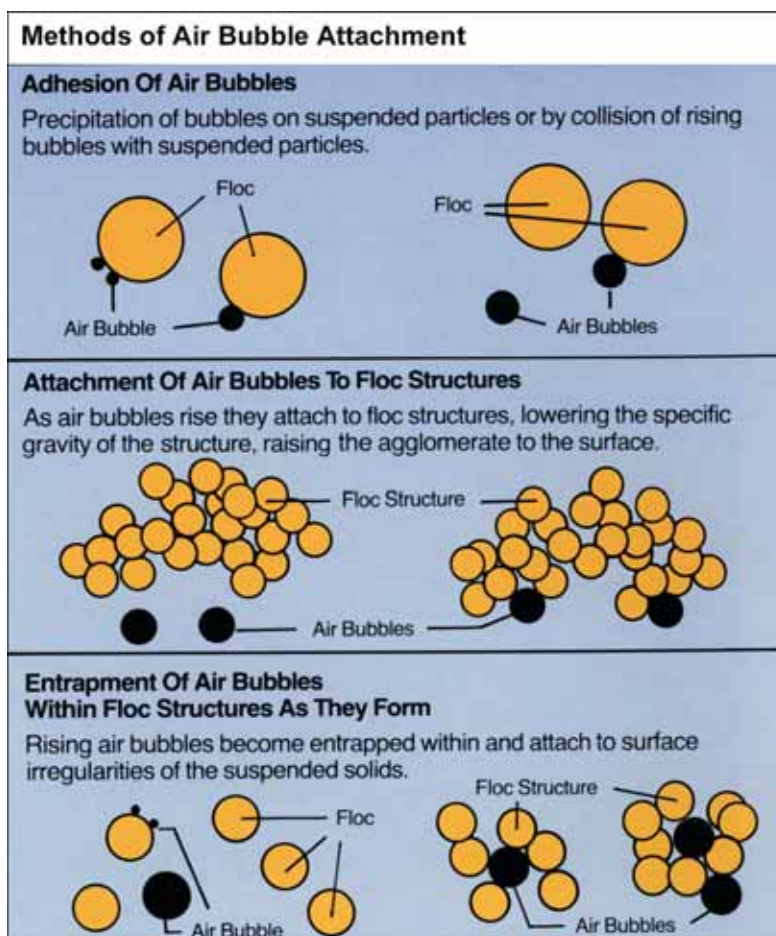
Flotation Equipment

- Separation of Solids from Liquids
- Oil and Grease Recovery
- Sludge Thickening

Operating Principle

Dissolved air flotation is a method for separating and removing suspended solids from liquid based on changes in the solubility of gas as pressure varies. Air is dissolved under pressure in a clean liquid, usually recycled effluent from the DAF unit, and injected into the raw feed stream. Upon entering the DAF unit, the air pressure is released and combined with the liquid, which becomes super saturated with micron-sized air bubbles. Suspended materials attach to the anionically-charged, micron-sized air bubbles producing a lower specific gravity for the agglomerate to less than that of water, thus effectively raising the suspended particles to the liquid surface, forming a floating sludge layer that is removed by skimmers. Heavier solids settle to the bottom of the tank and are raked to a sludge pocket for removal. Clear subnatant liquid is withdrawn under the tank baffle and over the weir for disposal or reuse.

Flotation of suspended solids is achieved by three methods of attaching waste particles with the gas. All three methods of bubble-to-solids attachment are very fragile and turbulence in flotation units must be kept to a minimum to prevent deterioration of operating performance.



Definitions

The following terms are generally used when describing the dissolved air flotation process:

Feed Or Influent-The wastewater, process water, or sludge being delivered to the flotation unit. The concentration is measured in mg/l suspended solids and flow in gpm.

Effluent-The liquid being discharged from the flotation unit.

Float-The concentrated sludge skimmed from the top of the unit. The concentration is measured in percent solids.

Flotation Aid-Any chemical that produces coagulation, breaks an emulsion, and/or aids in the absorption of air bubbles by the liquid or particles to be removed.

Hydraulic Loading-The hydraulic loading rate of the flotation unit is expressed in gpm/sq. ft. of flotation area. The influent loading rate is the influent flow plus the recycle flow divided by the surface area.

Solids Loading-Loading of the flotation unit in pounds (dry solids) per sq. ft. of effective flotation surface area per hour of operation (lbs./sq. ft./hr.).

Air to Solid Ratio-A/S is the ratio of the pounds of air available for flotation and the pounds of suspended solids to be floated. The A/S ratio is independent of flotation surface area.

