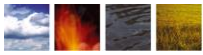




EVTN

3-phase separators



Example complete skid with three phase separator AVS 1000

Introduction

Auxill's voraxial Separator is a continuous flow turbo machine generating a strong vortex, which separates immiscible liquids and solids by their specific gravities. In this vortex the heavy elements are drawn to the outside, while the lighter materials are drawn to the form the central core of the vortex. Once the vortex is established a simple flow divider separates the flows into two streams, one of the heavier products and one of the lighter products.

The AVS Separator is self contained and driven by an electric motor. Its internal flow components are constructed of 316 SS.

AVS Separators are available in 1", 2", 4", 8", 16", 32", 48", 72", and 100".

All the separators serve as pumps in the system.

The AVS separators are now available in s wide range of models. Capacities run from a 1" diameter separation chamber with an average volume of 1.8 m³/hr up to a 100" diameter separation chamber with a maximum separation capacity of 621.000 m³/hr.

Applications

The AVS family is extremely versatile and can be used in a variety of situations and applications.

For example:

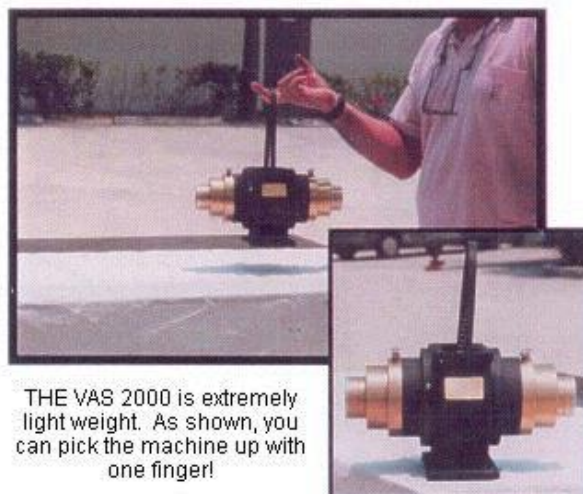
- Ocean, lake & river spill clean up
- Ground water remediation
- Municipal waste water treatment
- Bilge & ballast water treatment
- Food processing waste separation
- Oil processing & reclamation
- Metal finishing waste water treatment
- Gold makers waste water treatment
- Pc board makers waste water treatment
- Hospitals, hotels, cruise vessels waste water treatment.

Target markets

The Vorixial Separator has been developed with several key markets in mind. Among these key markets are:

- Oil & water separation in general
- Coast guards & navy's world wide
- Port authorities world wide
- Coast line states & nations
- Marine spill response corporation (msrc)
- Oil spill response companies
- Off shore oil rig owners
- Oil tanker owners
- Crude oil and chemical transport companies
- The pulp and paper industrie
- Municipal water treatment facilities
- Emergency transportable unit.

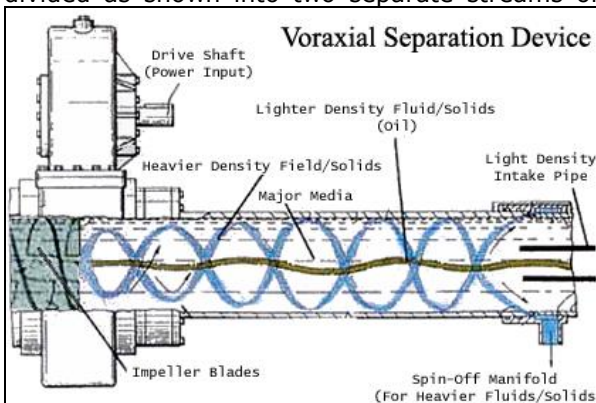
As you can clearly see, the Auxill Voraxial Separator is ready to service the separation needs over a broad market base.



THE VAS 2000 is extremely light weight. As shown, you can pick the machine up with one finger!

Technology

The AVS is continuous flow turbo machine generating a strong centrifugal action or vortex capable of separating light and heavy liquids such as oil and water, or any other combination of liquids and solids at extremely high flow rates. The AVS accomplishes this separation through the creation of a strong vortex in the flow as the fluid flows through the machine. In oil and water mixtures, this vortex causes the heavier elements (water) to gravitate to the outside of the flow and the lighter elements (oil) to move to the center and form an inner core. If solids are present and they are heavier than the liquid, they too will be drawn to the outside of the flow and follow the walls of the exit pipe or tube. The stream leaving the machine will be divided as shown into two separate streams of



the heavier liquid (water) and lighter liquid (oil). The AVS is similar to a pump (axial flow type) and is usually driven by an electric motor to turn the input shaft. The input shaft drives the impeller blades of the separator through a set of gears. While the device is separating it also acts as its own pump, moving the fluid mixture through the machine. The open design of the impeller blades makes the separator virtually non-clogable.

