

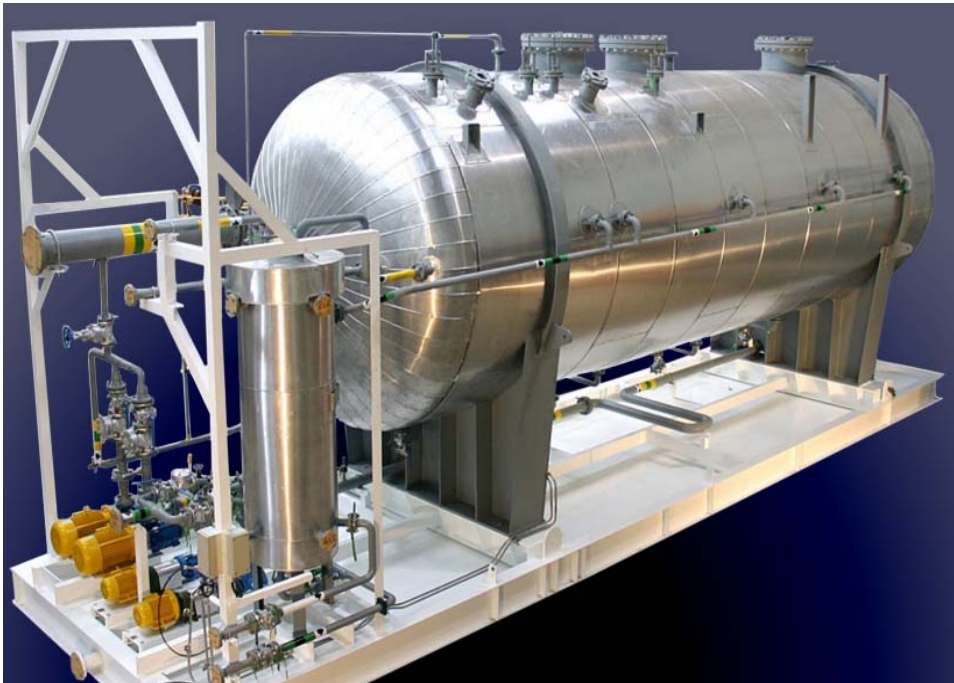
THE REVOLIFT LINE OF GAS FLOTATION VESSELS

Exterran Water Solutions has pioneered the use of Micro Bubble Flotation (MBF™) in a number of configurations. Many of our installations involve the modification of internals of existing tanks and vessels for the improved performance that results from the use of micro bubbles, however in some cases it is desirable to have vessels of new construction that have an optimal internal design. Revolift™ is the tradename that refers to a specific patented vessel internal design that has been developed to remove suspended oil from water through the use of these gas micro bubbles. The RevoLift product line incorporates all of the benefits of micro bubble flotation into a gas flotation vessel of either a Horizontal or Vertical orientation (depending on application location) that can outperform Induced Gas Flotation (IGF) or Induced Static Flotation (ISF) products currently on the market by others.

UNIQUE DESIGN FEATURES

Heavy Oil (eg: Bitumen) or emulsified oils can be efficiently separated using this multi chamber RevoLift module with micro bubbles integrated. The hydraulic flow design is a significant improvement over IGF or ISF packages that are commonly available on the market in that there is no possibility of short circuiting as with the incomplete wall baffling (common bottom design) utilized by our competitors.

Large quantities of micro bubbles (~ 30 μ in size) are generated by an Onyx-MB pump and are introduced into the flow of produced water. The bubbles will adhere to small oil droplets (often emulsified) and float them to the surface. The size of bubbles is critical to the process. The larger bubbles used by our competitors have more difficulty adhering to the smaller oil droplets due to their high rise velocity, smaller surface contact area and very short contact time. The other



