

**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.**

Nikojati 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 advance "whitewater" system makes it compact with small footprint. Our DAF is design to offer for 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 other types of applications. The DAF is a hardy piece of equipment and can accommodate many wastes types.

### **Standard Features:**

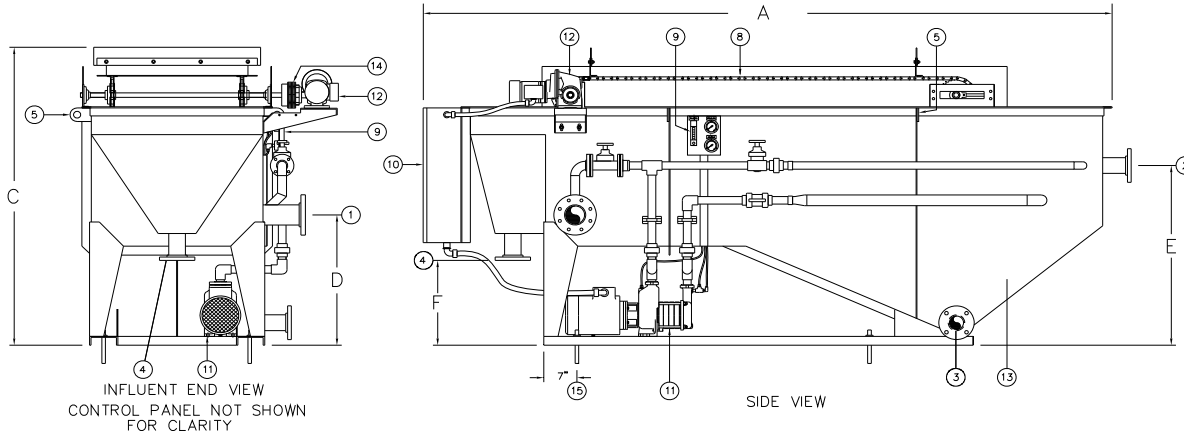
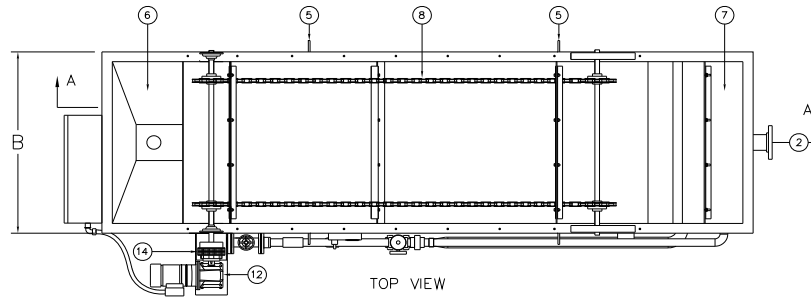
- ◆ FRP, 304 or 316 SS construction
- ◆ Adjustable water weir
- ◆ Integral float reservoir
- ◆ Influent diffuser
- ◆ Effluent chamber
- ◆ Recycle saturation system
- ◆ NPT/flanged fittings
- ◆ Surface drag skimmer
- ◆ V-hopper Bottom, sludge auger
- ◆ Lifting lugs
- ◆ Nema 4 controls

### **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



# DAF with Advance "whitewater" system



Model  
DAF

**DAF**  
Dissolved Air Flotation Systems

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:

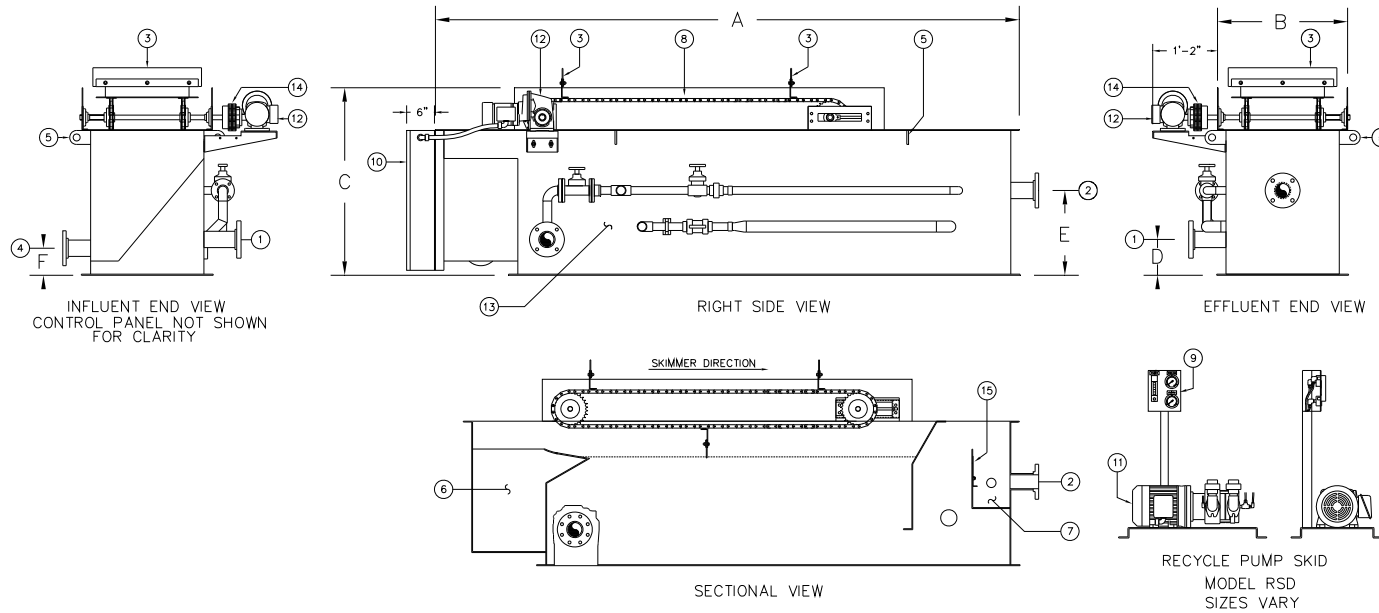
- Chemical pretreatment systems
- Advance recycle system
- Float pumpout
- Sludge pumpout
- Effluent pumpout
- Influent feed pump
- Walkway
- High level alarms
- Chemical metering pump systems
- Chemical makeup systems
- Containerized systems
- Trailer mounted systems
- 304/316 SS tank construction
- FRP tank construction
- Elevating structures
- Effluent filtration
- Sludge auger

