



Model
DAF

DAF

Dissolved Air Flotation Systems

The DAF Series Dissolved Air Flotation systems are designed to remove petroleum products, FOG, TSS, BOD, COD and other contaminants in a wide variety of industries & applications.

Pan America Environmental Dissolved Air Flotation systems are an extremely versatile design allowing high loads of a very wide variety of contaminants to be removed from your wastestream. DAF is considered to be the best, most cost-effective device for separating FOG and solids.

The DAF process consists of super saturation of effluent discharge water with air. The saturated water stream is then redirected and mixed with the wastestream prior to entering the inlet.

As pressure is removed from the saturated stream millions of microscopic bubbles form and attach themselves to the contaminants in the wastestream, thereby changing their buoyancy and floating them to the water surface where they can be skimmed from the water.

Our unique, compact, small footprinted Dinky DAF™ design is offered for small flows and tight spaces. Chemical pretreatment can be provided where required for all DAFs.

Our DAF systems can be used for removal of oils, fuels, emulsified products, FOG, BOD, suspended solids, COD, vegetable matter, vegetable oils, animal processing waste, river water for drinking or plant use, bilge water, pretreatment prior to bio-reactor systems and many many other types of applications. The DAF is a hardy piece of equipment and can accommodate many wastes.

Standard Features:

- ◆ A36 or 304 or 316 SS construction
- ◆ Adjustable water weir
- ◆ Integral float reservoir
- ◆ Influent diffuser
- ◆ Effluent chamber
- ◆ Recycle saturation system
- ◆ NPT/flanged fittings
- ◆ Surface drag skimmer
- ◆ V-hopper Bottom, sludge auger
- ◆ Lifting lugs
- ◆ Nema 4 controls

Typical applications:

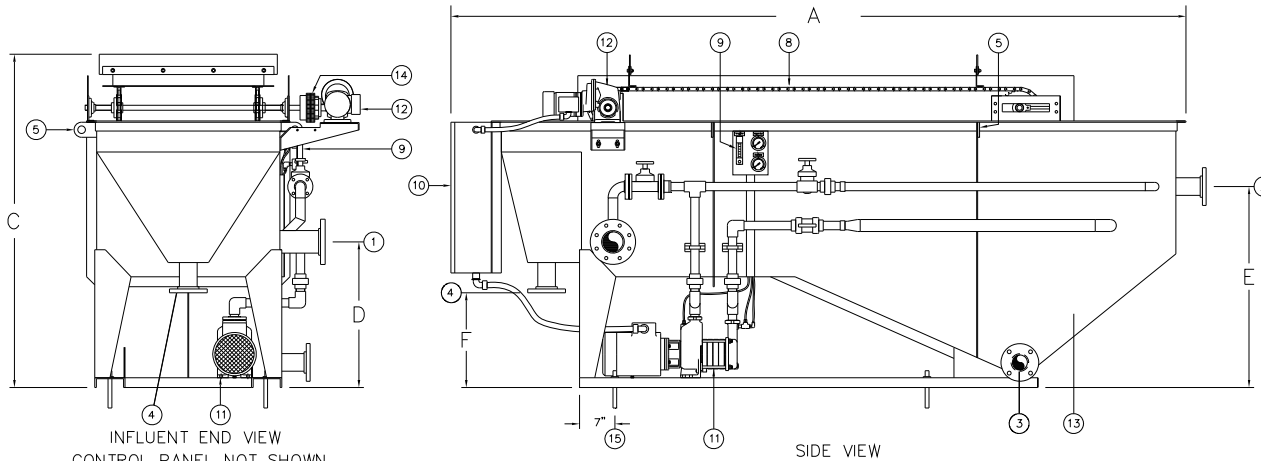
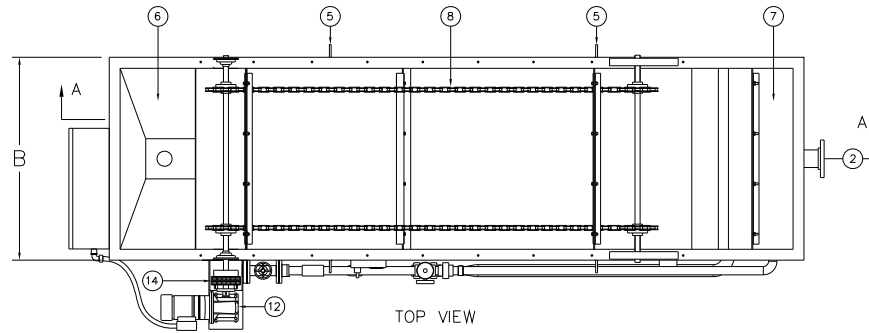
- ◆ Groundwater remediation
- ◆ Tank truck tank wash
- ◆ Refinery wastestream
- ◆ Biodiesel process water
- ◆ Drinking water pretreatment
- ◆ Pet food plant process water
- ◆ Beef, fish, fowl, pork processing
- ◆ Rendering plant wastewater
- ◆ Food processing plant water
- ◆ Algae removal
- ◆ Industrial process water
- ◆ Bilge water treatment
- ◆ Bakery wastewater
- ◆ Military wash racks
- ◆ Steel mills