Recycle Flow Pressurization-This applies to a dissolved air flotation unit operating with effluent recycle. The recycle flow is the percentage of the influent flow that is recycled.

Our flotator® units are used to remove suspended solids from liquids in industrial and municipal applications. They are especially effective where oils, fats, fibers, greases or colloidal solids are present. In many applications our flotator units recover valuable by-products, partially offsetting the operating cost of the plant.

Circular and rectangular configurations are available. Basic operating principles and many advanced design features are described in this brochure.

Pressurization Systems

Our Pressurization units incorporate unique design features into the DAF unit to provide a uniform flow of air bubbles for optimum operation and economy. The pressurization type and flow rate are selected for each individual application. Used exclusively on all our DAF units, the recycled flow pressurization system generates 50 to 100 micron-sized air bubbles helping to eliminate detrimental coalescing.

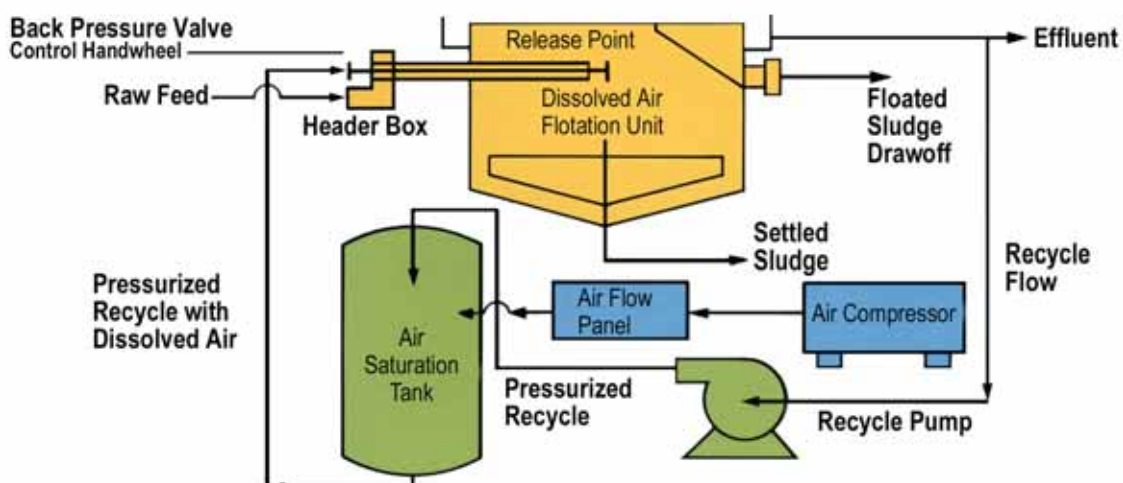
A single-stage pressurization pump and an air compressor are used to pressurize a portion of clarified effluent in a saturation tank. As a result of the high satu-

ration efficiency, the cost of pumps, saturation tank, and other pressure system components is reduced. Once saturated with air, the pressurized clean liquid is returned to the raw waste flow for injection into the flotation unit. A unique back pressure valve is specially designed to maintain the proper pressure in the pressurization tank and to aid in the formation of minute air bubbles. Pressurized flow is released in a conical pattern inside the flotation unit, producing thorough mixing with minimal turbulence. Loss of dissolved air in external piping or distribution systems is prevented. The air-water-solids mixture is uniformly distributed across the flotation tank by action of the inlet diffusion chamber.

Dissolving efficiency of the pressurization tank provides 80 percent or greater saturation. The tank is specially designed to reduce the exit velocity of the pressurized recycle flow to insure that all free air is removed from the liquid prior to leaving the tank. This feature insures that turbulence caused by large bubbles is reduced and that the micron-sized bubbles form properly.

In accordance with Henry's Law, more air is dissolved into a given volume of water at increased pressures. A 65 psi system, requires less recycled water and produces smaller air bubbles than those operated at lower pressures. Recycled water serves only to transport pressurized air to the flotation unit and provides no other benefit to the process. Minimum recycling reduces hydraulic loading and turbulence, increasing the amount of treatable liquid that can be introduced in a given tank, thus reducing the cost capital and operating costs.

Once air has been dissolved in the recycled liquid, the pressurized stream is released into the flotation unit to provide air bubbles to effect flotation. A shearing force occurs as the pressurized stream contacts the treated liquid. Micro-sized air bubbles form by action of the relief valve and diffuser, and attach to floc particles in the waste stream at the point of pressure release. Maximum solids capture and high quality subnatant is assured when air bubbles form on solids particles by the three methods of air bubble attachment.



