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Oil Water Separator Paper for Produced Water Society, January 18, 2007

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Subject: Oil Water Separator for Produced Water from Offshore Production Platforms.

Introduction

ACS Industries, Lp has supplied knitted wire mesh Hydrocarbon/ water separators to the Oil, Chemical and Petrochemical Industries since the early 1960's. These separators have a useful life expectancy from two years to ten years depending on the corrosion of the materials. The systems where they have been used successfully have been relatively clean and do not contain paraffin's or highly viscose materials.
When ACS knitted wire mesh units have been tried on offshore production platforms, these units have plugged up after 2 to 3 months of service. These units are made of co-knits of wire and multifilament fiber glass, designed to give low concentrations of oil in the water. With the co-knit material, it is common to get oil concentrations in the water from 1 to 15 parts per million.

The failure of the units comes from sand and mud collecting in the voids of the wire mesh and packing tightly so that the water flow is stopped. When the unit is opened the mesh material must be removed from the vessel. In addition the mud and sand are so tightly packed that the mesh can not be cleaned and must be discarded.

Object
The object of this invention is to provide a system which allows the co-knit wire mesh separators to perform for over a year or more with out having to remove the material or clean it.

History
In 1991,ACS had designed and patented a system to clean oil from water that had been removed from the surface of water.(US Patent numbers 5,023,002 and 5,246,592) this system had two pre-filters, a vane unit and two Interceptor Pak® (see figure 1).

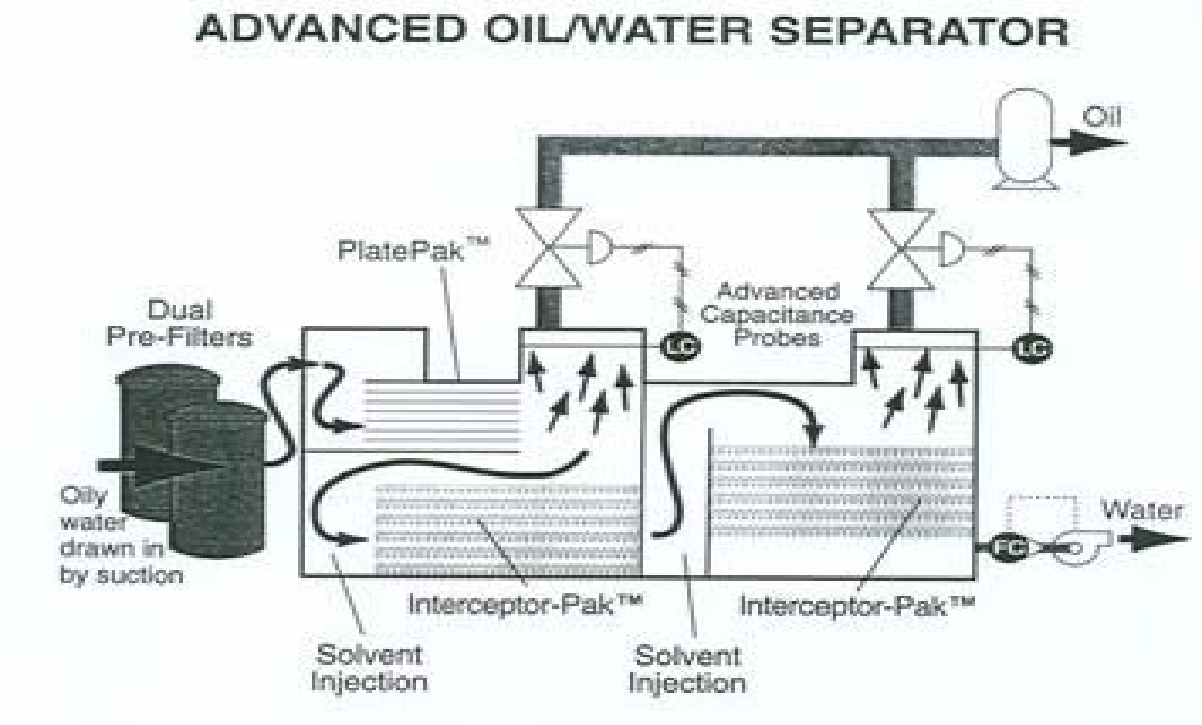

Figure 1.

This system, results in an oil and water discharge of less than 15 parts per million. The two pre-filters remove particles down to 50 microns and are designed to remove floating debris, but do not prevent plugging from sand or mud.
In 2004 ACS Industries, Lp engineers, Kanti Patel and Prafull Purohit had designed a system to remove oil from the produced water on an offshore platform. This unit followed a three stage separator and was designed approximately 2.5 times larger than required, in order to provide for future increased produced water. The unit was an 8 foot diameter vertical tank with the Plate Pak ® vane unit in a horizontal position. See figure 2.

This was a new well which had a large amount of sand and mud. In a matter of a few weeks there was an upset in the well and a large amount of drilling mud entered the system. The well was shut down and the separator was cleaned. The mesh pad was so badly plugged it could not be cleaned and was discarded.