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Dinky DAF™



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The DAF systems can be provided with many options to create a complete, custom system design to fit your application and particular needs.

Customization of the tank is offered to further tailor the design to your needs.

Options:

- Chemical pretreatment systems
- Traditional recycle system
- Tank vapor cover
- Class 1 div 2 grp D electrical
- Zone 3, 4 seismic design
- Float pumpout
- Sludge pumpout
- Effluent pumpout
- Influent feed pump
- Walkway
- High level alarms
- Chemical metering pump systems
- Chemical makeup systems
- Containerized systems
- Trailer mounted systems
- 304/316 SS tank construction
- Polypropylene tank construction
- Freeze protection
- Elevating structures
- Effluent filtration
- Sludge auger (Dinky DAF™)

Model	Length	Width	Height	Inlet	Outlet	Float Outlet	Sludge Vol. Gal.	Float Hopper Gal.	Inlet Size	Outlet Size	Sludge Outlet Size	Float Outlet Size	Empty Weight	Operat. Weight	Flow Rate GPM (Max.)
	A	B	C	D	E	F									
DAF-8	10'-6"	2'-4"	5'-6"	2'-6"	3'-4"	1'-7"	50	19	2"	2"	3"	3"	890	2720	16
DAF-12	10'-6"	2'-10"	5'-6"	2'-6"	3'-4"	1'-7"	66	23	3"	3"	3"	3"	985	3422	24
DAF-18	10'-6"	3'-4"	5'-6"	2'-6"	3'-4"	1'-7"	100	30	3"	3"	3"	3"	1250	4925	36
DAF-24	10'-6"	4'-4"	5'-6"	2'-6"	3'-4"	1'-7"	132	37	4"	3"	3"	3"	1560	6605	48
DAF-36	10'-6"	6'-4"	5'-6"	2'-6"	3'-4"	1'-7"	198	60	4"	3"	3"	3"	2165	9481	72

Item	Qty	Description	Item	Qty	Description	Item	Qty	Description	Item	Qty	Description	Item	Qty	Description
1	1	Inlet	4	1	Float outlet	7	1	Effluent Chamber	10	1	Control Panel	13	1	Sludge Hopper
2	1	Outlet	5	4	Lift Lug	8	1	Skimmer	11	1	Recycle Pump	14	1	Overload
3	2	Sludge Outlet	6	1	Float Chamber	9	1	Gauge Panel	12	1	Gearmotor	15	4	Holddown

Dimensions, design and capacities are not for construction and are subject to change without notice.