Circular Flotators - Concrete or Steel Construction

Designs through 50-foot diameter are standard with customized units available up to 100-foot diameter. A wide range of sizes assures the correct operational performance in the most economical construction.

Circular units are equipped with a heavy-duty drive with overload protection. A variable speed drive or constant speed drive with adjustable timer is provided to control the float removal rate for maximum float concentration. Positive removal of non-floatable materials is achieved by a bottom-raking mechanism, driven by the same motor that operates the float skimmer.

Low maintenance and operating costs are provided with the simple but rugged design of circular DAF units. There are no stuffing boxes, underwater bearings or chains

to require maintenance. Hydraulic principles of circular units have

been demonstrated in many thickening and clarifying applications.

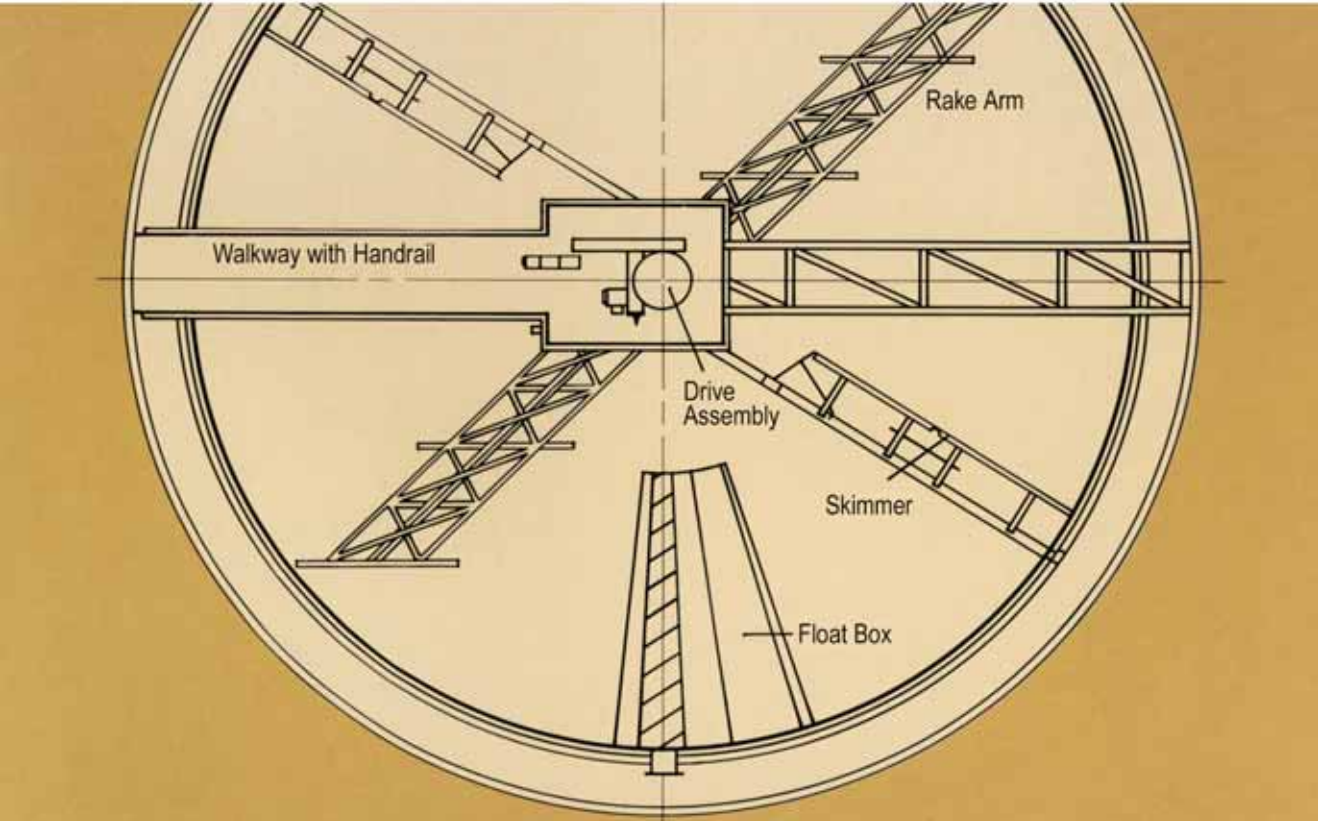
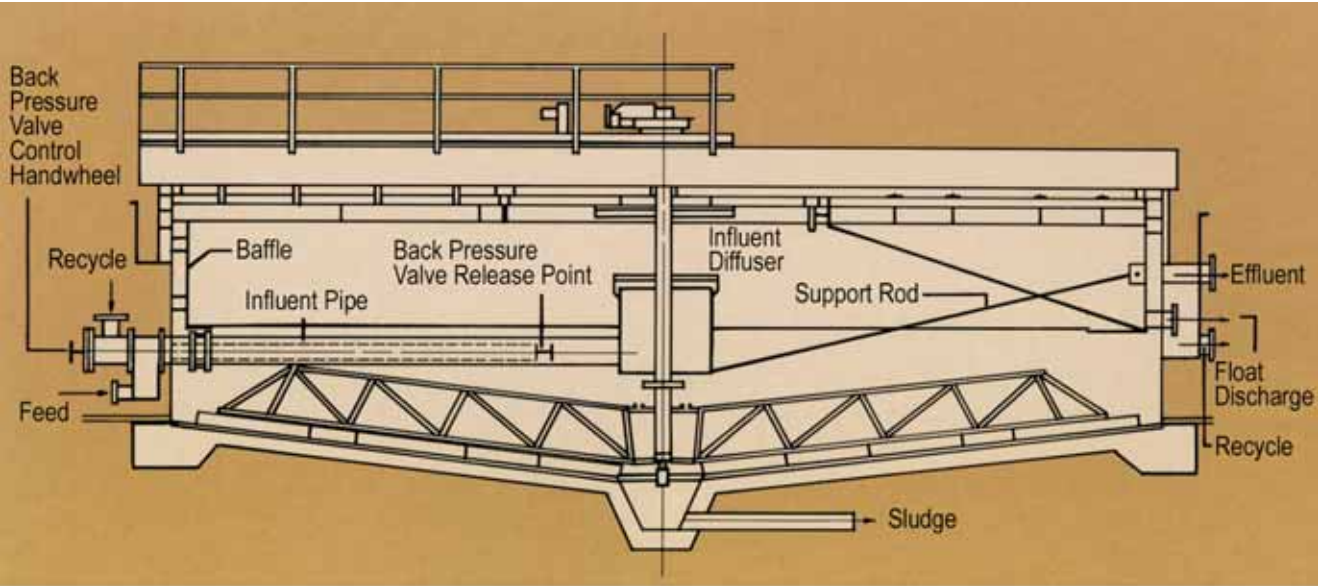
Flotator Mechanism Sizing – Steel Tanks*

