Pan America Environmental, Inc.

262.716.0105 · www.panamenv.com
technical@panamenv.com

ENGINEERING SPECIFICATION

PDHF Series Dissolved Air Flotation

Engineering Specification

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PRODUCT PAGE

https://www.panamenv.com/dissolved-air-flotation-daf/pdaf-plate-dissolved-air-flotation/

EQUIPMENT DESIGN & CONSTRUCTION

Performance

The Pan America Environmental PDHF Series Lamella plate DAF systems are designed to remove petroleum products, fats, oils & greases (FOG), suspended solids and many other contaminants. Clarification rates as high as 98% can be achieved using the PDHF Lamella DAF and Lamella plate dissolved air flotation systems.

A percentage of the clean effluent is recycled and super-saturated with air, mixed with the wastewater influent and injected into the PDHF 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 PDHF 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 Influent Mixing Chamber

The first chamber the waste flow and recycle flows enter is the mixing chamber where they are both intimately combined to bring the air bubbles into contact with the flocculated particles and velocities are reduced to promote rise rates. The flows enter, mix and then are directed into the plate pack separation zone.

1.02 Float/Separation Chamber

The separation chamber provides a velocity decreasing horizontal and vertical separation surface area consisting of the water surface and the lamella style plate pack surface area that reduces turbulence and velocity, maximizes co-current flow contact with the surface area and solids throughput. The mixed wastewater enters this chamber where separation and flotation occur. The waste flow redirects through the plate packs and float accumulates on the water surface. Any non-flocculated particulate that float, or sink can also be removed via the plate packs.

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1.03 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.

1.04 Effluent Chamber

The float is contained and skimmed off to the Float chamber while the water is directed through the plate packs and over the adjustable 304 stainless steel weir plate to maintain operating water level in the separation chamber. The treated water accumulates in this chamber and is discharged by gravity to discharge or additional treatment.

1.05 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 skimmer flights with Buna-N wiper blades
- Acetal flight chain, 304 SS hub with replaceable acetal sprockets
- Chain guides, upper & lower
- Chain guards on both sides of tank extending the full length of skimmer system.
- Variable speed drive, sprocket shafts, bearings and chain adjustment bearing frames.

  The flights will be bolted to the two 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.
- Adjustable timer on/off allows skimmer operation that will assist in the dewatering of the float prior to skimming by encouraging water to drop out of the float layer as the layer builds.

1.06 DAF Plate Pack

A Lamella plate pack system with multiple inclined plate packs is provided located in the separation chamber per the following features:

- FRP Wave Plates are provided bound in a pack system to allow multiple plates to be removed/replace simultaneously.
- 304 SS & PVC or other MOC pack structural components are provided to bind plates into a pack.
- Lifting lugs are provided with each plate pack.

Plate angle:	55°
Plate spacing:	2”

1.07 Sludge Hopper

An inverted pyramid style sludge hopper is located under the flotation/separation chamber to provide temporary storage of any settleable solids. An optional sludge auger can be provided to convey sludge to the sludge outlet.

1.08 Sludge Auger System

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.

1.09 Air Saturation System

The PDHF 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 PDHF tank with a bypass line to the effluent chamber.

Recycle Saturation Pump

The recycle system consists of the following features:

- High head, 304 SS turbine pump, 100 psi recycle pump mounted to the PDHF 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

The recycle pump draws ambient air into the pump and super-saturates the water with this air under high pressure. No external air source is required. Pump on/off operation is based on an on/off switch in the control panel. Once adjusted the recycle system can be turned on and off at will without losing settings and saturation process is virtually instantaneous upon startup.

1.09 RSS Recycle Saturation Saturation System

The PDHF 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 PDHF tank and/or on the recycle system skid with a bypass line to the effluent chamber.

Recycle Saturation Vessel System

The recycle system consists of the following features:

Recycle Pump:	High head 304 stainless steel centrifugal 90 psi pump, mounted to the PDHF or saturation vessel skid to provide air saturated water under pressure to the recycle system.
Saturation vessel:	304 SS 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 Field Technician

A Field Technician can be provided ask for a quote, per Diem is $1250.00 + expenses.

