

# *TiPSS TECHNOLOGY DISSOLVED AIR FLOTATION*

## 1 General

TiPSS DAF systems are used when gravity separation of oils or suspended solids by CPI does not meet the specifications. Unlike most DAF systems the TiPSS DAF holds a plate pack in a rectangular tank for enhanced separation and reduced footprint. Chemical coagulation & flocculation packages can be included. Veolia TiPSS Technologies has experience since the 1950's in the oil & gas market. We can comply to the demanding Oil & Gas clients requirements and specifications.

## 2 Process description

The flocculated and/or discrete suspended solids are removed by means of the Dissolved Air Flotation (DAF) process. Principle of this removal is the increase of the buoyancy of the suspended particles, caused by the attachment of small air bubbles to the flocculated impurities. These will attach to the air bubbles and derive their buoyancy from it. The proper choice of coagulant and flocculants aid (dosed upstream of the TiPSS DAF unit) can see to it that the bond between the suspended floc particle and the air bubble is sufficiently strong to withstand the shearing forces in the dissolved air flotation basin.

The floating sludge, containing both the air bubbles and the collected contaminants, will float rapidly to the liquid surface, from where it is permanently removed by means of a reciprocating pneumatically driven skimmer device into the scum compartment.

A part of the treated effluent is recycled. The required amount of air is added in the suction line of the recycle pump. Due to the high level of turbulence and shearing forces in the pump chamber, the air dissolves in the water. The combination of water flow, air and pump pressure makes the water saturated with air.

Just before the water enters the DAF Unit the saturated recycle flow is injected into the influent water. Due to the sudden pressure loss, the dissolved air is released in the form of a myriad of 30 to 50 micron sized air bubbles that attach themselves to the flocculated and suspended impurities.

The separation process works by gravity, which utilizes the density difference between two liquid phases. A globule of the lighter phase in the heavier other phase will attain a constant rising velocity when the resistance to motion offered by the other phase is equal to the rising force created by the density difference. The globule in a DAF is an air-attached impurity.