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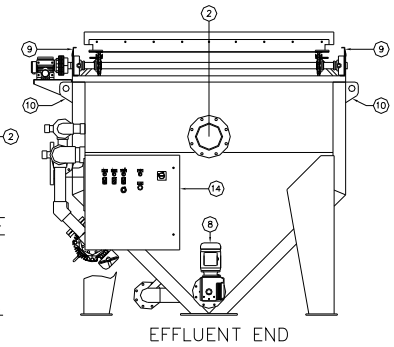
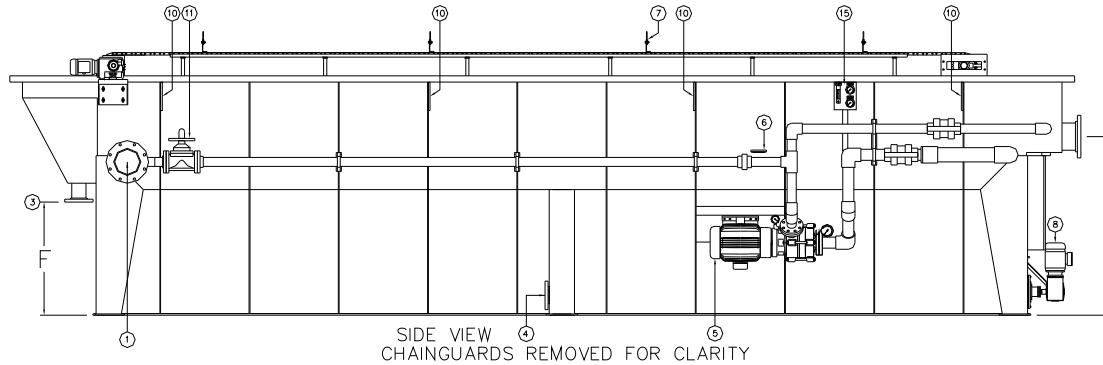
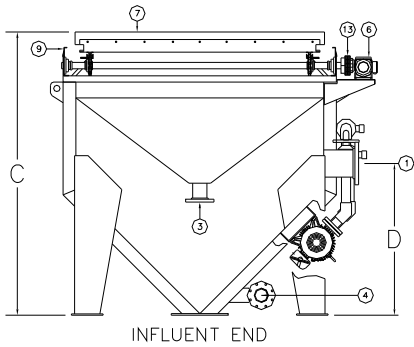
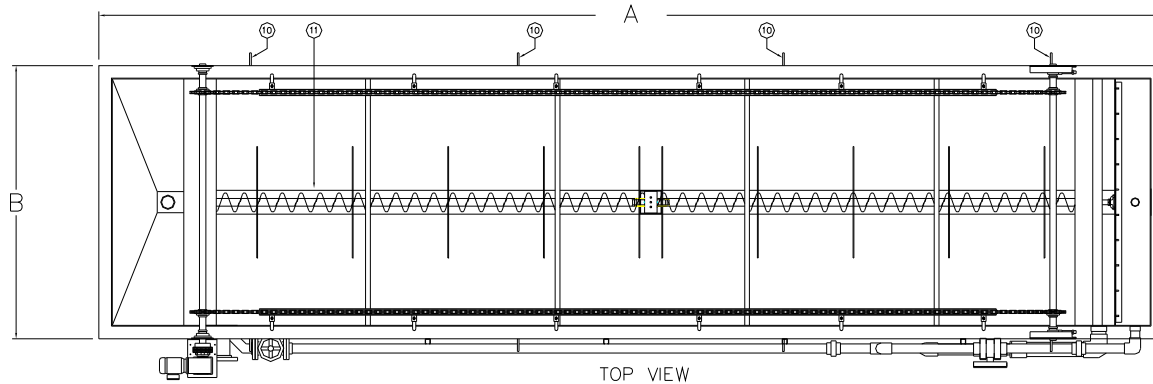




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Item	Qty	Description	Item	Qty	Description	Item	Qty	Description	Item	Qty	Description	Item	Qty	Description
1	1	Inlet	4	1	Sludge outlet	7	-	Skimmer flight	10	6	Lifting lug	13	1	Overload
2	1	Outlet	5	1	DAF pump	8	1	Auger drive	11	1	Recycle valve	14	1	Control panel
3	1	Float Outlet	6	1	Skimmer drive	9	2	Chainguard	12	1	Auger	15	4	Gauge panel

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Large DAF Specification Table