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

# Flat Bottom DAF

# DAF

Dissolved Air Flotation Systems



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	Recycle Plumbing
2	1	Outlet	5	4	Lift Lug	8	1	Skimmer	11	1	Recycle Pump	14	1	Overload
3	3	Flight	6	1	Float Chamber	9	1	Gauge Panel	12	1	Gearmotor	15	1	Weir plate

## Advance vs Conventional with tradition Recycle Saturation Systems

The DAF systems are offered with two types of recycle saturation systems.

1. **ARSS** recycle DAF pump style, no saturation vessel is required.
2. **CTRSS** uses a saturation vessel with recycle pump to super saturate the recycle flow.



CTRSS recycle module with the DAF



CTRSS recycle module

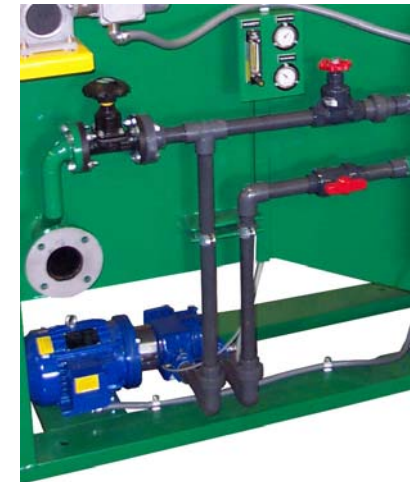
The RSS recycle system can be used for all flow rates from 5 GPM to 2000 GPM or as large a system as is needed. Multiple systems can be provided where required.

### The CTRSS System Features:

- **Recycle Pump:** High head cast iron or 316 stainless steel centrifugal 100 psi pump mounted to the DAF or saturation vessel skid to provide air saturated water under pressure to the recycle system. Motor: TEFC
- **Saturation vessel:** 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 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.
- **Air rotameter** with needle valve for fine air control.
- **MCP NEMA 4** controls in Master Control Panel provided. - System requires compressed air.
- **Saturation vessel** is required
- **Air compressor** is required

### The ARSS System Features:

- **DAF pump:** High head, coated cast iron or 316 stainless steel centrifugal, recycle pump mounted to the DAF tank to provide super saturated water under pressure to the air/wastewater mixing inlet.
- **Motor:** Close coupled TEFC.
- Inlet mixing chamber
- **Valving:** suction control, discharge control & air flow measuring and metering
- **Pressure** gauge
- **Vacuum** gauge
- **Air rotameter** with needle valve for fine air control
- **MCP NEMA 4** controls in Master Control Panel provided
- No saturation vessel is required
- No air compressor is required



ARSS recycle system

# DAF

## Dissolved Air Flotation Systems

## Chemical Treatment Systems

The DAF process and performance can often be increased with chemical pretreatment depending on the wastewater characteristics.

Our pretreatment systems offer you the latest in design and flexibility.

### Chemical Reaction Tank

The CRT product line is based on a reaction retention design where agitators and reaction tanks are provided to implement a variety of chemistries such as pH neutralization, metal/mineral precipitation, coagulation, flocculation, reduction and oxidation.

The CRT system can be provided in single, stand-alone or multi-stage designs with chemical makeup, storage and on-demand flocculant breakdown systems.



The CRT products are offered in a variety of materials of construction such as coated steel, stainless steel, polyethylene, polypropylene and FRP.

The systems can be integrated with their chemical metering systems or can be provided as separate skid mounted designs to fit the needs of the facility layout.