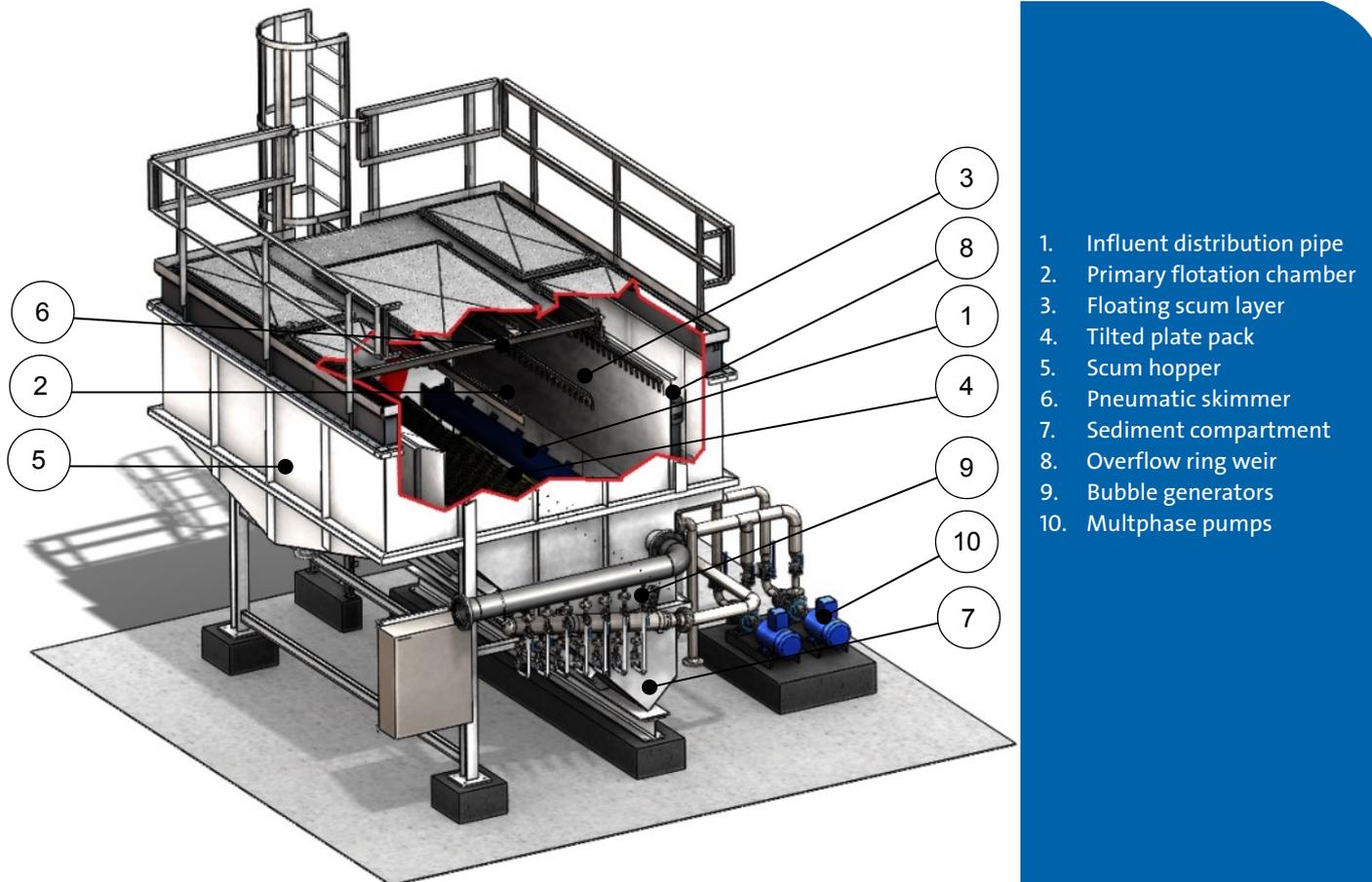


Figure 2.1 Left: The fine bubbles created by Dissolved Air Flotation. Right: GRP plate pack

### 3 Functional description

The wastewater enters the DAF preferably by gravity, through a distribution pipe (1). Fast rising conglomerates are immediately intercepted in the diverging, primary flotation chamber (2) and collected in the oily scum layer (3). Material having a lower rising velocity is intercepted in the plate pack (4), coalesces/flocculates there and rises up again towards the scum layer. The scum is drained of its excess free water and is skimmed off into the scum hopper (5) by means of a reciprocating pneumatically driven skimmer (6). Settling solids are collected in the sediment compartment (7) from where the sediment is periodically evacuated. The treated effluent is discharged over an overflow ring weir (8). The water for the DAF recycle stream is taken from the clarified waterside of the plate pack and is pressurized in a multiphase air water mixing pump.

A metered quantity of air is introduced in the suction of the pump. The air dissolves instantaneously in the water before the water leaves the pump. The supersaturated water is added to the raw influent through bubble generators (9) by a sharp pressure drop causing small micro bubbles. In order to identify unit's main components refer to figure 3.1.



1. Influent distribution pipe
2. Primary flotation chamber
3. Floating scum layer
4. Tilted plate pack
5. Scum hopper
6. Pneumatic skimmer
7. Sediment compartment
8. Overflow ring weir
9. Bubble generators
10. Multphase pumps

Figure 3.1 TiPSS DAF 4-PACK Unit

## 4 Technical data

### Tank rectangular

Model / Type	2-PACK	4-PACK	6-PACK	8-PACK
Nominal treating capacity [m <sup>3</sup> /h]	50-80	100-150	170-220	240-280
Weight empty[kg]	3.140	5.850	9.663	12.885
Weight filled[kg]	16.000	31.500	41.563	55.419

### Tank options

Model / Type	2-PACK	4-PACK	6-PACK	8-PACK
Covers weight [kg]	675	1.200	1.950	2.250
Handrail ladders weight [kg]	590	690	810	910
Plate pack weight [kg]	244	488	732	976

### Materials

Tank	CS coated
Covers	CS galvanized with Aluminum hatches
Handrail ladders	CS galvanized
Plate pack	GRP (Glass reinforced polyester resin)