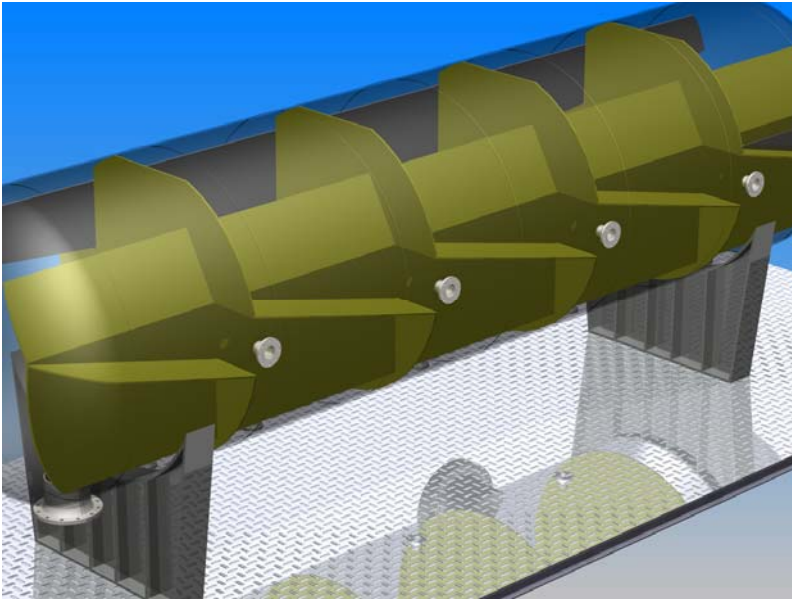
benefit of the use of these small bubbles is that little or no chemicals are required as the micro bubbles can readily attach to small oil droplets therefore requiring less aid in chemical flocculation.

The Revolift vessel is a completely hydraulic design with no rotating equipment inside the vessel where many competitors' products have rotating equipment for bubble generation and oil skimming.

The RevoLift technology is available in either horizontal or vertical configuration to accommodate the unique requirements of offshore environments relative to those of on shore facilities.

HORIZONTAL REVOLIFT PROCESS DESCRIPTION

The Revolift vessel is a horizontal cylindrical vessel the inside of which is divided into 5 equally sized discrete chambers each of which performs the separation of oil and water.

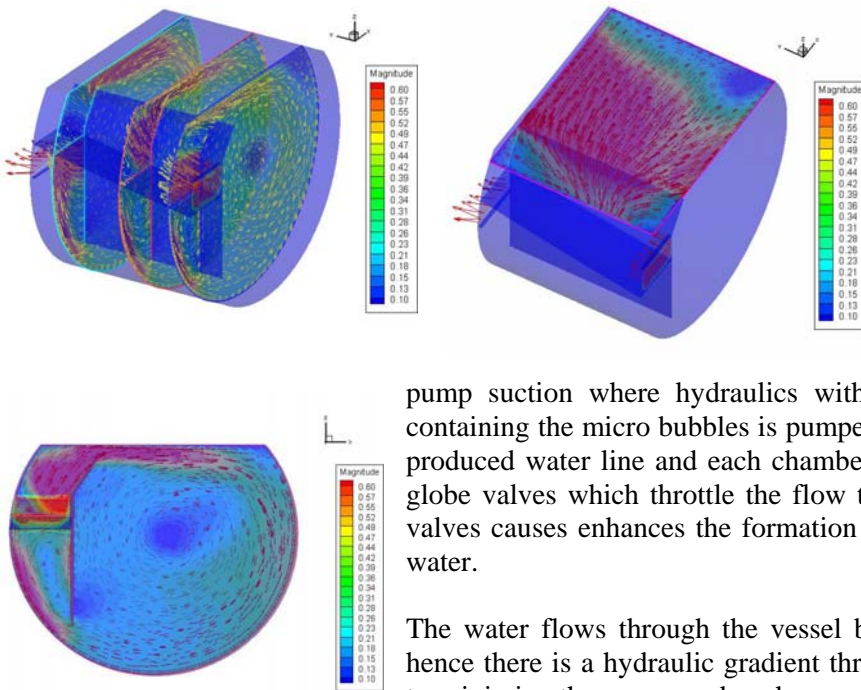


The produced water is combined with about 40% of the recycle flow containing the micro bubbles and enters the vessel through an inlet nozzle in Chamber 1. The micro bubbles and entrained oil are therefore in intimate contact upon entering the vessel. This mixed flow enters the inlet water box and overflows into the first chamber. The recovered oil floats on the bubble layer and moves across the chamber where it overflows the oil weir. The water flows downwards to the bottom of the first chamber and exits into a connecting weir which leads it to the inlet box of the second chamber. More bubbles are added to this stream as it leaves the first chamber so that by the time it reaches the inlet box there has been additional intimate contact with the gas bubbles and the oil.