After the restart of the unit with out the Interceptor- Pak®, the oil in the produced water has not exceeded the 25 ppm limit required by law.

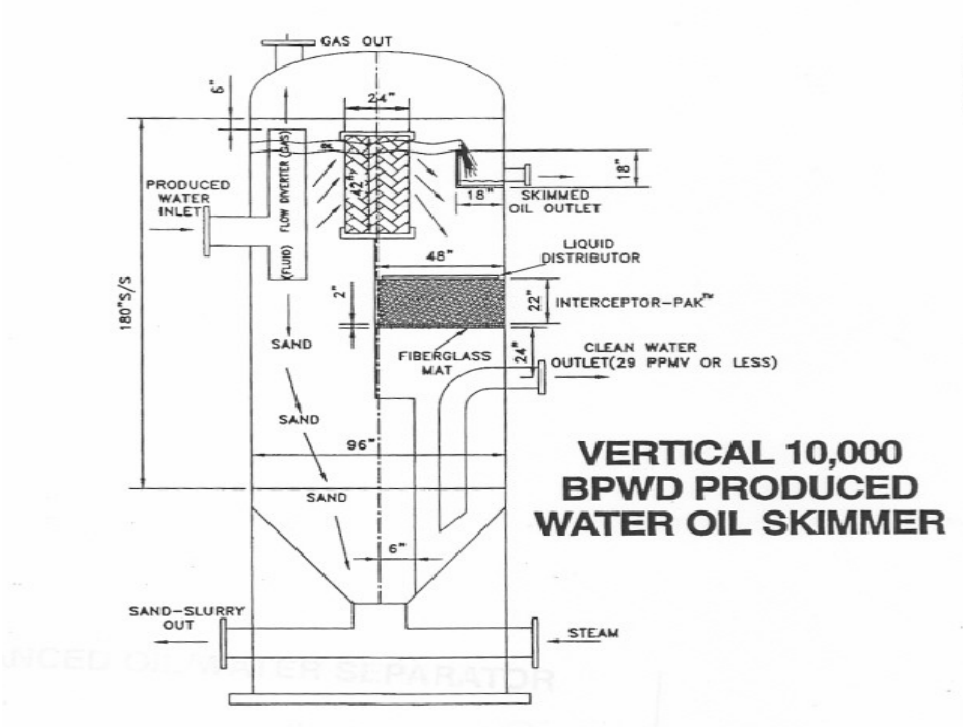

Figure 2.

Normally a Plate Pak® vane unit will not reduce the oil content this low, but the a fortuitous combination of particle size, viscosity, and specific gravity and flow rate resulted in this low oil content. This unit has been running for several years without having to be cleaned.
With the knowledge that a Plate Pak® vane unit could operate without cleaning, ACS Engineers decided to investigate the use of a continuous cleaning filter in front of the wire mesh coalescer pad and the polishing unit. Several continuous cleaning filters where identified which had continuous cleaning capabilities.

The System

The system that ACS engineers decided to build and test comprised of a vane unit, for sand removal, followed by a continuous filter followed by a coalescer Interceptor Pak® and a polishing Interceptor Pak® (see figure 3).

The system that ACS used for testing consisted of a vane unit, a continuous filter unit, a coalescer agglomerated unit, and a polisher unit. The vane unit traps the bigger particles and has them drop out of the flow. The filter unit processes all the water going into the coalescer through a 10 micron filter. The filter will backwash after 5 hours. After this period, there is a build up of thin sand and clay. The liquid then goes through a coarse coalescer that makes the oil droplets bigger. The flow is then directed through a fine coalescer that keeps the oil below 50ppm.

Figure 3.

The unit has been in operation for slightly more than 6 months and the coalescers have not needed to be cleaned yet. There were occasions that the system was fed 100 % sand and this feed was bypassed until it was clear. Approximately every 3 to 4 wks there is a build up of Hydrocarbons in the coalescer unit and this would lead to a coalescer carry over of up to 35ppm. The unit would backwash to remove this oil buildup and would begin to

operate normally after a ½ hr backwash cleanup. Once the unit got to a steady state condition, the backwasher was no longer required.

A schematic lay out of the system is shown on figure 4. It shows the flow of approximately 8 gpm with an oil content between 100 and 400 ppm going into a vane unit through a moyno pump, and then to a filter unit. After being filtered, the flow goes through a wire mesh coalescer and then through a wire mesh polishing unit. When backwashing is required, the flow is reversed so that the outlet water is pumped in reversed direction through the coalescing units. This action frees up any heavy buildup of hydrocarbons in the system. For the most part, we did not find that this was normally required.