### Multiphase pump

Model / Type	2-PACK	4-PACK	6-PACK	8-PACK
Capacity [m <sup>3</sup> /h]	10	25	35	50
Feed pressure [barg]	5,0	5,0	5,0	5,0
Power absorbed [kW]	4	11	2x7,5	2x22,5
Electrical feed	230/400/690 [V] 50 [Hz]			
Safety class	EExde-IIC-T4			
Isolation class	IP55			
Connections [suc/press]	DN		DN65/DN40	DN80/DN65
MOC housing	CS coated / Stainless / Duplex			
MOC impeller	Stainless / Duplex			
MOC shaft	Stainless / Duplex			
MOC O-ring	Viton			
Shaft mechanical seal	Sic/Sic-viton			
Number + redundant	1 + 1	1 + 1	2 + 1	2 + 1
Including	Skid mounted, valves, piping and pressure gauges			

### Power utilities

Electrical feed	380 [V] 50 Hz 3F
Maximum treated water capacity	150 [m <sup>3</sup> /h]
Absorbed power	

### Skimming scum scraper

Pneumatic feed	4 [nm <sup>3</sup> /h]
Pneumatic pressure	6 [barg]

## 5 Plate pack

Enhanced separation plate pack is used to improve the overall DAF performance. To minimize the friction resistance between the separated components and the plates, a high quality material (GRP) is selected for the plates. With these plates the friction resistance is minimal and the lifetime of the applied plates is maximized. To ensure the mechanical strength the plates are formed corrugated.

## 6 Skimming scum scraper

The automatically operating skimming scum scraper is driven by pneumatic cylinders. The forward and backward movement is dampened to ensure smooth movements. Using a pneumatic driven system overcomes the issues that are faced when using electrical driven scrapers in a hazardous zone 0 or zone 1. Velocity and cycle time of the skimmer are adjustable to meet the process requirements.

## 7 Recirculation, saturation and mixing system

Veolia uses a special air saturation pump that is designed to mix the recycled DAF effluent with air. The distinctive feature of this pump is the impeller, open on both sides, and the innovative hydraulic design of the impeller blades. The pump can mix water/air ratios up to 85/15%.

Using this special pump eliminates the need for a so-called saturation vessel. In the old school DAF design the recycled water is saturated with air in a saturation vessel. The vessel is fed by a normal centrifugal recycle pump and holds several controls for water level and air feed.

Using the water/air mixing pumps does make operations more simple and economical by eliminating a saturation pressure vessel and instruments.

The recirculation circuit has the following adjustable parameters:

- Recirculation pump delivery pressure. Influencing the pump capacity where delivery pressure is adjusted either by a (partial) opening of the bypass valve between the suction and delivery line of the recirculation pump or by the adjusting bubble generators
- Delivery pressure and air flow rate of the air supply to the suction of the recirculation pump, by means of the pressure control valve in the pneumatic control panel