Type	Tank Diameter*	Net Flotation Area (sq.ft.)
Circular-Type B	9'	60
	11'	92
	14'	129
	16'	173
	18'	226
	20'	283
	25'	452
	30'	660
	35'	907
	40'	1194
Circular Type C	45'	1520
	50'	1885
	60'	2733
	70'	3739
	75'	4243
	80'	4840
	85'	5476

*Larger units available in concrete tanks.

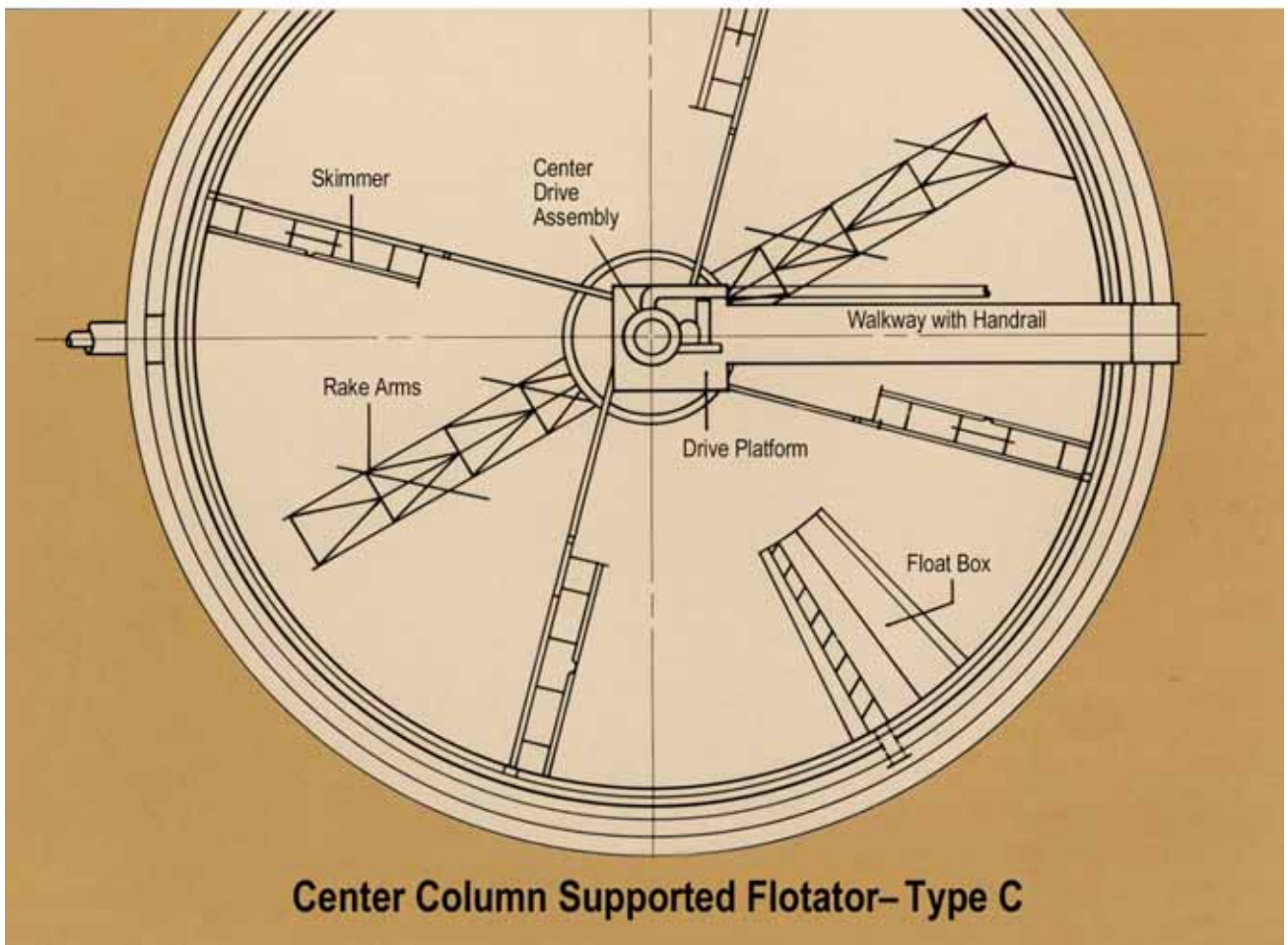
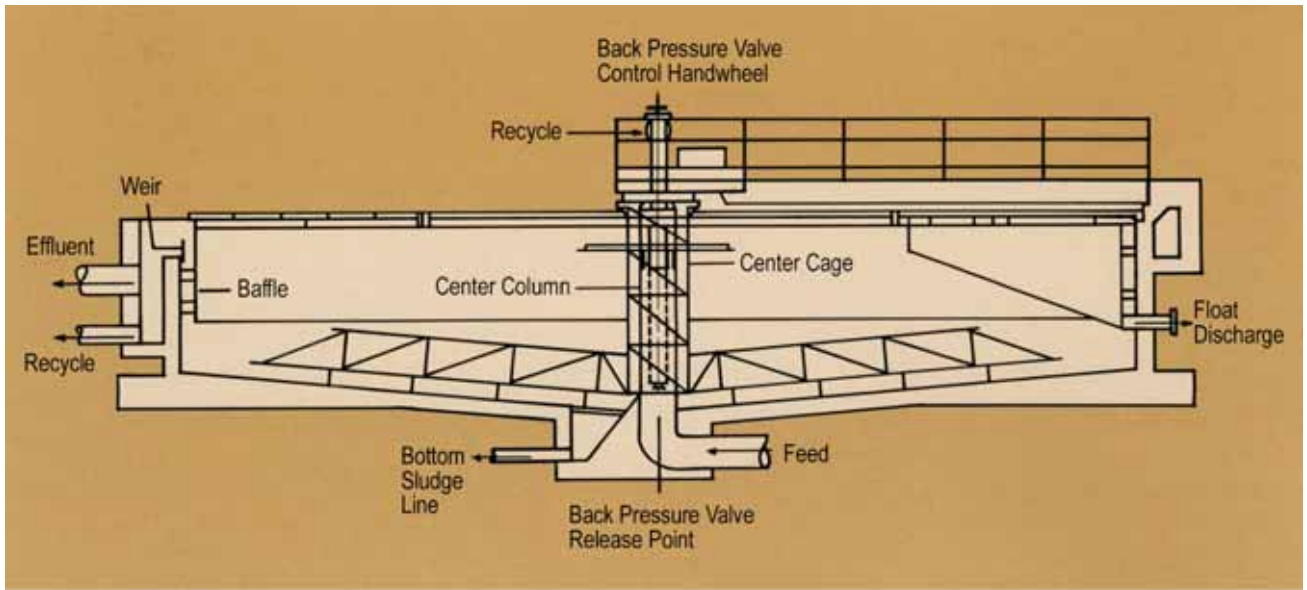


