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 bouyancy and floating them to the water surface where they can be skimmed from the water.

Our unique, compact, small footprint 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 other types of applications. The DAF is a hardy piece of equipment and can accommodate many wastes types.

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, foul, pork processing
- Rendering plant wastewater
- Food processing plant water
- Algae removal
- Industrial process water
- Bilge water treatment
- Bakery wastewater
- Military wash racks
- Steel mills
Dinky DAF™

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™)

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<tr>
<th>Model</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Inlet</th>
<th>Outlet</th>
<th>Float Outlet</th>
<th>Sludge Vol. Gal.</th>
<th>Float Hopper Gal.</th>
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Dimensions, design and capacities are not for construction and are subject to change without notice.

DAF with the RSP recycle system

Model DAF
Dissolved Air Flotation Systems

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

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DAF-8 through DAF-600

Dimensions, design and capacities are not for construction and are subject to change without notice.
**Large DAF Specification Table**

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Flat Bottom Dinky DAF™

Dimensions, design and capacities are not for construction and are subject to change without notice. Maximum flow based on 2.0 gpm/ft² loading. Loading can vary based on application.
Recycle Saturation Systems

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

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

**The RSS 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**: PVC, coated steel 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 control assembly with switch sight glass, pressure gauge and isolation valves.
- **Auto-Q™** automatic EQ electrical control logic.
- 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
- System requires compressed air.

**The RSP System Features:**
- **DAF pump**: High head, coated cast iron or 316 stainless steel centrifugal, 100 psi 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
Chemical Treatment Systems

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

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

CRT

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 makedown systems.

STAX™

The STAX™ 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 STAX™ 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.

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.

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/antisiphon, 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
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, auto on/off timer, 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.

AQM Filter Systems AQAM 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.
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 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 RSP Recycle DAF Pump**

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 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 RSS Recycle Saturation System (Alternate)**

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.

**RSS Recycle Saturation Features**

The recycle system consists of the following features:
- High head, coated cast iron or 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

**Recycle Saturation Vessel**

The recycle system consists of the following features:
- Recycle Pump: High head 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, coated steel or stainless steel construction.
- Air preparation and control assembly consisting of: check valve, solenoid valve, air flow meter with needle valve, bypass valve, regulator/brain and air pressure relief valve and vent valve.
- Auto-Q™ automatic equalization control assembly with switch sight glass, pressure gauge and isolation valves.
- Auto-Q™ automatic EG electrical control logic.
- Inlet mixing chamber.
- Valving: suction isolation, bypass and discharge control.
- Pump discharge pressure gauge.
- 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 Master Control Panel (MCP)**

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. 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 A36 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 dfi). 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 Fasteners**

All wetted fasteners to be ANSI, 304 stainless steel minimum. 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 tank, plumbed, wired and functionally tested prior to shipping.

**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 wastewater 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.

Pan America's DAF using the RSP recycle pump 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. High air transfer efficiencies are also realized due to high saturation pressures with 12% @ 93% entrainment. Pan America can provide both styles of DAF recycle designs depending on application, flow rate 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 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 Al2SO4. 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 solid 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 precipco filter.

Pan America's Conventional DAF using the RSS 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 than our RSP recycle design. This design requires somewhat more time to establish a stable EQ point compared to the DAF pump design and this is where the Pan America Environmental Auto Q™ automated EQ system simplifies the entire process. Air transfer efficiency is approximately 12% @ 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.