2015 De-sanding Recommendations

Use the Patented DFSD™ to Capture Sand in 2015

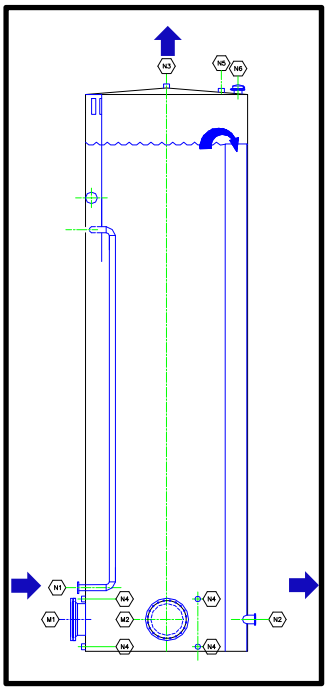
INTRODUCTION

The DFSD™ vessel is the answer to de-sanding inlet oilfield water streams in 2014. The DFSD™ is a patented De-sanding, Flow Splitting, and De-gassing Tank, all in one! It is both simple and efficient constructed from an atmospheric vertical oilfield tank specifically designed to pre-condition oilfield fluid streams inlet to production or processing facilities in three ways:

1. ***To remove solids larger than 120 microns from a liquid stream according to Newton's First law using centrifugal force followed by Stoke's Law ($V = G_c \cdot r^2 \cdot [d_1 - d_2)$/viscosity in cP) gravitational settling so solids accumulate in the bottom of the DFSD™ tank.***
2. ***To divide the flow hydraulically and evenly , consistent with very low Reynolds Number fluid characteristics (Re = <1), into two or more effluent streams to improve downstream distribution, reduce effluent flow rates, and promote more efficient downstream liquid-liquid (oil-water) separation.***
3. ***To remove all associated gasses and their inherent mixing energies from the inlet fluid stream to reduce the Brownian effect on solids, further promoting their separation, and to enhance flow divisions which increases downstream separation efficiencies.***

DESCRIPTION

The DFSD™ is typically a 10' or 12' OD API 12F or 12P vertical tank, normally 30' high. The diameter is varied according to the predicted solids loading; the larger holding 40% more solids per foot of height than the smaller. The height is varied according to the height of the downstream tankage to assure gravity flow, thus eliminating the use of transfer pumps and the associated mixing energy which tends to re-entrain oil minimizing separation.



HOW IT WORKS

The inlet fluid, often a mixture of oil, water, solids, and gas/air, enters into the inlet nozzle on the side of the DFSD™, just above grade elevation to simplify installation. It routed internally up inside the tank where it turns horizontal to enter a vertical cyclone tube on tangent and near the bottom of the tube. This cyclone tube spins imparts a rotating flow onto the inlet fluid path inside the tube to separate solids by centrifugal force in a counter-clockwise flow path above the equator; the reverse below the equator. Solids larger than 120 (the nominally smallest size of frac sand used in the industry) separate from the inlet fluid stream and fall downward out of the upward rotating liquid flow path, settling to the bottom of the tank.
The inlet nozzle and piping are sized and numbered according to the instantaneous inlet fluid stream flow rate.

Just above the inlet to the cyclone tube a large diameter liquids outlet tube allows for the solids free liquid stream to exit the cyclone tube horizontally and on tangent. This fluid stream is directed toward the inside diameter (ID) of the vessel, allowing the ID to further enhance solids separations by impingent, and to distribute the liquid stream into the liquids phase of the vessel.
Entrained gas and/or air concentrate in the center of the cyclone tube and rise rapidly in the tube to exit at the top of the tube which protrudes into the gas/air phase in the top of the vessel above the liquid phase. Since the instantaneous gas/air volume may be huge due to slugs accumulating upstream or simultaneous truck blow down events, gas is allowed to escape through an oversized pressure-vacuum vent valve mounted on the top of the vessel.