Circular Flotators



Bridge Supported Flotator–Type B

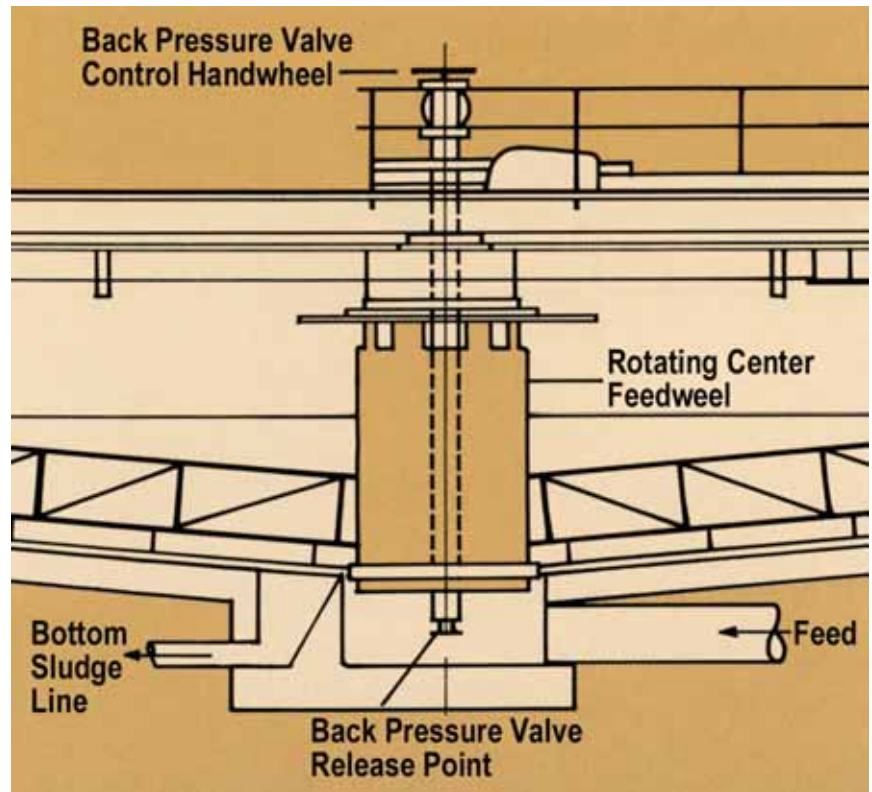
Circular Flotators



Circular Flotators

Rotating Center Feedwell For Applications with Chemical Additions

We offer an optional rotating center feedwell in place of the center cage. The rotating center feedwell provides a low-velocity chamber in which the pressurized air stream comes in contact with the incoming feed, allowing for good dispersion of chemicals and enhanced floc formation. The feed inlet is located at the bottom of the tank, and the pressurization line is fed in from the top. This arrangement has been proven to be effective in both municipal and industrial applications.



Rectangular Flotators - Concrete or Steel Construction

A wide selection of sizes is available to suit most application requirements. An integral float storage sump with inclined bottom is incorporated in all our rectangular flotators. This provides sufficient storage capacity to eliminate the need for a separate sludge storage tank.

Complete mixing of the influent and pressurized flow is achieved inside the flotation unit. A specially

designed radial influent diffuser is provided to uniformly distribute the incoming flow across the surface of the flotator.

Positive acting float skimmers complete with wipers and variable-speed drive assure maximum control for removal of floated material. Bottom raking blades remove non-floatable materials independently of the skimmer drive mechanism. Sludge can be trans-

ported to one end of the tank for removal by sludge pumps or an optional screw conveyor.