Model	Length	Width	Height	Inlet	Outlet	Float Outlet	Sludge Vol. Gal.	Float Hopper Gal.	Inlet Size	Outlet Size	Sludge Outlet Size	Float Outlet Size	Drain	Empty Weight	Operat. Weight	Area Ft ²	Flow Rate GPM (Max.)
	A	B	C	D	E	F											
DAF-60	15'-2"	6'-0"	5'-7"	4'-4"	3'-11"	2'-9"	700	70	4"	4"	4"	3"	2"	4876	19376	60	120
DAF-85	19'-8"	6'-0"	5'-7"	4'-4"	3'-11"	2'-9"	850	90	4"	4"	4"	3"	2"	5356	25110	85	170
DAF-100	22'-11"	6'-2"	5'-7"	4'-4"	3'-11"	2'-9"	1090	110	6"	6"	4"	3"	2"	6100	29000	100	200
DAF-120	24'-3"	6'-7"	6'-7"	4'-4"	5'-1"	2'-2"	1160	175	6"	6"	4"	4"	2"	10600	50000	120	250
DAF-150	27'-3"	7'-2"	6'-10"	4'-4"	5'-1"	2'-2"	1300	205	6"	6"	4"	4"	2"	12200	74000	150	300
DAF-180	28'-3"	8'-2"	8'-0"	5'-6"	6'-1"	2'-0"	1435	280	8"	8"	4"	4"	2"	14000	92000	180	360
DAF-200	31'-1"	8'-2"	8'-0"	5'-6"	6'-1"	2'-0"	1500	315	10"	10"	4"	4"	2"	15100	100600	200	400
DAF-250	33'-1"	9'-0"	8'-5"	6'-0"	6'-4"	1'-8"	1580	360	10"	10"	4"	4"	2"	18200	129870	250	500
DAF-300	36'-0"	9'-0"	8'-5"	6'-0"	6'-4"	1'-8"	1660	400	12"	12"	4"	4"	2"	20800	166000	300	600
DAF-350	42'-0"	10'-4"	9'-0"	6'-2"	7'-2"	1'-8"	1740	450	12"	12"	4"	4"	2"	22300	175000	350	700
DAF-400	48'-0"	10'-4"	9'-0"	6'-2"	7'-2"	1'-6"	1900	530	12"	12"	4"	4"	2"	25350	225000	400	800
DAF-450	55'-0"	10'-4"	9'-6"	6'-2"	7'-2"	1'-6"	2450	620	14"	14"	4"	4"	2"	29000	240500	450	900
DAF-550	59'-0"	11'-0"	9'-6"	6'-6"	7'-2"	1'-6"	2900	695	14"	14"	4"	4"	2"	39700	268000	550	1100
DAF-600	62'-0"	11'-4"	9'-8"	6'-6"	8'-0"	1'-6"	3735	750	14"	14"	4"	4"	2"	46000	295000	600	1500

Dimensions, design and capacities are not for construction and are subject to change without notice.



DAF Options Descriptions

Influent Feed System Air operated, diaphragm pump with air controls or progressive cavity pump, sump level switches & Nema 4 control panel, base mounted, 115/230/460V power offered. Electric diaphragm pumps available.

Effluent Pumpout Centrifugal pump with level switches & Nema 4 control panel, base mounted, 115/230/460V power offered. OS Effluent chamber must be expanded to accommodate pumpout or provision of an external pumpout tank.

Sludge Pumpout System Air operated, diaphragm pump with air controls & Nema 4 control panel, auto on/off timer, base mounted, 115V/1ph/60Hz power req'd. Progressive cavity pump system also available. 1 - 100 GPM.

Float Pumpout System Air operated, diaphragm pump with air controls, level switches & Nema 4 control panel, base mounted, 115V/1ph/60Hz power req'd. Electric gear or progressive cavity pump systems available. 1 - 100 GPM (larger if required)

Sludge Auger Dinky DAF V-hopper can be provided with a sludge auger. System consists of stainless steel shafts with coated steel screw auger(s) driven by a slow speed gear motor drive assembly. The auger extends the full length of the solids hopper and conveys solids to the sludge outlet. A Nema 4 on/off control box is provided, power required: 230 or 460V/3ph/60Hz.

Cover DAF tank can be provided with a vapor retaining cover.

Freeze Protection Immersion heaters mounted through tank wall. Each heater has an independent thermocouple well, 0-100 deg. F thermostat and Nema 1 (or optional Nema 4) housing. 230/460V/3ph/60Hz power req'd.