The liquid phase in the DFSD™ is distributed into the body of the tank to minimize velocities, wave action, and turbulence. It then flows over the top of vertical flow dividing tubes and exits the vessel. From one to as many as four (or more) vertical flow dividing tubes may be installed. Each tube has precisely the same upper elevation to assure equal spill-over hydraulics, thus assuring an evenly divided effluent.

Effluent piping carries the now-divided flow stream to its respective destinations into vessels at least 5' shorter in overall height. The distribution piping is sized so it need not be concentric; the 5' of head differential providing the hydraulics necessary to prevent flow restriction, and to assure uniform overall distribution.

INSTALLATION

Perhaps the most important step in setting any oilfield tank is foundation preparation. Soil should be checked to assure that it is suitable to sustain the weight of the new tank, including its contents. This tank will weigh approximately 32,000 pounds full, which imparts approximately 2.8 pounds per square inch on the foundation. Compacted soil is preferred to assure stability even after a rain. Where soil conditions require fill, road base is often used to a depth of 12"-36" and compacted. Whatever foundation the end user chooses, it should be stable and not allow the DFSD™ to settle. Even one inch of settling one side of the DFSD™ will defeat its hydraulics and render it less effective. In the event settling is observed at any point in the life of the DFSD™, it should be re-set to correct this issue immediately.
Once the foundation is secure, care must be taken when installing the DFSD™. The vessel must be installed perfectly vertically to avoid any lean which will certainly affect the spillover elevations and preclude uniform flow division.

Since this degree of care and attention to detail is not commonplace in the oil industry, it is often necessary to adjust the spillover elevation of the flow dividing tubes after the vessel is set in its final location. When this is anticipated, it is necessary to first fill the vessel to allow it to settle on its foundation. Using fresh water for this step is advisable since no additional cleaning of the tank will be required in the next step if fresh water is used. Once it has been filled with fluid and has settled (usually overnight), the vessel is then drained and entered. The elevation of the spillover tube(s) is checked with a laser level, and adjusted as necessary to create elevation uniformity by cutting the tops of the spillover tubes at the same exact elevation to assure spillover elevation uniformity. If produced water or oil were used to fill the vessel, it must be cleaned and checked for safe entry prior to entry.

OPERATION AND MAINTENANCE

Once the DFSD™ is properly set and the spillover tube is confirmed to be level, the specified PVV vent valve must be installed to assure proper venting for all truck blown events.

Prior to start-up the DFSD™ should be inspected inside and out to check for damages in transit. Internal piping should be filled and checked for leaks. Then, the DFSD™ should be filled with water using any one of the bottom drain connections. Once the filling operation results in water spilling over into the downstream tanks the DFSD™ can be put in service.

It is common practice for water haulers to pressure up their trailer compartments to speed up offloading. As trucks are pressure up, the compressed air volume inside the compartment increases as the water is displaced. When the tank compartment is finally filled with air and empty of liquids the air escapes rapidly to the DFSD™, which, when fitted with the specified PVV vent valve, is designed to vent the huge instantaneous stream of air. This air flow rate can approach a 1.75 MMSCFD flow rate, so the sizing of the PVV vent valve is critical to prevent damage to the tank. Each DFSD™ end user must double check the overall installation to avoid damage.

The DFSD™ is designed to be a "flow splitter" if two or more outlets are present. Each of these outlets is connected to a vertical riser. As mentioned above, the tops of each riser MUST be at precisely the same elevation to achieve the desired uniform hydraulic division of the flow into various outlet vessels or process trains.