Flotator Mechanism Sizing-Steel Tanks*

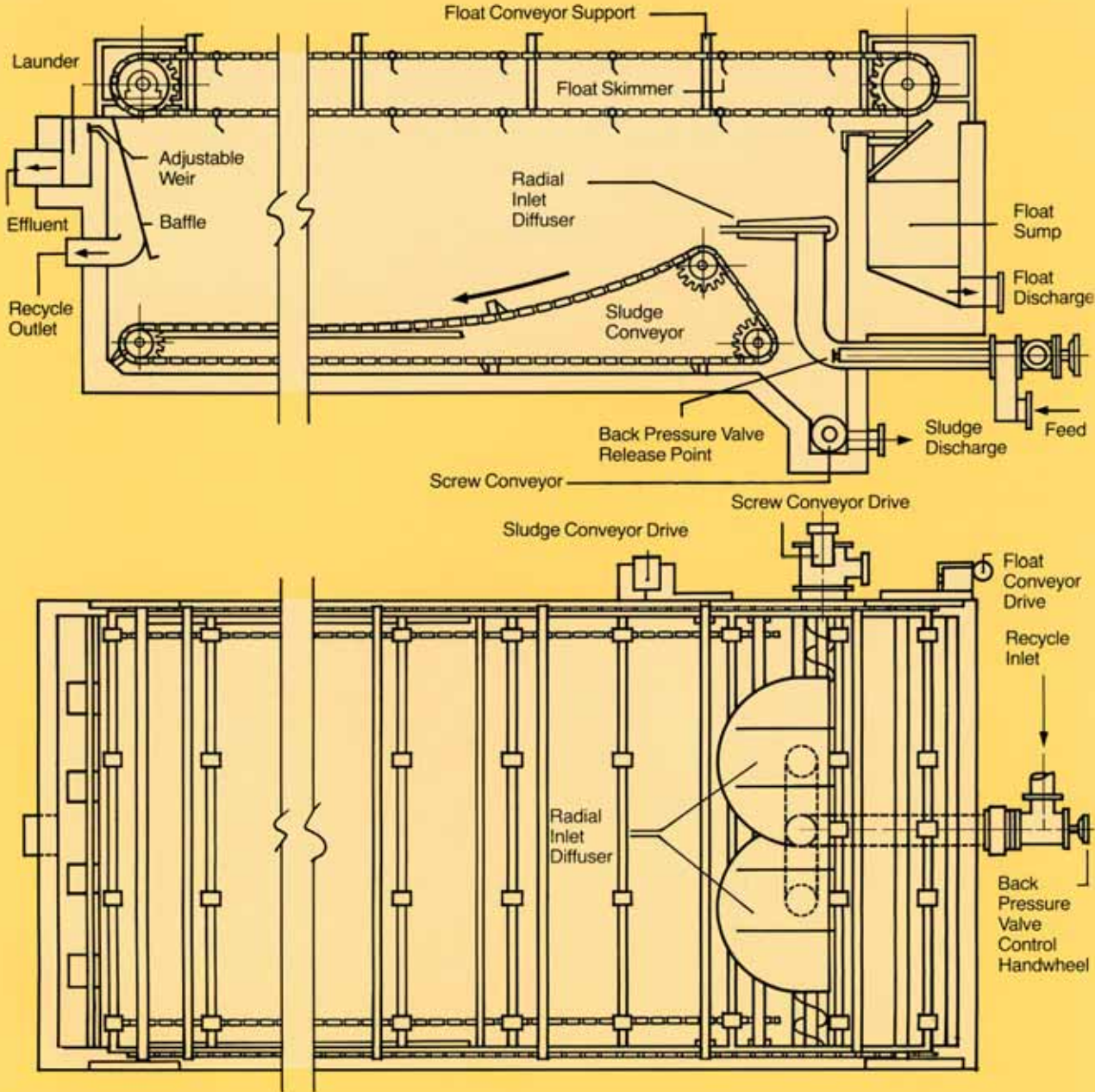
Type	Size*	Net Flotation Area (Sq. Ft)
Rectangular	RS-10	105
	RS-15	168
	RS-25	254
	RS-40	422
	RS-55	553
	RS-75	760
	RS-100	1052
	RS-125	1250

*Larger units available in concrete tanks.