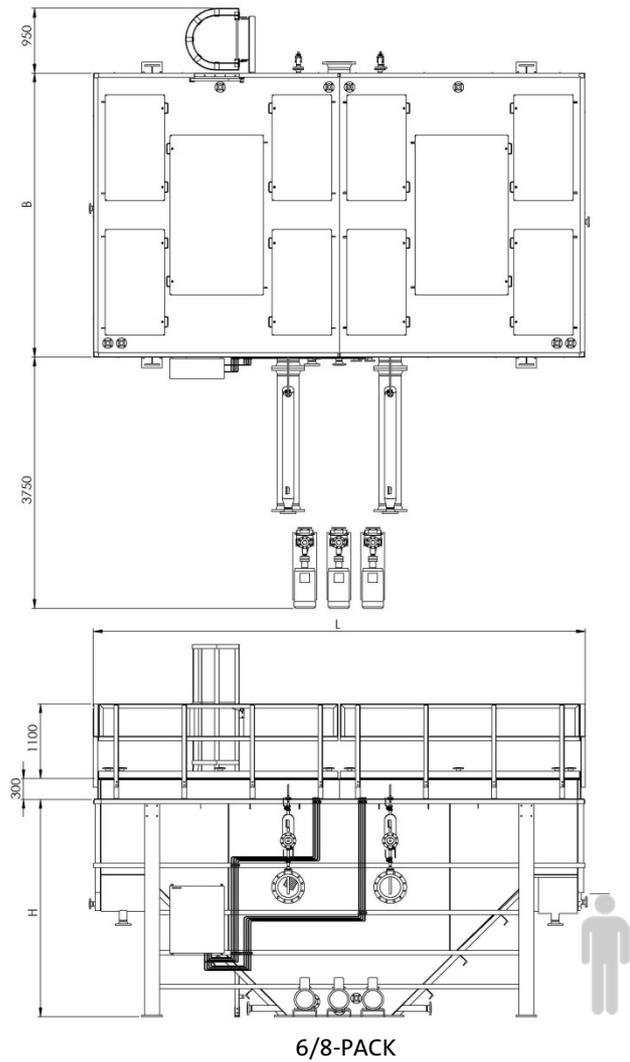
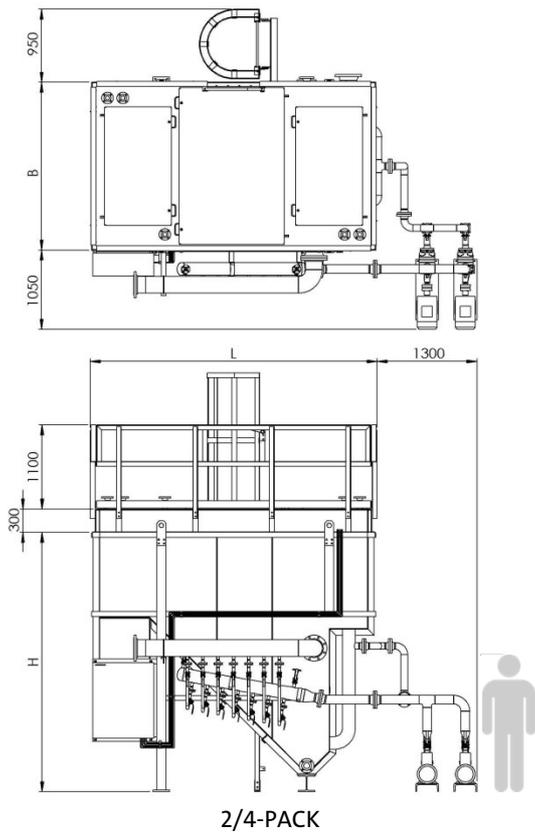
## 8 Overflow ring weirs

Overflow ring weirs have been provided in the discharge compartment of the DAF in order to be able to adjust the DAF at its proper liquid level. The weir is mounted on top of the discharge pipe. This weir is installed to ensure a smooth and accurate adjustable effluent flow. The level and thickness of the scum layer can be adjusted by changing the height of the overflow ring weirs.

## 9 Options and accessories

Supply	Option
Redundant water/air mixing pump	✓
Gas tight tank cover with access hatches	✓
Handrails and ladder	✓
Level instruments	✓
Nitrogen purge system	✓
Sludge disposal pump	✓
Interconnecting piping	✓
Coagulation design	✓
Flocculation design	✓

## 10 General arrangement plot plan



TYPE	Length [L]	Width basin [B]	Height basin [H]	Height total
2 PACK	3750 mm	2216 mm	3420 mm	5525 mm
4 PACK	3750 mm	4216 mm	3420 mm	5525 mm
6 PACK	7230 mm	3216 mm	3225 mm	5525 mm
8 PACK	7230 mm	4216 mm	3225 mm	5525 mm

## 11 Services

Veolia TiPSS Technologies is a process specialist with knowledge in engineering and fabrication. To ensure projects comply to client specification we use our quality management system. For competitive reasons we are able to outsource manufacture of the tank near client location. Typical services delivered within the projects are:

- Basis of design
- P&ID
- Process calculations
- Mechanical calculations
- Engineering
- Fabrication
- Testing
- Logistics
- Document control
- Quality Assurance
- Quality Control

### Note

The data in this document are indicative. Veolia TiPSS Technologies reserves the right to change any data without prior notice. The front page image is neither representative of all versions nor models. \* Values originate from flocculation flotation combination

**Resourcing the world**

**Veolia Water Technologies**

VWS MPP Systems B.V. • Celsiusstraat 34 • 6716 BZ EDE • The Netherlands  
Office: +31 318 66 4010 / Fax: +31 318 66 4001  
[www.veoliawatertechnologies.com](http://www.veoliawatertechnologies.com)