Oil Sight Glass Two automatic, brass valves with tempered sight glass and protection rods mounted in oil reservoir. If glass is broken check ball stops outflow from reservoir.

External Sight / Level Glass An externally mounted clear PVC sight tube is provided with multi-point level switch for indication or pump control of oil or water. Switch is removable for cleaning and inspection.

Elevation Stand Epoxy coated steel stand or legs to elevate tank to desired level. Standard deck height is 30". Full platforms & walkways with ladders or stairways can be designed where required or desired.

Alternate Tank Construction Standard carbon steel construction can be changed to 304 or 316 stainless steel.

External Storage/Feed Tanks A wide variety of tank volumes can be supplied for your water, product and sludge holding needs. Flat bottom and cone bottom designs constructed in polyethylene, fiberglass, steel & stainless steel can be provided.

Effluent Filter Systems Solids filter systems can be provided to remove filterable solids from the separator effluent. Contact Pan America to determine proper filtration needs for your application.

AQAM Filter Systems AQAM (Alkyl Quaternary Ammonium Montmorillonite) filter systems can be provided to remove trace hydrocarbons, sheens, DNAPLs, slightly soluble chlorinated hydrocarbons and high molecular weight organics from the separator effluent. Contact Pan America to determine proper filtration needs for your application. AQAM can also be used to protect and increase GAC lifespan.

Carbon Filtration Systems (GAC) GAC carbon filters can be provided to remove contaminants after the separator. Contact Pan America to determine proper system needs for your application.

Emulsion Cracking Systems Emulsion cracking systems can be provided to remove oil-in-water emulsions prior to the separator. Contact Pan America to determine proper system needs for your application.

pH Adjustment Systems pH adjustment systems can be provided to maintain pH levels prior to or after the separator. Contact Pan America to determine proper system needs for your application.

Chemical Pretreatment Systems Chemical pretreatment system can be provided to coagulate, flocculate, precipitate, oxidize, break emulsions and/or adjust pH before or after the DAF. Contact Pan America to determine proper system needs for your application.

System Containerization DAF systems with any options can be installed in a 20 or 40' shipping container(s) to simplify system provision and field implementation. System would include the complete mounting, piping and

wiring of the system in one or more container as required by the project.

Trailer Mounting OS separators can be mounted on a trailer for system mobilization. Trailer design generally includes corner leveling jacks, bubble levels, walkway, toolbox, electric or hydraulic brakes, piping and wiring of options.

Field Skid Mounting DAF systems can be mounted to a mobile skid with leveling for quick field mobilization.

Skid Mounted System DAFs can be combined with our other treatment equipment and options into a fully integrated, custom designed system completely mounted, plumbed and wired to a system skid. To simplify your need to do the wiring and plumbing on site, reducing your time frames and on site costs, we design around your requirements.

Vent Scrubber Separator vapors can be extracted and scrubbed prior to discharge to atmosphere to remove VOC content.

Level Sensors Level sensors can be provided to detect water and oil/fuels. One or more sensor points can be provided to perform various functions such as high level, low level, pump on/off based on liquid levels and level detection for DCS controls or other functions based on your needs.

Class 1 Div 1 & 2 Systems can be designed for use in a class 1 div 1 or 2 environment. Controls, components and wiring are changed to meet the needs of these environments. Intrinsically safe relays are also used for level sensors.

Oil Monitor an oil detection system can be provided to monitor effluent oil content and provide various actions based on the oil alarm setpoint. Actions might include: audible/visual alarm, redirection of influent or effluent via actuated valve, shutdown of influent pump or your custom action.



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DAF Series Dissolved Air Flotation Engineering Specification DAF12 through DAF600

EQUIPMENT DESIGN & CONSTRUCTION

Performance

The Pan America Environmental DAF Series systems are designed to remove fats, oils & greases (FOG) and suspended solids. Clarification rates as high as 97% can be achieved using the DAF systems.

A percentage of the clean effluent is recycled and super-saturated with air, mixed with the wastewater influent and injected into the DAF separation chamber. The dissolved air comes out of solution, producing millions of microscopic bubbles. These bubbles attach to solids and float them to the surface where they are skimmed and removed from the tank.