Application

- DAF for food processing wastewater
- DAF for animal processing wastewater
- DAF for FOG removal (fats, oils, grease)
- DAF for suspended solids removal
- DAF for metal hydroxide removal
- DAF for FRAC water treatment
- DAF for petrochemical wastewater
- DAF for paper mill effluent
- DAF for vehicle wash water treatment
- DAF for bilge oily water treatment

Type of DAF System

- lamella plate DAF wastewater treatment
- dissolved air flotation with inclined lamella plates
- high efficiency lamella plate DAF system
- compact lamella DAF for industrial effluent
- lamella plate pack in DAF unit
- DAF clarifier with lamella plates
- inclined plate DAF vs conventional DAF
- lamella DAF for high solids wastewater
- advanced lamella dissolved air flotation system

SECTION 2.0 ChemClear SYSTEM

2.01 Chemical Treatment System Model CT-CpF

The two-stage, pretreatment system will provide wastestream coagulation, pH and flocculation on a continuous basis for gravity flow into the DAF inlet and consists of the following components:

- (2) Reaction tanks
- (2) Variable speed mixers
- (3) Chemical metering pumps
- (2) Makeup tanks with mixers
- Controls

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Reaction Tanks

Coagulation/pH reaction chamber will include the following features:

Volume:	100 gallons
Construction:	304 SS
Shape:	Rectangular/square
Design:	Both reactors are rectangular or square and integral as a two chamber, single tank design
Fittings:	2” FNPT
Top:	Open
Drain:	1.5” valved
Internal piping:	304 SS
Injectors:	2

Flocculation reaction chamber will include the following features:

Volume:	50 gallons
Construction:	304 SS
Shape:	Rectangular/square
Design:	Both reactors are rectangular or square and integral as a two chamber, single tank design
Fittings:	2” FNPT
Top:	Open
Drain:	1.5” valved
Internal piping:	304 SS
Injectors:	1
CT Dimensions:	6.5’L X 3’W X 5.5’H

Mixers

Each CT reaction tank will be provided with 0-425 RPM (or other rpm), adjustable fixed mount, variable speed mixer with 316 stainless steel impeller shaft and dual axial flow style impellers, inverter duty TEFC motor close coupled to the mixer gearbox.

Chemical Metering Pumps

Solenoid driven diaphragm metering pumps are provided and include the following features:

- NEMA 4/IP66 thermoplastic housing
- Wet end and diaphragm matched to chemical being metered
- 50-150 psi discharge pressure based on GPDHF and model used
- Stroke and frequency adjustment knobs on pump face
- 4-20mA input for external pacing of frequency control providing speed control via Intell-i-Touch control logic
- Stroke rate and length turn down ratios of 10:1 each for a total of 100:1
- Viscosities up to 1,000 cP for coagulant/caustic/acid

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- Viscosities up to 20,000 cP for flocculants
- Low current and amp draw drive system
- Continuous duty rated design
- Injection quill with integral back pressure valve provided at tank injector
- Bleed valve on discharge
- Suction tubing with foot valve, screen & ceramic weight
- Poly tubing plumbing and/or PVC or materials as required by volume and chemicals being metered
- Controls in MCP

Makeup Tanks

Two makeup tanks are provided for coagulant and flocculant solution preparation and storage.

Coagulant:	125-gallon polyethylene construction, mixer and on/off controls in the MCP.
Flocculant:	15-gallon polyethylene construction, mixer and on/off controls in the MCP.

pH Control

A pH probe and quick remove probe assembly are provided to monitor coagulation tank pH level and control the caustic pump to maintain pH set point. pH functions are monitored and controlled via the MCP. When chemical metering pumps are provided by others, those controls are also by others.

SECTION 3.0 PUMPING SYSTEMS (OPTIONAL)

3.01 Influent Feed System — Model IFS-10-AO

Description: The Influent Feed System will provide the capability of transferring the waste stream from the EQ chamber to the inlet of the ChemClear system. The system can be operated via manual or automatic mode.

Components:

- 1" air operated, double diaphragm pump with aluminum body/Buna-N diaphragms and check valves. Pump will be plumbed with a ball valve on inlet and outlet. Pump to be base mounted to a 304 SS base.
- Filter, regulator, metering valve and electric solenoid valve will be provided mounted to the pump base for filtering, regulation, fine meter control and on/off of air flow to pump. The assembly will include an air hose from assembly discharge to pump air inlet.
- Controls will be included in the MCP with HOA operation to control manual and automatic on/off of pump based on high/low levels in tank. Two float switches will be provided in the EQ tank for pump control.

3.02 Sludge Pumpout System — Model SPS-15-AO (3 required, OWS, DAF & filter press feed, optional)

Description: The Sludge Pumpout System will provide the capability of transferring settled sludge from the DAF sludge hoppers. The system is designed per the following:

Components:

- One (1) 1.5" air operated, double diaphragm pump with aluminum body/Buna-N diaphragms and check valves. Pump will be plumbed with a ball valve on inlet and outlet. Pump will be base mounted and plumbed to sludge outlet(s) provided in the sludge hopper.