By design, the primary purpose of the DFSD™ is to separate sand and solids. It is designed to remove most of the 120 micron size solids, since 120 micron frac sand is the most commonly used of all oilfield solids today. The inlet stream enters a vertical separation chamber on tangent to produce the centrifugal force needed to "spin" the solids out of the water stream. The heavier solids flow downward and out of the vertical "cyclone tube", settling on the tank's bottom. Several nozzles near the tank bottom are included so the operator can periodically pull the sand and sediment off of the tank's bottom. Periodically, perhaps once every week, the facility operator should gage or thief the tank to determine the elevation of accumulating solids. When the level of the solids approaches 4' an effort should be made to remove them

SOLIDS REMOVAL

As solids accumulate they should be removed. Several nozzles located around the bottom of the tank may be used for this effort.
One removal method calls for two vacuum trucks to be used. One truck is filed with clean water; the other is empty. The water truck is tied onto the lower of two vertically parallel nozzles while the empty truck is tied onto the upper nozzle. As the truck tied to the upper nozzle tried to pull a vacuum to remove solids, the water truck pumps water into the lower nozzle to help fluidize the sand and sediment.
By relocating the trucks around the bottom of the DFSD™ and repeating the above procedure, most of the sand and sediment can normally be removed.

As an alternate to the truck method, the DFSD™ can be fitted with a TORE™ (see http://novapservices.com/wp-content/uploads/2012/10/ToreOVD_MTD.pdf)
If the end user desires to minimize hauled water a portable filter press can be used to dewater the removed solids and water stream.

When the solids are cementatious the above procedure may not be viable. In this case it may be necessary to have a tank cleaning crew physically enter and clean the tank.

SAFETY
All current safety OSHA and confined space entry procedures MUST be observed when working in and around oilfield tankage. Only personnel properly trained in all current procedures should be allowed to do this work.

CONTACTS

The DFSD™ is a patented product. The patents were sold by HTC to KBK in 2014. The patents are now the property of KBK and should not be infringed upon under penalty of law.

Feel free to contact HTC at any time at 918-298-6841 or visit www.hightechconsultants.net for more information. Alternatively, feel free to contact KBK.

DISCLAIMER

In 2015 the litigatory nature of business demands that firms like HTC, whose goal it is to provide help, assistance, and guidelines can be entangled in debilitating litigation. We all hear people say, "No good deed goes unpunished". So, while it is HTC's goal to provide free assistance to all readers, HTC accepts no liability whatsoever for the contents of this or any other document found on HTC's website.

ABOUT THE AUTHOR AND HTC

Bill Ball is the founder and owner of HTC, Inc. He has a long history of oilfield separation system design experience, which when coupled with his hands-on oilfield experience and career portfolio, make him one of the industry's leading separation authorities today. After his university studies he launched his career in a 1,000,000 b/d waterflood operation where he was responsible for the evaluation and performance improvement all surface facilities. Through this hands-on effort, he learned the modifications necessary to improve process efficiency; what works and what doesn't! In the decades since Bill has accumulated a lifetime of knowledge and experience in the fields of real-world oilfield separation and facilities design. Bill's many patents speak for themselves.

The culmination of Bill's efforts to improve processing in oil field operations is the Pro-Fit® System with its DFSD™ De-sanding, Flow Splitting, and De-gassing tank, the HWSB™ Skim Tank, a Gunbarrel replacement for all high water cut applications, and the "HEGB™ High Efficiency Gunbarrel". These unique designs achieve the highest level of hydraulic and separation efficiency known to exist in any design. In combination they form the foundation of HTC's ProFit™ SWD Plant Design Package currently considered to be the most cost effective SWD Plant Design available. In overview, each produces results that achieve unparalleled quality in the effluent streams.

Today in 2015, HTC, Inc. is one of the industry's leading low-cost surface facilities design firms. HTC specializes in salt water disposal (aka SWD) plant, flowback water treatment plants, two and three phase separation systems, and crude oil processing and dehydration/desalting plant designs worldwide. 3D Cad augments 2D designs and gives clients and construction firms another 21st century tool to use in shrinking costs and installation times.

In 2015 more HTC facilities blanket every sector of the oil and gas industry than ever before, adding to HTC's already strong reputation as a competent and capable full service engineering and design provider to meet your every need.