SECTION 1.0 EQUIPMENT

The DAF Dissolved Air Flotation system will be designed and fabricated per the following specifications. The tank shall be a rectangular design with features as described.

1.01 Float/Separation Chamber

The separation chamber provides a velocity decreasing horizontal separation surface area that minimizes turbulence and maximizes flow and solids throughput. The mixed wastewater enters this chamber where separation and flotation occur.

The Separation chamber includes the float storage chamber, float baffle, water baffle with adjustable water weir, settleable sludge hopper, surface float skimmer, clean water effluent chamber and the skim ramp.

1.02 Float Storage Chamber

As the surface float skimmer continuously skims float from the water surface it conveys float up the skim ramp and deposits it in the float storage chamber which is provided to allow temporary float storage. The chamber has sloped sides to allow solids to slide to the bottom sludge outlets.

1.03 Effluent Chamber

The waste flow and float run into the float baffle at the effluent end of the tank. The float is contained while the water is directed under the baffle and over the adjustable 304 stainless steel weir plate. The clean water accumulates in this chamber and is discharged.

1.04 Sludge Hopper

A sludge hopper is located under the separation chamber to provide temporary storage of any settleable solids. A sludge auger is provided to convey sludge to the sludge outlet (auger provided as standard feature with DAF60 and larger).

1.05 Sludge Auger System

(standard feature on DAF-60 & larger)

The solids hopper is provided with a rotating, screw type sludge auger. The auger consists of stainless steel shafts with coated steel screw auger driven by a slow speed gear motor drive assembly. The auger extends the full length of the solids hopper and conveys solids to the sludge outlet. Power required: 230/460V/3ph/60Hz.

1.06 Surface Float Skimmer

A mechanical surface drag skimmer assembly is provided to sweep the floating solids (float) from the effluent end of the separation chamber toward the influent end. The skimmer consists of 304 stainless skimmer flights and neoprene or Buna-N wiper blades, carbon steel flight chain, sprockets and chain guides, variable speed drive, sprocket shafts, bearings and chain adjustment bearing frames. The flights will be bolted to two roller chains spanning the width of the tank and will be designed to wipe the tank sides and float ramp. UHMWPE flight wear bars are provided to reduce tank and flight wear.

1.07 Air Saturation System

The DAF is provided with an air saturation system that is designed to direct a portion of the water from the effluent end of the tank, super-saturate the water with air and then mix this solution with incoming wastewater facilitating intimate mixing of both flows. Recycle saturation pump and schedule 80 PVC piping are mounted on DAF tank with a bypass line to the effluent chamber.

1.08 Recycle Pump (standard design)

A high head, coated cast iron centrifugal, 100 psi recycle pump mounted to the DAF tank is included to provide air saturated water under pressure to the air/wastewater mixing inlet prior to entering the separation chamber. A Nema 4 control panel is provided mounted to the DAF tank. The recycle pump draws ambient air into the pump and saturates the water with this air under high pressure. No external air source is required. A fine air-metering valve with rotometer are provided to control and measure the air flow into the recycle pump. A discharge control valve and suction control valve are provided to facilitate adjustment and operation of the air saturation process. Once adjusted the recycle system can be turned off and on at will without losing settings and saturation process is virtually instantaneous upon startup.

1.09 Air Saturation System (Alternate to standard)

The DAF is provided with a recycle air saturation system that is designed to direct a portion of the water from the effluent end of the tank, super-saturate the water with air and then mix this solution with incoming wastewater facilitating intimate mixing of both flows. Recycle saturation pump and schedule 80 PVC piping are mounted on DAF tank and/or on the recycle system skid with a bypass line to the effluent chamber.

Recycle Saturation Features

The recycle system consists of the following features:

- High head, coated 316 stainless steel centrifugal, 100 psi recycle pump mounted to the DAF tank to provide air saturated water under pressure to the air/wastewater mixing inlet.
- TEFC motor, close coupled.
- Inlet mixing chamber
- Valving: suction control, discharge control & air flow measuring and metering
- Pressure gauge
- Vacuum gauge
- Nema 4 control in MCP is provided

Recycle Saturation Vessel

The recycle system consists of the following features:

- *Recycle Pump:* High head 316 stainless steel centrifugal 90 psi pump, mounted to the DAF or saturation vessel skid to provide air saturated water under pressure to the recycle system.
- *Saturation vessel:* PVC or stainless steel construction.