- Filter, regulator, metering valve and electric solenoid valves will be provided mounted to the pump base for filtering, regulation, fine meter control and on/off of air flow to pump. The assembly will include an air hose from assembly discharge to pump air inlet.
- Controls: An HOA allows manual and auto operation based on two adjustable timers are provided to control the pump on and off times.

3.03 Float Pumpout System — Model FPS-15-AO (2 required & optional)

Description: The Float Pumpout System will provide the capability of transferring skimmed sludge from the DAF & API float hopper. The system can be operated manually, automatically and is designed per the following:

Components:

- One (1) 1.5" air operated, double diaphragm pump with aluminum body/Buna-N diaphragms and check valves. Pump will be plumbed with a ball valve on inlet and outlet. Pump will be mounted to the DAF & API tanks and plumbed to the float chamber outlet.
- Filter, regulator, metering valve and electric solenoid valves will be provided mounted to the pump base for filtering, regulation, fine meter control and on/off of air flow to pump. The assembly will include an air hose from assembly discharge to pump air inlet.
- Controls: An HOA allows manual and auto operation based on high and low level in the float chamber. Two level switches are mounted in the float chamber to control the automatic on/off.

3.04 Effluent Pumpout & Filtration System — Model EPS-5

Description: The Effluent Pumpout System will provide the capability of transferring the treated DAF effluent from the effluent chamber of the tank to down stream processes or discharge to drain. The system can be operated via manual or automatic mode.

Components:

- Centrifugal, multi-stage pump plumbed with ball valves on inlet and outlet. Pump construction: cast iron volute and impeller. Pump to be base mounted to a carbon steel, enamel coated base or to the tank. Pump will be plumbed, wired and tested prior to shipment. Pump performance will be 5 GPM @ 115' TDH. Piping is to be sch. 80 PVC. Motor to be TEFC.
- Control is included with HOA operation to control manual and automatic on/off of pump based on high/low levels in tank effluent chamber. Two float switches will be provided installed in the effluent tank. Controls are integrated into MCP.
- Effluent tank: 25 gallon, polyethylene, flat bottom, domed top, 2 pt level switch assembly for pump control. Tank is plumbed to DAF effluent via schedule 80 PVC pipe.
- Bag filter: Two (2) 7"D X 30" aluminum housing with isolation valve on inlet/outlets. Inlet/outlet pressure gauges provided. Drain valve at bottom of vessel. Filter is plumbed to the DAF effluent pump via schedule 80 PVC pipe. A pressure differential sensor is provided for high pressure alarming. One (1) case of 25 filter bags is provided 25-micron size.

SECTION 4.0 CONTROLS

4.01 Master Control Panel (MCP)

The options provided with this quotation will include controls that will be integrated into one, centralized Master Control Panel (MCP). The MCP will provide the following controls:

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- DAF drag skimmer with adjustable timers
- RSS recycle controls
- HMI operator interface
- CT mixer controls
- Chemical metering pumps
- Dewatering system pump control
- Power disconnect transformer and circuit breakers are provided to accommodate a 3-phase input power.

MCP power required:	230 or 460V/3pH/60Hz.
Control power:	110V/1pH/60 Hz. & 24VDC
Enclosure:	NEMA 4, steel construction, ANSI 61 grey enamel coating.
Designed per:	UL508, NEC
Conduit:	EMT/Liquid tight
Wire:	THHN
Logic:	PLC

PLC Based Design

The MCP will be provided as a PLC based logic design. The system is as follows:

- Unitronics Unistream 7 PLC/HMI system or other as available.
- 7" HMI color touchscreen
- Unilogic software for PLC & HMI programming is provided.
- SD card
- Datalogging
- Ethernet ready

Communications Capabilities

- TCP/IP via Ethernet
- MODBUS and other protocol support

Alarms

The following alarms are provided:

- pH low & high
- EQ tank high-high
- DAF float chamber high-high

SECTION 5.0 SLUDGE DEWATERING SYSTEM (OPTIONAL)

5.01 Sludge dewatering system

A dewatering system is provided to collect the sludge and float from the DAF and pump these sludges through a dewatering filter press to reduce water content before disposal of the solids sludge. The filter press typically reduces sludges to 35% water content.

It is recommended to test filterability of your waste prior to committing to a filter press.

