



**Suspended Air™ Flotation**

# WHY SAF™ REPLACES DAF

**SAF™ (Suspended Air™ Flotation)** by Heron Innovators uses an externally-generated bubble suspension with high air content. Each bubble is covered with a chemically active film which strongly attaches to the flocculated solids in the wastewater, achieving high rate and efficient flotation. DAF (Dissolved Air Flotation) uses high pressure to dissolve a small amount air in water with no chemically active agent, and depends on physical entrapment and a weak surface bond to float the flocculated solids.

**SAF™ is re-writing the book on flotation technology,** replacing DAF as the method of choice for removal of suspended solids from wastewater. **Here's why:**

## 1. SAF™ is smaller than DAF.

Small equipment footprint is highly desirable, even necessary, in most applications. SAF™ flotation tanks are less than 20% as large as DAF tanks for the same treatment rate. This is because the SAF™ process operates at 10 times the hydraulic loading rate and 15 times the solids loading rate of DAF – 10 gpm per square foot hydraulic loading rate and 15 lb/hr per square foot solids flux. Two factors account for this:

- The volume fraction of air contained in the SAF™ air emulsion is 40%, 20 times the volume fraction of air in typical DAF recycle flow (see chart); and
- The chemically active film on the SAF™ air bubbles attaches much more strongly to flocculated wastewater particles than plain air bubbles.

## 2. SAF™ uses less power than DAF.

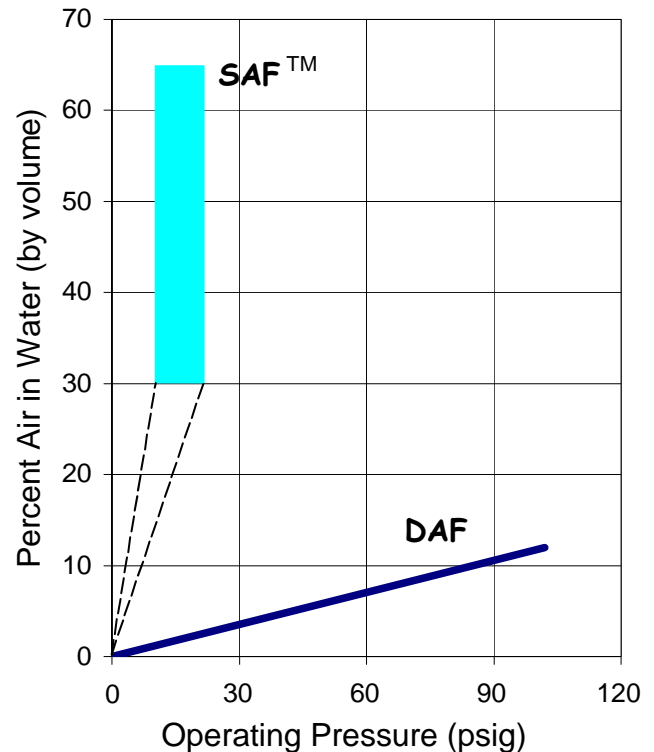
Using a frothing agent in the process of generation of the Suspended Air™ Emulsion radically reduces the power consumption per unit of air delivered to the flotation tank. One gpm of Suspended Air™ Emulsion generated at approximately 20 psi contains as much air by weight as about 8.5 gpm of DAF recycle flow pressurized to 60 psi. Furthermore, because SAF™ flotation requires half (or less) as much air as DAF, a SAF™ can be just as effective as a DAF using only 2% of the power used by DAF for air generation.

## 3. SAF™ removes more solids than DAF.

Each SAF™ bubble is a working bubble, with an electrically-charged film ready to attach and stick to oppositely-charged floc particles. SAF™ removes many more small size flocs than DAF could ever do.



**Vegetable Processing Solids On Model DWC Dewatering Conveyor**



## 4. SAF™ floated solids can be dewatered more easily than DAF solids.

One of the most remarkable things about SAF™ flotation is the gelatin-like consistency of the floated solids. SAF™ floated solids, with firmly attached air bubbles entrained inside, appear “rubbery” as though high doses of polymer were added. This makes it possible to remove all free-draining water by simple gravity drainage on a Heron Innovators Model DWC slowly-moving thermoplastic chain belt.