Centrifugal force generated and the vortex created around the centerline of the impeller are the fundamental separation mechanisms for the AVS.

Comparison

The conventional way of rating separators and centrifuges is to express the separation force in the number of "g's" created. One "g" represents the equivalent of the force of the earth's gravity. Therefore, a machine with a 10 "g" rating would exert a separation of 10 times the force due to the earth's gravity. A common separation device is a settling basin where fluid mixtures are

allowed to separate in a large tank by gravity (or 1" g").

The lighter elements eventually will rise to the surface and the heavier elements settle at the bottom of the tank. This process is very time consuming and may take large tanks or holding ponds. This ultimately adds to the expense of the operation and requires large space for the separation process.

Devices such as hydro-cyclones and centrifuges increase the "g" forces and accelerate the process of separation. In the design of centrifuges, as the "g" force increases, the allowable flow rate drops. Hydro-cyclones produce separation up to 200 "g" 's and allow for large flow rates.

A practical 35 m³/hr centrifuge can operate at 5000 to 7000 "g" 's. For more active separations at higher "g" forces, machines requiring batch removal of solids are required. When using higher "g" forces, (ultra centrifuges of 200,000 +g), only small amounts of material can be processed in single batches only.

In mthe most industries separations of solids form liquids are accomplished by filtration. This is a simple and direct approach to removing solids of a specific size determined by the filter material. However, large flow rates require corresponding large filter surface areas. The filtered material must be changed, cleaned or back flushed frequently as solids accumulate on the filter surface. Recovery of these solids is often cumbersome and extensive back flushing may be required.

The AVS can effectively replace the conventional filtration process where the solids to be separated are of different density than the fluid transporting the solids. The recovered solids are readily available form the Voraxial Separator in the form of a highly concentrated slurry. To further emphasize the superiority of the AVS, Frost & Sullivan categorized separations in the following method to which they are employed as: 52% of all filtration, 27% settling, with the remainder to centrifuging and hydrocyclones.

The AVS can be used to replace 50% of all filtration, 90% of all settling processes and 75% centrifuging and hydrocyclone processes! Very simply put, the AVS is far superior to anything available on the market today.

The uniqueness of the AVS is its ability to expand the operational scope of liquid - liquid, as well as liquid - solid separations and combine high "g" separation forces and high flow rates.

To date, the Voraxial Separator is the only separation technology, which can operate in this regime.

Specifications

Materials

type 1000

- | | |
|---------------------------|------------------------------|
| ◆ separation unit housing | CPVC |
| ◆ separation impeller | special plastic |
| ◆ bearing | self lubricating - standard |
| ◆ voraxial tube | transparent perspex or steel |
| ◆ valves, connectors | CPVC |
| ◆ separation manifold | CPVC |
| ◆ O-rings | acid and oil resistant |
| ◆ Motor & separator mount | aluminium |
| ◆ Tube & separator mount | aluminium |

other types

- | | |
|---------------------------|------------------------------|
| ◆ separation unit | cast aluminum |
| ◆ separation impeller | stainless steel 316L |
| ◆ bearing | self lubricating - standard |
| ◆ voraxial tube | transparent perspex or steel |
| ◆ valves, connectors | CPVC or stainless steel |
| ◆ separation manifold | CPVC |
| ◆ O-rings | acid & oil resistant |
| ◆ Motor & separator mount | aluminium |
| ◆ Tube & separator mount | aluminium |

Motor

A standard electrical motor 220 V – 50 Hz is used. We will select european standard motor with CE approval. Presently used are:

type 1000: 3450 RPM

- ◆ ½ HP Motor, Baldor or similar
- ◆ Catalogue number (USA) L1303 –
- ◆ frame 56
- ◆ Series M499
- ◆ Spec. 34FO74X716

other types: 3450 - 2600 RPM

type 2000:

- ◆ 2 HP, Baldor or similar
- ◆ Catalogue number (USA) M3555T
- ◆ Frame 145T
- ◆ Series F398
- ◆ Class B – code L
- ◆ Spec. 35A00IT962H1
- ◆ standard speed regulator

Relation between RPM's, Capacity and Retention time

- if lots of solids are in the liquid an increase of Rpm's might be useful

Separation manifold

- adjustable sections are
- selection of heavy phase – outer manifold part - in relation to the amount of solids
- selection of light phase – inner manifold nozzle – in relation to amount of oil (light phase)