- *Air preparation* and control assembly consisting of: check valve, solenoid valve, air flow meter with needle valve, bypass valve, regulator/filter, pressure relief valve and vent valve.
- Auto-Q™ automatic equalization level control assembly with switch sight glass, pressure gauge and isolation valves.
- Auto-Q™ automatic EQ electrical control logic.
- Inlet mixing chamber.
- Valving: suction isolation, bypass and discharge control.
- Pump discharge pressure gauge.
- Recycle pump discharge flowmeter (optional)
- Nema 4 control in MCP is provided.
- System requires compressed air.

1.10 Influent Mixing Chamber

The saturated flow mixes with the wastewater flow at the DAF influent via a mixing chamber. Chamber to be constructed of same material as DAF tank.

1.11 Controls

A Nema 4 control panel with pump and auger control switches, lights, starters, variable speed motor control for flight skimmer and power disconnect are provided mounted and wired to the DAF tank for convenient operation. 230/460V/3 ph/60Hz power required.

SECTION 2.0 MATERIALS OF CONSTRUCTION

2.01 Steel Construction

Tank shell, baffles and internal structural members shall be constructed of A-36 carbon steel. Weld joints are to be double welded and dye penetrant tested.

2.02 Surface Preparation

Interior surfaces shall be prepared to an SSPC-SP10 near white metal blast. Exterior surfaces shall be prepared to an SSPC-SP6 commercial blast.

2.03 Coatings

Interior coating to be a self-priming coal tar epoxy (14-16 mils dft). Exterior coating shall be primer coat followed by industrial polyurethane enamel coat (6 mils DFT). Finish color is Green.

2.04 Internal Piping

Internal piping shall be ASTM A53 black steel.

2.05 Hardware

All wetted hardware to be ANSI, 316 stainless steel. All non-wetted hardware to be zinc plated.

2.06 I.O.M. Manuals

Two copies of the Installation, Operation and Maintenance manuals will be provided.

2.07 Assembly

The DAF components will be installed on or in the DAF tankage, plumbed, wired and functionally tested prior to shipping. The manufacturer of preference shall be: Pan America Environmental

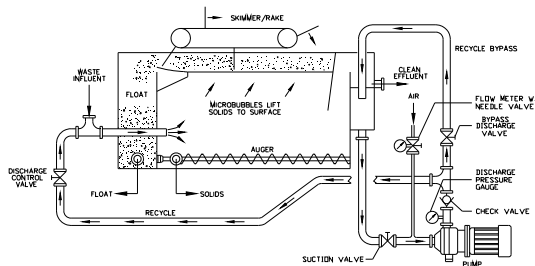
2.08 Warranty

Pan America Environmental warrants its products to be free of defect in materials and workmanship for a period of one year from the date of shipment.

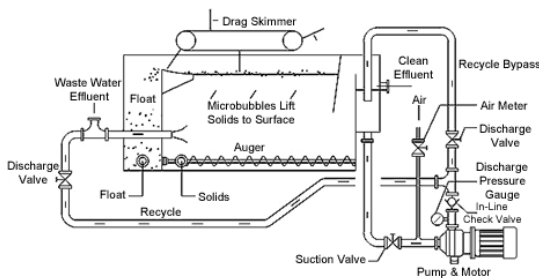
Dissolved Air Flotation (DAF) Operational Theory

Dissolved Air Flotation (DAF) is the process of removing suspended solids, oils and other contaminants via the use of air bubble flotation. Air is dissolved into water, mixed with the wastestream and released from solution while in intimate contact with the contaminants. Air bubbles form, attach to the solids, increase their buoyancy and float the solids to the water's surface. A percentage of the clean effluent is recycled and super-saturated with air, mixed with the wastewater influent and injected into the DAF separation chamber.