## 5. SAF™ operation is more flexible than DAF.

In virtually all industrial wastewater treatment applications, shutdowns of various durations are inevitable. SAF™ handles these with ease, but DAF always falters. Starting a SAF™ takes less than a minute of automatically timed “warmup” for the generator and NO operator attention is required. When a SAF™ stops, the floated solids all stay on top of the tank, ready to be scraped off during the next run period.

## 6. SAF™ is more cost-effective than DAF.

In case after case, SAF™ installations have soundly trounced DAF in cost-effectiveness over the life cycle of the installation, with simple payback periods commonly 2 years or less.

***Don't be fooled by imitators - always ask for Suspended Air™ Flotation by Heron Innovators, Inc.***

# SERIES SAF™

## Suspended Air™ Flotation Systems

### Typical Applications

**Food, Dairy, and Animal Products Processing:** Removal of suspended solids from screened raw wastewaters, with thickening of recovered solids.

**Municipal Wastewater:** Waste activated sludge thickening, primary clarification with grit removal, secondary clarification with solids thickening.

**Wastewater Effluent Ponds:** Removal of algae and other suspended solids for direct discharge or as a polishing step prior to tertiary filtration.

**Water Treatment:** Removal of suspended solids as a polishing step prior to filtration. Increases filter run time between backwashes.

**Oily Wastes:** Removal of emulsified oil from water (air compressor condensate, vehicle wash water, oilfield produced water, etc.).



**Complete SAF™ System  
Treating Food Processing Wastewater**

### Operational Advantages

**SAF™ is re-writing the book on flotation technology,** replacing DAF as the method of choice for removal of suspended solids from wastewater.

SAF™ flotation tanks are less than 20% as large as DAF tanks for the same treatment rate. Because of the high air content of Suspended Air™ Emulsion, a SAF™ system can be just as effective as a DAF using only 2% of the power for air generation. Floated solids are gelatinous and can be dewatered by simple gravity drainage.

The SAF™ System can successfully treat wastewaters containing as much as 15,000 mg/L of suspended solids with removal rates greater than 90%. In many cases effluent suspended solids are less than 5 mg/L.



**Skid Mounted SAF™ System  
Treating Wine Bottling Wastewater**

### System Features and Options

**Standard Features:** Systems are supplied complete, pre-engineered and ready for on-site assembly, including an influent flow meter, dual compartment conditioning tank, coagulant metering pump, polymer activation system, Series F Suspended Air™ Emulsion Generator, Series CF ClearFloater™ Flotation Separator, Series DWC Dewatering Conveyor, and NEMA 4X electrical control panel containing all controls, displays, and motor drives. A pH sensor / controller and acid / base metering pumps can be supplied as an option.



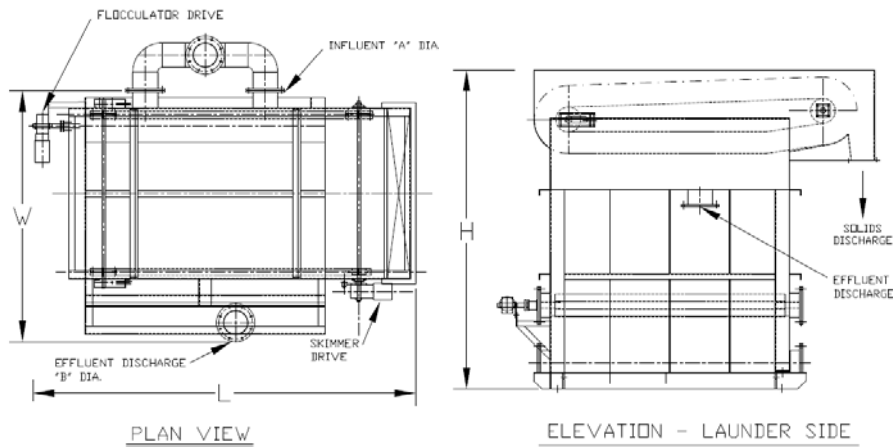
**SAF™ System Pilot Trailer  
200 gpm Treatment Capacity**