Installation

- ◆ the VAS unit may be fed from tank; if three phase separation is required – use of a skimmer might be necessary.
- ◆ The units may be built inline – the feeding pump should be balanced against capacity of the proposed unit (avoid air bubbles)

Prescreening (advised)

- ◆ for type 1000 1 mm advised
- ◆ for other types 2 mm advised

Ratio swings

- ◆ in oil - liquid
 - ◆ in liquid - solids
 - ◆ in oil – liquid – solids
- No problems*

Amount of solids

- ◆ up to 20% by volume
- ◆ size of solids
 - 1 mm for the 1000 – types
 - 3 mm for bigger types
- ◆ efficiency of solids separation 96% removal of beach sand
- ◆ additional testing is being done shortly

Amount of liquid – liquid

- ◆ oil in water
 - depending on gravity of the oil from less than 1 ppm till less than 15 ppm.
- ◆ water in oil
 - depending on concentration 6 – 20%
- ◆ reduction of oil concentration
 - e.g. LABTEST RESULTS 25 GPM containing 7000 ppm of oil
 - resulting in
 - 23.4 GPM clean water (less than 2.5 ppm)
 - 1.6 GPM oil / water mixture

Densities/specific gravity

- ◆ required difference in specific gravity is 2% for both liquid and solids

Spares & replacement parts

- ◆ no spares
- ◆ just a few O-rings
- ◆ 2 bearings (life span 5 years)
- ◆ motor parts & belt