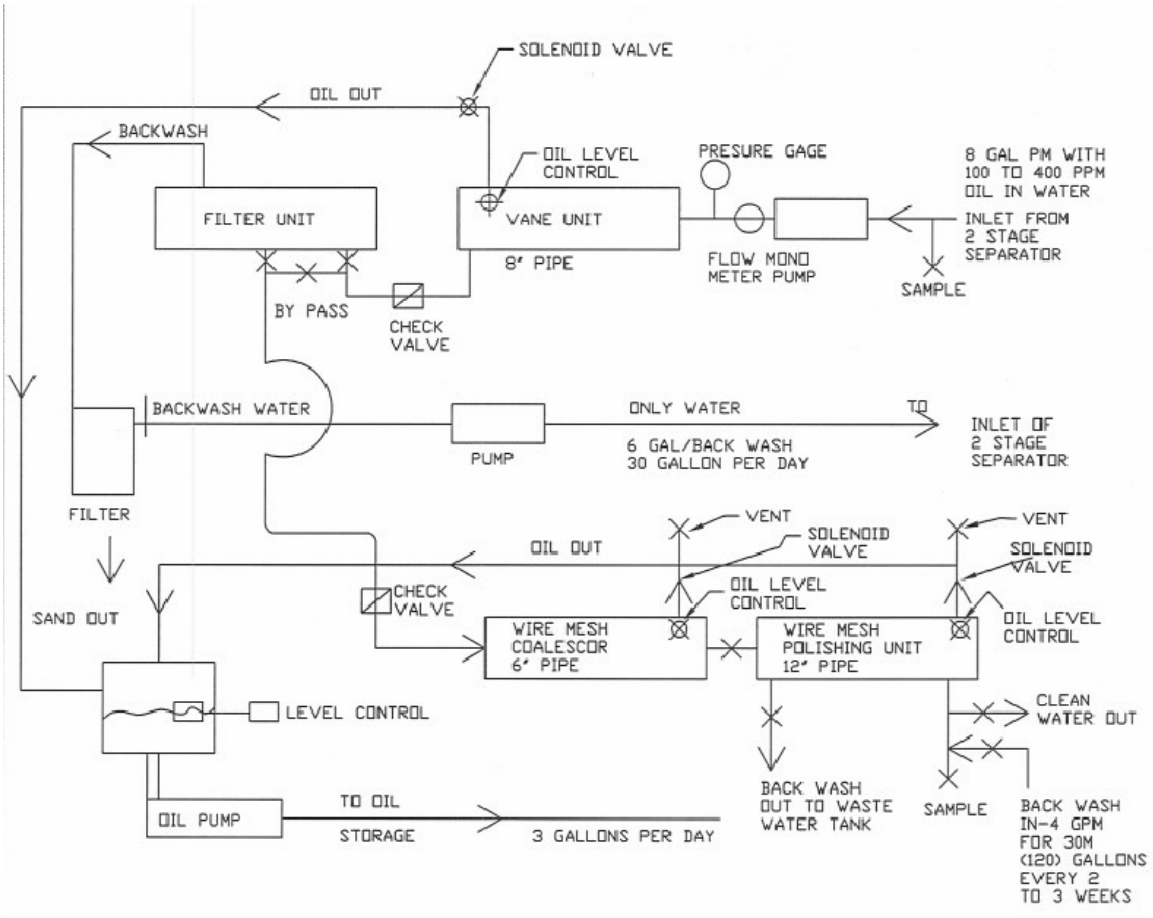

Figure 4.

The system is designed to be redundant so that the flow is forced to go through all three elements. Each coalescer would have a vane, a filter, a coalescer, and a polishing unit.

The coalescer material is a co-knit of fiberglass, teflon, and wire.

A typical system set up would include a single vane unit, followed by one or more filters which are then followed by a coalescing and polishing unit. The units are very compact. A 4 ft diameter vessel which holds the coalescer and the polishing unit would process approximately 300 gpm.

A typical case would be two 4 ft vessels containing a coalescer and a polishing unit. This allows the system to work in tandem continuously without any interruption of flow. When a unit needs backwashing, the second would process the backwash water. The backwashing is done at a rate of 25% of the flow to allow the unit to accommodate this extra capacity.

The advantage of our system is that it is compact, self supported, and easy to accommodate. The unit comes in sizes of 4ft to 12 ft diameter vessels.

As more water needs to be processed, more units are added. Generally speaking, the unit is over-designed for low flow rates; for example, for a required 100 gpm flow application, the system would be built at a minimum rate of 300 gpm which is the minimum size vessel recommended.

This extra capacity allows for future expansion. As more water needs to be processed, more units are added.

The coalescer units tend to give carry over of less than 15 ppm. The high purity is an actual phenomenon resulting in the capture of particles 10 microns and below.

The system has a piping arrangement to allow 25 % or less of the backwash water to reverse through the pad when cleaning.
The pressure drop across the coalescer and polishing units is less than 3 psig.
The automatic filtration unit reduces build up in the pads.

There are no moving parts in the coalescer units, and as a result there is no maintenance required. Each system requires an oil water inter-phase sensor which opens when the oil level builds up and closes when water is detected.

These systems can be calibrated to the capacitance of a specific fluid which makes them extremely reliable. They are installed in duplicate so they are fail-safe and self supporting.

Conclusion

In conclusion, ACS coalescer units provide low maintenance and reliable performance with a system consistently obtaining readings less than 15 ppm of oil in water. The units are compact and require less space than traditional separators. Maintenance is at a minimum and only the filtration system itself requires cleaning and this is an automatic process. We invite you to contact us for a specific system designed for your needs.