# SERIES CF ClearFloater™ Flotation Separator

## Dimensions



Model CF125



PLAN VIEW

ELEVATION - LAUNDER SIDE

MODEL	FLOTATION AREA (sq. ft.)	DIMENSIONS			PIPE SIZE (in.)	
		W	L	H	A	B
CF50	8	4'-6"	7'-5"	7'-0"	3	3
CF125	17.5	7'-0"	9'-0"	9'-2"	6	6
CF250	35	7'-4"	11'-2"	9'-5"	8	8
CF500	72	8'-9"	16'-3"	10'-10"	10	10
CF1000	144	8'-9"	28'-3"	10'-10"	12	12
CF2000	304	11'-6"	42'-6"	12'-9"	16 (2)	16 (2)
CF3000	432	11'-6"	58'-6"	12'-9"	18 (3)	18 (2)

## Standard Specifications

### APPLICATION

Series CF Flotation Separators are designed to be used in a Suspended Air Flotation (SAF™) System, properly matched with a Series F Suspended Air™ Emulsion Generator to treat the flow rate and suspended solids content of the particular wastewater.

Hydraulic loading rates as high as 15 gpm per square foot of flotation area have been sustained in test runs. The Series CF is rated for solids fluxes as high as 15 lb. per hour per square foot of flotation area. This results in a footprint less than 30 percent of DAF for the same treatment result.

Flotation treatment can be interrupted for extended periods of time and re-started quickly without loss of treatment efficiency, because the floated solids remain on the tank surface.

### FLOTATION TANK DESIGN

The Series CF design has been developed to realize the full advantage of the extremely high rise velocities and stable float characteristic of flocculated solids having Suspended Air™ bubbles attached.

The inlet passes through an agitated flocculation chamber, and the inlet to the flotation area is distributed evenly across the tank length. The skimmed surface is typically longer than it is wide. The solids are skimmed off immediately after reaching the surface, without allowing a mat of solids to build up.

Skimmed solids are scraped up an inclined beach section to the discharge chute. Clarified effluent passes underneath a deep baffle, overflowing a full-width adjustable weir to the effluent receiving box.

### EQUIPMENT FEATURES AND OPTIONS

**Tank and Support Materials:** A36 carbon steel, minimum 12 gauge, welded construction. Stainless steel available as an option.

**Flocculation Chamber:** Mechanically agitated compartment within the flotation tank, mixer shaft direct driven by a variable speed gearmotor. Provides for effective blending of Suspended Air™ Emulsion and additional polymer with influent coagulated / flocculated wastewater.

**Mechanical Skimmer:** Chain and flight, stainless steel flights and shaft, thermoplastic sprockets and pintle chain, with the drive sprocket direct driven by a variable speed gearmotor. Timed on / off cycle can be supplied as an option.



Model CF2000

# SERIES F

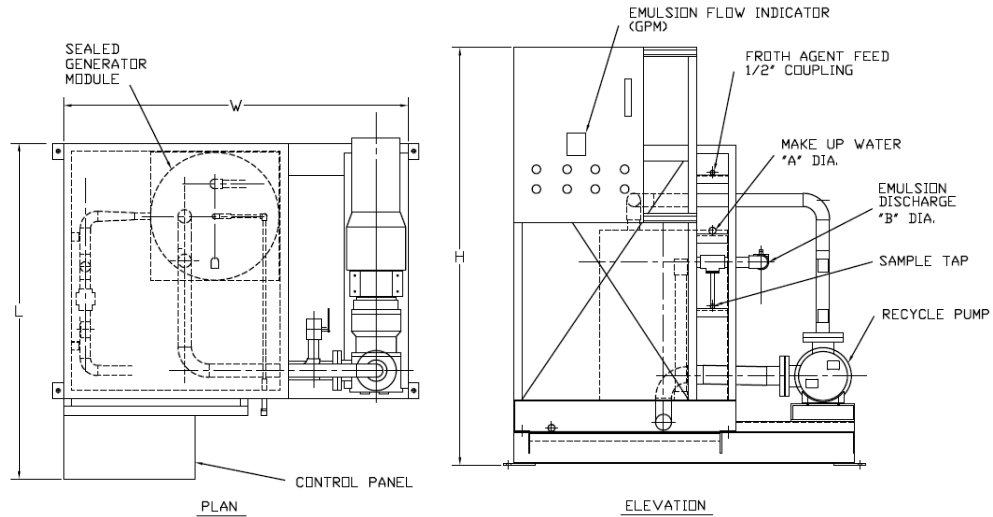
## Suspended Air™ Emulsion Generator (patent pending)