### Pipe Flocculator

The reaction systems are a pipe flocculator type of design that provides multiple-chemical reaction contact in a compact footprint design without moving parts, wearing components and no need for power. The pipe flocculator design uses water turbulence induced by a spiral piping network to mix chemical products into a wastestream.

The design eliminates the need for mixing tanks, mixers and electrical consumption. The process takes place under highly controlled, well-defined and optimized conditions.

- No power requirements and no moving parts, which means minimal maintenance.
- Uniform mixing in the pipe cross-section promotes uniform flocculation.
- No mixing dead zones.

*Designed for a particular flow range, each pipe flocculator can be configured with:*

- Multiple chemical injection ports for up to three stage treatment (coagulant, pH adjustment and flocculant).
- Centralized, valved chemical pump connection ports.
- Multiple sample ports.
- In-line monitoring probes (pH, suspended solids, conductivity).
- Flanged and NPT connections.



# DAF

## Dissolved Air Flotation Systems

### Chemical Metering Systems

Custom designed systems tailored to the project and customer needs. *Designs can provide:*

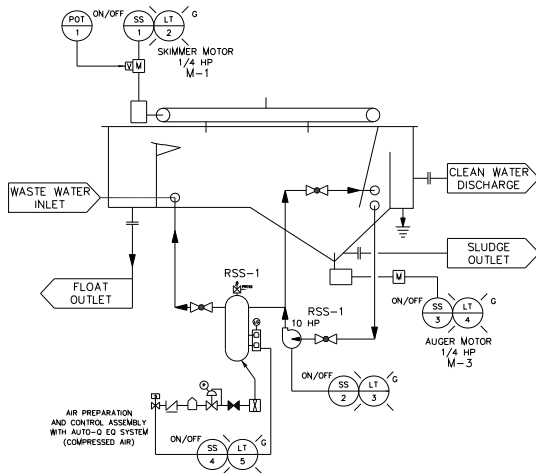
- Choice of skid materials
- Containment systems
- Wall or floor mount
- Optional instruments for measurement and control
- Pulsation dampener, back pressure/anti-siphon, pressure relief, pressure gauge
- Calibration column
- Choice of plumbing materials
- Choice of control: on/off or proportional control
- Package & skid mounted systems
- Relay logic or PLC control center
- Solenoid/motor actuated diaphragm pump designs
- Pulsafeeder & LMI pumps supplied by standard, others by request
- Hazardous & non-hazardous environments



# 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.

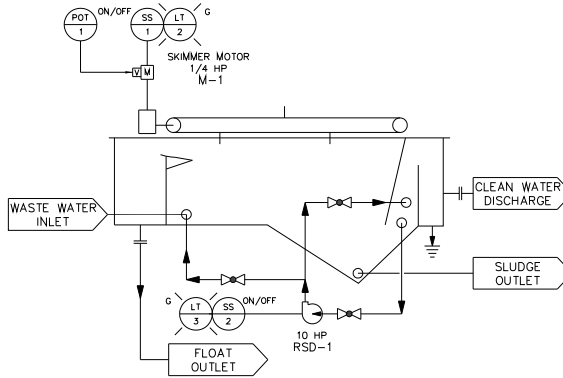
The dissolved air comes out of solution, producing millions of microscopic bubbles. These bubbles attach to the solids and float them to the surface where they are mechanically skimmed and removed from the tank. The Pan America Environmental dissolved air flotation systems are designed to remove fats, 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** using the tradition saturation system design provides a high head recycle pump combined with a saturation vessel to dissolve air into the water. This type of system is quite effective and can be applied across all flow rates and has more components to the design compare with the **ADVANCE DAF** recycle design. This design requires somewhat more time to establish a stable EQ point compared to the **ADVANCE DAF** pump design. Air transfer efficiency is approximately 8% @ 93% entrainment due to the high pressure

operation (90-100 psi) as opposed to traditional designs that use pressures ranging from 60 – 70 psi.

The PAE DAF designs can be sized for any flow rate and can also be provided for tanks constructed of concrete where flow rates exceed the capacity of factory fabricated tanks.



**ADVANCE DAF** incorporates today's technology multiphase recycle pump in DAF design. This design simplifies the DAF process, requires less startup time, less 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. High air transfer efficiencies are also realized due to high saturation pressures with 12% @ 93% entrainment.

**DAF sizing** takes into consideration many criteria for sizing: Flow rate, Water temperature, Waste characteristics, Chemical pretreatment, Solids loading (LBS/HR/Ft2), hydraulic overflow rate (feed + recycle flow/ft2 area), Air to solids ratio (LBS of air/LBS of Solids). The amount of air that can be dissolved into the recycle water stream is directly proportional to the pressure of the air in the saturation vessel this would be valid up to approximately 7 atmospheres.

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 by increasing solids surface area and creation of a matrix in which to trap air bubbles.

**Chemical Pretreatment** often improves DAF solids removal efficiencies and oil emulsion breaking. 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 AISO4. 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 0.5 - 3% solution with dosages in the 100 – 500 mg/L range. 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.

**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.