Temperature

- ◆ standard units can handle up to 95 °C

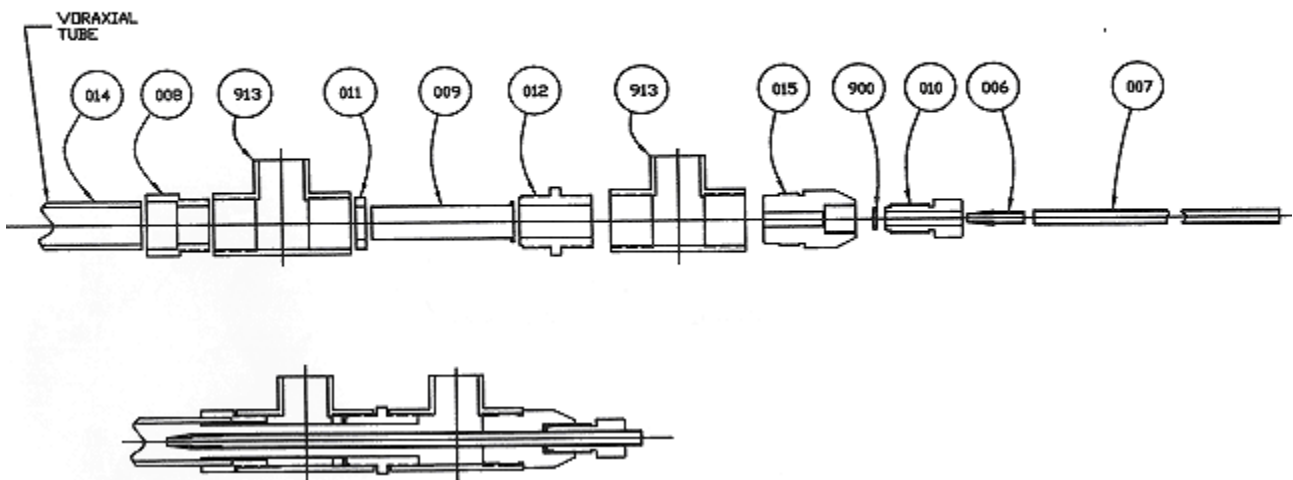
Chemical resistance

- ◆ all wetted parts out of stainless steel and special PVC

Footprint / capacity chart

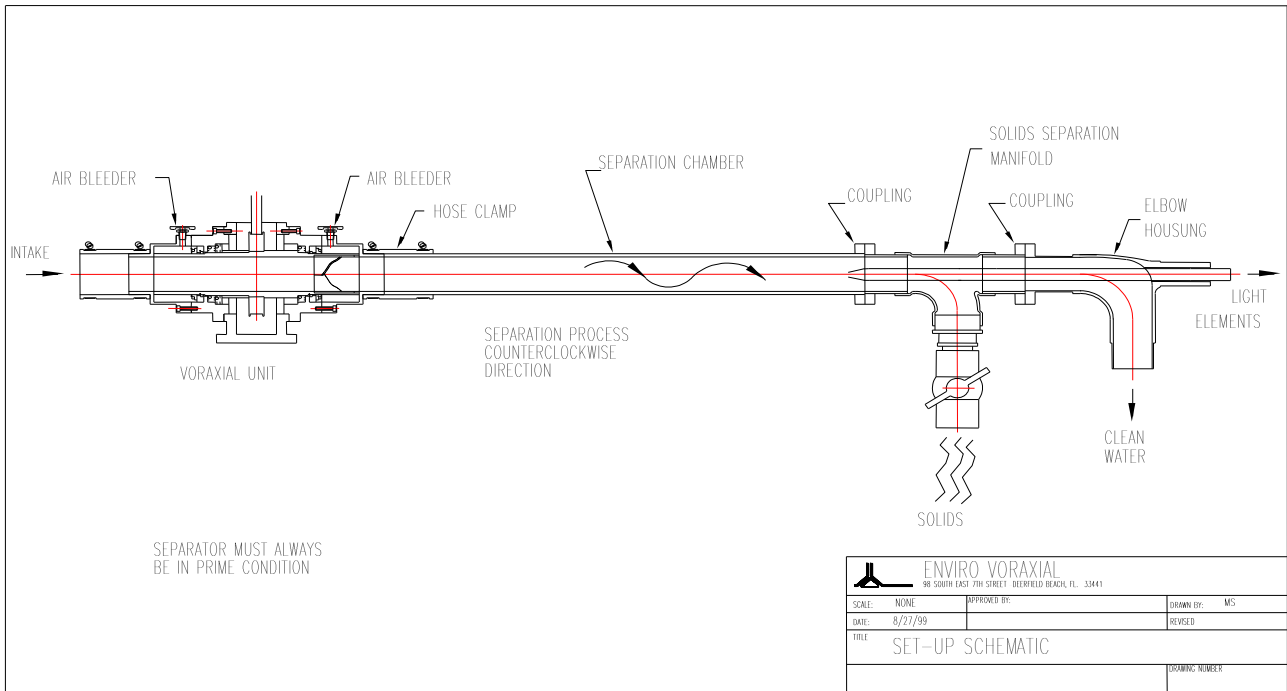
MODEL	Max. Height (mm)	Max. Width (mm)	Motor plate (mm)	Total length (mm)	Weigth (kg)	Cap. (M ³ /h)	Power (kW)	Diameter size (")
1000							0.375	1
2000	457	305	430	1828	45	11.5	1.50	2
4000	508	914	609	1828	202	115.0	9.00	4
8000	762	1219	914	6705	315	920.0	37.25	8
1600	1219	1828	1219	9145	835	11500.0	37.25	16

Parts list of separation manifold

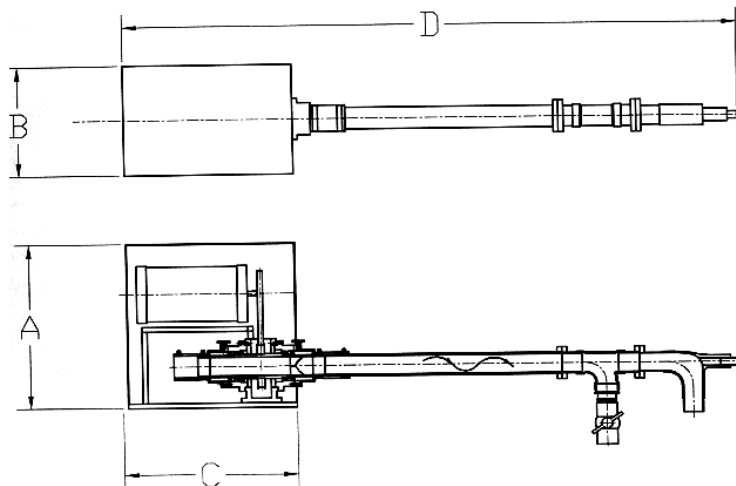


014	VORAXIAL TUBE
008	MANIFOLD JOINT
913	SOLIDS OUTLET
011	SPACER RING
009	SOLIDS COLLECTOR - OUTER VORTEX RECEPTION
012	MANIFOLD JOINT
913	HEAVY LIQUID OUTLET
015	LIGHT LIQUID RECEPTOR
900	O-RING
010	SPACER
006	RECEPTION NOZZLE
007	EXIT TUBE

Set-up schematic



Dimensions



Model	A	B	C	D	Weight
2000	18"	12"	17"	75"	100kg
4000	20"	36"	24"	72"	450kg
8000	30"	48"	36"	264"	700kg
1600	48"	72"	48"	360"	1850kg