The recovered oil floats on the bubbles and moves across the chamber where it overflows the oil weir.

The water flows downwards to the bottom of the chamber and exits into a connecting weir which leads it to the inlet box of the third chamber. Additional bubbles are added into each chambers inlet weir for sequential cleaning of the water.

The operation of the third, fourth and fifth chambers is the same as chambers one and two.



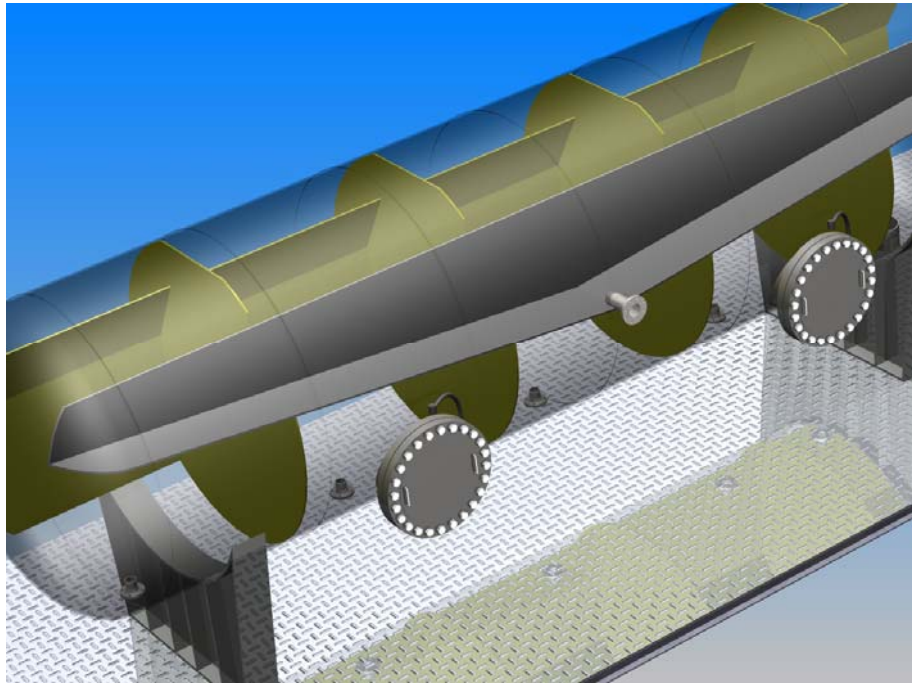
The clean water leaving the Revolift vessel is split into two streams. The main flow (which is the clean produced water) is flow controlled to match the inlet produced water flow. A level controller on the fifth chamber trims the flow controller to maintain the desired level in the vessel.

The second clean water stream is the recycle flow to the ONYX-MB Pumps to produce the bubbles. Gas is introduced to the ONYX-MB pump suction where hydraulics within the pump creates micro bubbles. The water containing the micro bubbles is pumped back to the Revolift vessel. The flow to the inlet produced water line and each chamber of the Revolift vessel is manually controlled by globe valves which throttle the flow to each chamber and the pressure drop across the valves causes enhances the formation of the bubbles prior to mixing with the produced water.

The water flows through the vessel by gravity from the first chamber to the last and hence there is a hydraulic gradient through the vessel. The interconnecting pipe is sized to minimize the pressure drop however there will be a slight difference in level in each chamber.

This difference in level means that the oil weirs have to be adjustable to minimize water loss with the oil. This is accomplished by having adjustable weirs which operate like a sluice gate. Observation ports are provided so that the operator can adjust the weir height and observe the oil flow over the weir. The oil weir position is adjusted by a spindle which protrudes through a nozzle directly above the weir. The spindle is sealed with a packing gland similar to a valve packing gland. The adjustable weir is made of Kynar which will not bind with metal and which can resist any chemical attack by the oil.

The oil is collected in a trough which runs the full length of the vessel. The bottom of the trough is sloped to encourage a good flow. Since the oil trough is submerged in the water its temperature is that of the water and it should flow easily. The recovered oil flows by gravity from the vessel into a small skimmed oil tank located closed to the vessel.



VERTICAL REVOLIFT