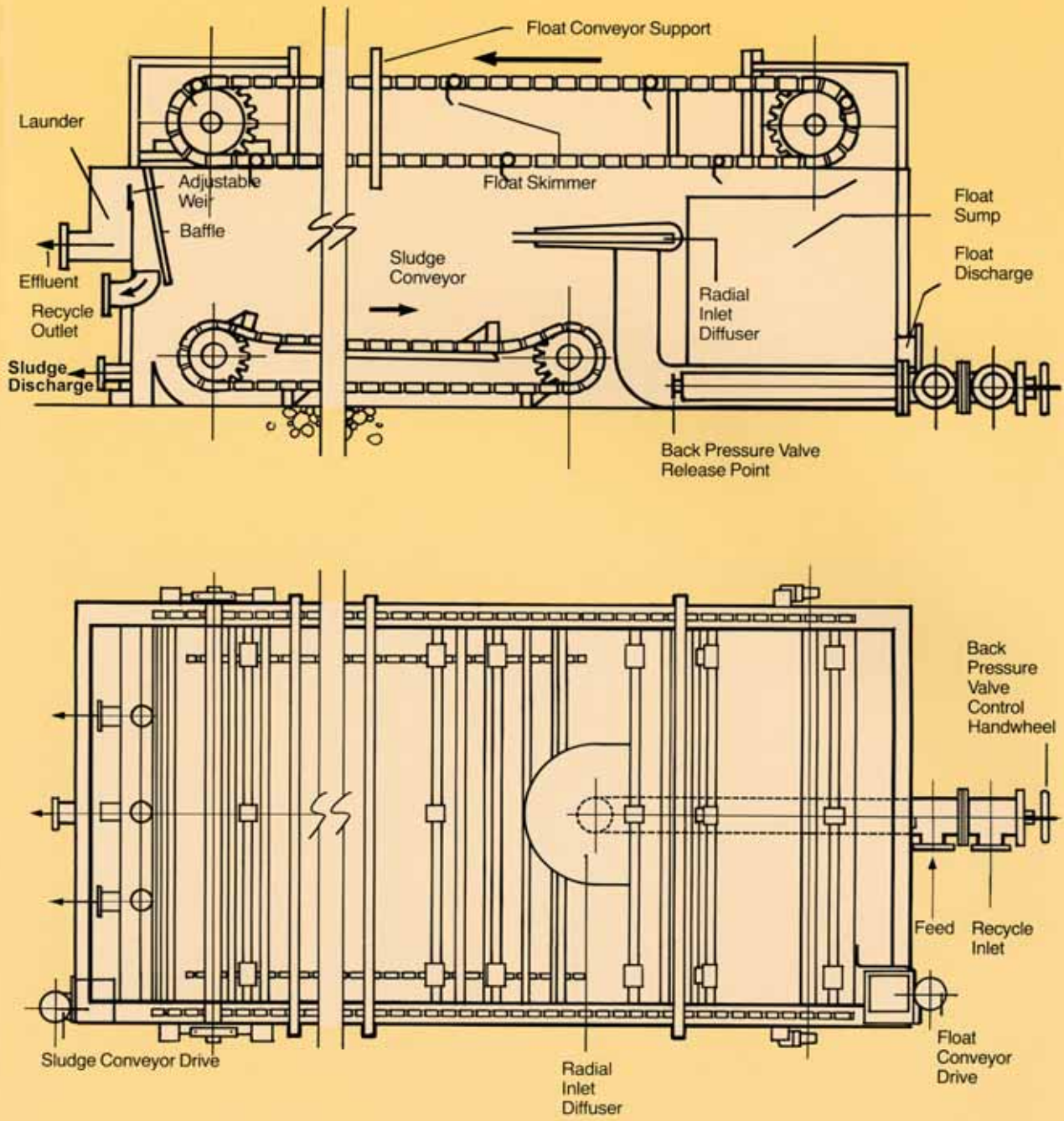
Rectangular Flotators

Rectangular Flotator—Concrete Tank Arrangement



Rectangular Flotators

Rectangular Flotator—Steel Tank Arrangement



Pilot Plant Equipment

Complete pilot plant units are available in circular and rectangular designs for testing industrial or municipal wastes at your facilities. Our qualified engineers can assist your engineers in determining design loadings, air requirements and expected results. Bench tests can determine suitability of your waste to dissolved air floatation treatment. Bench test kits are available for in-site testing and can be purchased to optimize your floatation applications.



Bench test kit, packed in aluminum case, is easily assembled for use.

Typical Applications for Flotators



Applications for DAF Flotation Systems

Industrial

- Poultry Processing
- Meat Packing
- Rendering
- Canning
- Prepared Foods
- Seafood Processing
- Snack Foods
- Railroads
- Refinery
- Storm Water Treatment
- Power Plants
- Chemical Processing Plants
- Stockyard and Feedlot Run-Off
- Tanning
- Pulp and Paper
- Ballast Water Treatment
- Produced Water
- Tank Truck Cleaning
- Textile
- Fiber Recovery
- Mining
- Algae Removal
- Heavy Metals Removal
- Automotive
- Aircraft Maintenance
- Durable Goods
- Oil Refinery Waste

Municipal

- Sludge Thickening
- Algae Removal
- Clarification

Design Parameters

Air/Solids, lbs. air/lbs. solids	0.02
Hydraulic surface loading gpm/ft ²	1.5 - 2.0
Solids loading, lbs./ft. ²	1.5 - 2.0
Float Concentration, %	4 - 6
Capture - w/o polymer, %	85
-w polymer, %	95+