### Dimensions



**DUAL MODEL F200s**  
**Replacing two DAF pressurization systems**  
**190 Hp reduced to 20 Hp**

### Standard Specifications



MODEL	EMULSION (gpm)	WATER REQ. (gpm)	DIMENSIONS (inches)					MOTOR HP
			W	L	H	A (dia.)	B (dia.)	
F2	0.5	0.3	16	16	24	3/8	1/4	1/4
F8	2.1	1.3	36	34	64	1/2	3/8	1
F25	6.6	4	40	49	78	1/2	3/4	2
F50	13.2	8	53	61	78	3/4	1	3
F100	26.4	16	64	63	78	1	1.5	5
F200	52.8	32	66	69	78	1.25	2	10

### OPERATION AND APPLICATION

SAF™ outperforms DAF because each Suspended Air™ bubble is a working bubble, with an electrically-charged surfactant film ready to attach and stick to oppositely-charged floc particles. This results in extremely high rise rates and a stable float characteristic, and makes it possible to operate a flotation process at 10 times the hydraulic loading rate and 10 times the solids loading rate of DAF.

An existing DAF can be retrofitted: Suspended Air™ Emulsion Generators are replacing DAF pressurization systems, increasing the hydraulic and solids loading capacity of an existing DAF flotation tank by 3 to 4 times without increasing footprint and without modifying the existing tank. Generally, retrofits have the added benefit of reducing connected HP.

### STANDARD FEATURES

Unit is supplied pre-piped and pre-wired, with removable side and top cover panels, a NEMA 4X control panel, and connection points for electrical power, makeup water, frothing agent, and emulsion output.

**Sealed Generator Module:** Stainless Steel, fully seal welded, carrying an extended warranty of five (5) years against defects in materials or workmanship. Patented technology.

### STANDARD FEATURES (cont.)

**Frothing Agent Metering Pump:** Pulsed-diaphragm type, manual stroke length adjustment. Control signal input for pulse frequency adjustment proportional to emulsion flow rate.

**Instrumentation and Controls:** Polypropylene Hall-effect flow sensor, flow rate and totalized flow display, and control signal output. Float and solenoid water level control. "Warmup" time delay on emulsion output solenoid valve.

**Recycle Pump:** Rotary lobe or gear positive displacement pump coupled to a 3 phase 460v electric motor with electronic variable speed drive and gear reducer on Models F8 through F200. Single phase 230v motors available as an option on Models F8 and F25. Model F2 has a 110v single phase motor.

**MODEL F200**  
**Replacing a DAF pressurization system**  
**60 Hp reduced to 10 Hp**



# SAF™ HISTORY AND INSTALLATIONS

In continuous development since 1975, Suspended Air™ Flotation (SAF™) by Heron Innovators incorporates all of the innovations and improvements made over the years. Since 1998, the SAF™ technology has incorporated these exciting new improvements:

- Emulsion generators of much larger capacity,
- Flotation equipment of radically reduced size, and
- Float solids dewatering which is simple and effective.

Over the past 14 years, Heron Innovators scientists and engineers have been involved in development of this remarkable flotation treatment technology, and now over a dozen facilities depend on SAF™ to meet their wastewater treatment goals cost-effectively.