The system components are per the following details:

Filter Press

- 7 Ft3 volume expandable to 10 Ft3
- 630mm plates, polypropylene construction
- Painted steel framework
- Polypropylene filter clothes
- PVC head connections, 1.5" center feed, 1.5" top & bottom corner air inlets/outlets, 1.5" top & bottom wash/air filtrate outlets
- Inlet pressure gauge
- PVC air blow down manifold w/manual valves
- Self-dumping cake cart
- Manual plate shifting
- Manual hydraulic power unit closing device

Sludge Storage Tank

- 1000-gallon
- Tank and stand are polyethylene construction
- Cone bottom design
- Sludge discharge outlet in cone w/valve
- Ultrasonic level sensor
- (3) 1.5” water phase decant valves on sidewall
- 64"D X 111”H

Filter Press Feed Pump

Description: The filter press sludge feed system will provide the capability of transferring settled sludge from the sludge tank hopper. The system can be operated via manual or automatic mode.

FP Feed system provides a multi-step pressure increasing logic to start pumping sludge under lower pressure and gradually increasing the pressure based on feedback from the filter pressure in order to limit filter cloth blinding.

Components:

- 1.5" air operated, double diaphragm pump with aluminum body/Buna-N diaphragms and check valves. Pump will be plumbed with a PVC ball valve on inlet and outlet. Pump is to be mounted to an enamel coated base.
- Filter, regulator, metering valve and electric solenoid valve will be provided mounted to the pump base for filtering, regulation, fine meter control and on/off of air flow to pump. The assembly will include an air hose from assembly discharge to pump air inlet.
- Controls will be included in the MCP with HOA operation to control manual and automatic on/off of pump based on high & low level in the sludge tank

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SECTION 6.0 SUBMITTAL PACKAGE

6.01 Submittal Approval Package

Upon receiving an order Pan America Environmental will engineer and produce a Submittal Approval Package, which allows you the customer to review and change or keep aspects of the system detailed in this quote. The submittal package provides the following at a minimum:

- General arrangement drawings, 2D, 3D, plan, end, sectional, detail and other views
- Hydraulic profile
- Electrical schematics
- Control panel physical layout
- Process/control narrative (where project size is applicable)
- Component datasheets
- Component cutsheets

Options

- P&ID
- Structural, seismic, wind load, lifting lug review, anchorage and/or other PE review calculations
- Design sizing PE calculations and/or calculations of any other types
- Testing review and implementation during fabrication and assembly, i.e. NDT, NDE, radiographic, x-ray, ultrasonic, magnetic particle exam, others
- Piping testing per desired standards, i.e. ASME B31.1 power piping, ASME B31.3 process piping
- Rigging and lifting guide, drawings and/or procedures and methods
- WPS, ITP, PQR, PMI, others
- Document, QC report and/or other project document binder
- Mill certificates

Revisions & Meetings

The submittal package contains a limited amount of engineering and provides a maximum of Two (2) revisions of up to 10% maximum each. This quote does not include open ended, extensive or continuous revisions until approval is given. This submittal package does not include: Iterative R&D and review projects, design/redesign projects, pre-submittal before or after order placement to attain approval from the end user before order is placed, honored or executed by Buyer, engineers/consultants, contractors and/or other parties involved with this project. In addition, numerous and/or excessive meetings relative to the system design and complexity are not provided as PAE strives to have all valuable communications in writing so as to create a trackable/traceable project evolution.

Engineering Only

The quotation provides a limited amount of engineering and does not provide “Engineering Only”. The limited engineering is part of the system cost and is provided to give direction and final understanding as to what is being provided to you in the system design. The quoted and submitted system is a proprietary PAE product and PAE will not produce drawings for you to build, license, bid out or produce and/or market as your product for your or any other entities use.

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SECTION 7.0 MATERIALS OF CONSTRUCTION

7.01 DAF Steel Construction

Tank shell, baffles and internal structural members shall be constructed of 304 stainless steel. Weld joints are to be double welded and dye penetrant tested.

7.02 Surface Preparation

External surfaces prepared via passivation.

7.03 Coatings

None.

7.04 Internal Piping

Internal piping shall be ASTM 304 stainless steel.

7.05 Fasteners

All wetted fasteners to be ANSI, 300 series stainless steel. All non-wetted fasteners to be zinc plated.

7.06 I.O.M. Manuals

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

7.07 Assembly

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

7.08 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.

SECTION 8.0 FREIGHT AND SHIPPING PREPARATION

8.01 Freight Cost

The quoted freight cost is an actual or estimated cost. This cost is subject to change throughout the life of the quote and any resultant order.

8.02 Palletizing

All equipment prices include palletization where equipment size requires a pallet. Most DAF designs require flat bed shipment.

8.03 Crating

Any crating cost included or itemized includes an export slat crate design. Other crate styles can be provided on request and may incur additional cost. Export crating is not included in the equipment cost unless indicated in the quote provided to you.

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