The dissolved air comes out of solution, producing millions of microscopic bubbles. These bubbles attach to the solids and float them to the surface where they are mechanically skimmed and removed from the tank. The Pan America Environmental dissolved air flotation systems are designed to remove fats, oils & grease (FOG), suspended solids, food/animal production/processing wastes, industrial wastes, hydrocarbon oils/emulsions and many other contaminants. Clarification rates as high as 97% or more can be achieved using our dissolved air flotation systems. Chemical pretreatment can often help to improve the performance of contaminant removal.



Conventional DAF saturation design uses a recycle pump combined with a saturation vessel and air compressor to dissolve air into the water. This type of system, while effective, is expensive, labor intensive and can destabilize its point of equilibrium, creating burps due to incorrect, loss or creeping of EQ set-point in the saturation vessel. This design is slow to recover and can upset the flotation process in the DAF. Air transfer efficiency is approximately 9% @ 80% entrainment. This style of operation can increase chemical use, labor costs, downtime, effluent loadings, production schedules and other detrimental domino effects due to EQ loss.



Pan America's DAF design incorporates today's "state of the art" technology in DAF design. This design simplifies the DAF process, requires less startup time, less capital cost, instrumentation, labor and maintenance. The design is process friendly, providing virtually instant saturation upon system startup without equalization and complex startup procedures. Once the system is adjusted the system can be shutdown and started up again without any readjustment or equalization. Higher air transfer efficiencies are also realized due to higher saturation pressures with 12% @ 93% entrainment. Pan America can provide both styles of DAF design depending on application and customer preferences.

DAF sizing takes into consideration many criteria for sizing: Flow rate, Water temperature, Waste characteristics, Chemical pretreatment, Solids loading (LBS/HR/Ft²), Hydraulic loading (GPM/FT²), Air to solids ratio (LBS of air/LBS of Solids).

DAFs are designed on the basis of the peak flow rate expected. The flow can range from 1 to 5 gallons per minute per square foot of surface area (GPM/Ft²). Bench testing of waste stream samples is usually the preferred starting point when sizing equipment and determining proper chemical processes prior to the DAF. The chemical pretreatment will assist and improve the DAF separation process.

Chemical Pretreatment often improves DAF solids removal efficiencies. The use of chemical flocculants with DAF is based on system efficiency, application (use of DAF) and cost. Commonly used chemicals include trivalent metallic salts of iron, such as FeCl₂ or FeSO₄ or aluminum, such as AlSO₄. Organic and inorganic polymers (cationic or anionic) are often used to enhance the DAF process.

The most commonly used inorganic polymers are the polyacrylamides. Chemical flocculant concentrations used normally range from 100 to 500 mg/l. (One mg/l in 1 million gallons per day is 8.34 lbs of material.) The wastewater pH may need to be adjusted between 4.5 and 5.5 for the ferric compounds or between 5.5 and 6.5 for the aluminum compounds using an acid such as H₂SO₄ or a base such as NaOH. In many applications, the DAF effluent requires pH adjustment utilizing a base such as NaOH to assure the DAF effluent pH is within the limits specified by the POTW (6-9 typically).

Attachment of most of the bubbles to solid particles can be effected through surface energies while others are trapped by the solids or by hydrous oxide flocs as the floc spreads out in the water column. Colloidal solids are normally too small to allow formation of sufficient air-particle bonding. They must first be coagulated by a chemical such as the aluminum or iron compounds mentioned above and then absorbed by the hydrous metal oxide floc generated by these compounds. Frequently, a coagulant aid is required in combination with the flocculant to agglomerate the hydrous oxide floc, increase particle size and improve the rate of flotation. Mechanical/chemical emulsions can also be broken through pH and polymer reactions.

Where the float is to be used to feed animals used for human consumption, organic compounds such as chitosan, carrageenan, and lignosulfonic acid, or their derivatives can be used. Use only compounds approved by the Food and Drug Administration (FDA) Office of Veterinary Medicine.

Float Dewatering DAF float often contains 2 to 10 percent solids. The solids may need to be dewatered before disposal to reduce the sludge volume by reducing water content. Float dewatering is usually performed by using one of the following technologies: Filter press, Belt filter press, Centrifuge, Drying bed or Vacuum precoat filter.



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