## PRIOR DEVELOPMENTS

The Micro Gas Dispersion was invented by the late Dr. Felix Sebba in 1975. A Micro Gas Dispersion is an emulsion of very small bubbles in water with diameters ranging from 5 – 50 microns. The Micro Gas Dispersion contains 40% – 65% of air by volume, and is stabilized by the addition of a frothing agent which coats each bubble and prevents the coalescence of the bubbles. The Micro Gas Dispersion generator technology of 1975 was able to produce small flow rates, less than 2 liters per minute, suitable for experimental and development purposes but too small for industrial applications.

The engineering and production team now with Heron Innovators further developed the Micro Gas Dispersion technology under the trade name Superfroth from 1994 through 1997, in cooperation with one of Dr. Sebba's associates. The generators manufactured during that period could produce emulsion flow rates up to approximately 25 gallons per minute. The flotation tanks utilized with SuperFroth at that time were of conventional design, similar to the circular and rectangular flotation cells still used in the Dissolved Air Flotation (DAF) process.

## SUSPENDED AIR™ FLOTATION TECHNOLOGY

Since its inception in 1998, Heron Innovators has made numerous improvements to the Superfroth technology. Suspended Air™ Flotation (SAF™) has incorporated all past developments, and has taken flotation treatment to a new level, rendering this technology suitable for all municipal and industrial wastewater treatment and product recovery operations, from the very smallest to the very largest. SAF™, with its emulsion generated in Heron Innovators proprietary design Suspended Air™ Emulsion Generators, effectively replaces DAF in all flotation treatment applications.

For each candidate application type, Heron Innovators engineers perform bench scale treatability and flotation testing to establish the correct chemical treatment program and select the frothing agent to be used to produce the Suspended Air™ Emulsion. The results of bench scale testing are immediately applicable to the full scale process. There is no scale-up problem because the flocculation and flotation processes all operate on a micro physical scale much smaller than the bench testing units.

A 200-gpm capacity pilot trailer is available for on-site testing. This trailer contains a complete treatment system including a 1,700-gal. two-compartment conditioning tank for coagulant and polymer, a polymer activation system, a pH control system, a self-priming wastewater feed pump, Model CF125 ClearFloater™, Model F50 Generator, a peristaltic solids transfer pump, and on-board chemical storage and metering capability.

## PARTIAL LIST OF INSTALLATIONS

- Complete system with Model CF400SP ClearFloater™, Model F100 Generator, and Model DWC2415 dewatering conveyor, at a snack food manufacturer in Fresno, CA.
- Complete skid-mounted system with conditioning tank, Model CF125 ClearFloater™, Model F25 Generator, and polymer activation system, at the Kendall-Jackson wine bottling plant in Santa Rosa, CA.
- Model CF2000 ClearFloater™ and Model F200 Generator, at a meat packing plant in Kansas.
- Complete system with 3,500 gal. dual compartment conditioning tank, Model CF250 ClearFloater™, Model F50 Generator, Model DWC2412 Dewatering Conveyor, polymer activation system, and peristaltic solids transfer pump, at a food processor in Clovis, CA.
- Complete trailer-mounted system with dual compartment conditioning tank, Model CF125 ClearFloater™, Model F50 Generator, and polymer activation system, at a food processor in White City, OR.
- Two Model F200 Generators replacing two DAF pressurization systems, at a meat packing plant in Kansas. Reduced connected horsepower from 190 Hp to 20 Hp, and increased recovery of bleachable tallow.
- Model F200 Generators replacing DAF pressurization systems at canneries in Escalon and Kingsburg, CA. Reduced connected horsepower while dramatically improving performance.

**Manufactured By:**

**Heron Innovators, Inc.**  
700 Sunrise Avenue, Suite H  
Roseville, California 95661  
Phone (916) 630-7169  
FAX (916) 630-1275  
www.heroninnovators.com

Copyright © 2009 Heron Innovators Inc.

**Bench Scale Suspended Air™  
Emulsion Generator**



**Your Local Representative:**