Desanding, Degassing, Flow Splitting

The What, How, and Why of the DFSD®

Innovation has been slow in the oil and gas industry. A key reason is the paradigm "Because we've always done it that way." Together, we can change that!

A Technical Paper

Prepared for

Facility Engineers and Designers

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Houston, Texas

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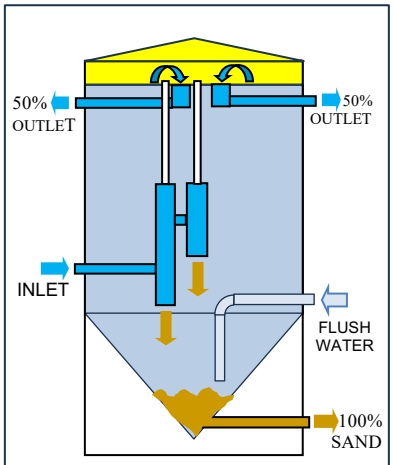
EXECUTIVE SUMMARY

In the last 15 years the industry has matured into a new era of highly prolific oil and gas production. We are now in the era of long lateral horizontal well completions augmented by massive multi-stage frac jobs. Because of these advancements in drilling technology, oil, gas, and water production rates have soared. This is good news for the oil and gas industry, and for the country as a whole. With this good news comes challenges never faced before, 1) wells producing very large volumes of water and frac sand, particularly during initial production (IP), and 2) much high oil carryover rates in produced water.

Sandy oilwell production has always challenged upstream operations. When seriously increased produced water volumes are added to the mix, the challenges become monumental. Almost overnight, separation challenges have become so impactful that most standard process and storage equipment was undersized and overworked.

A KEY DESIGN ADVANCEMENT

A new system that could 1) de-sand, 2) divide the flow, and 3) de-gas inlet water streams was needed. With this in mind, a patented system now known as the DFSD® was designed, tested, and continually improved to accomplish each of these challenges. The DFSD® design, shown at the right, was the result. KBK's owns the patent. With no moving parts, this tank is a 21st century workhorse. It is also a necessity for today's high-volume sand and water applications in all central tank batteries and SWD plants alike.



DFSD®
KBK's DEGASSING, DE-SANDING, FLOW SPLITTING TANK

The DFSD® incorporates proprietary two-stage hydrocyclones to separate sand and entrained gas from the inlet stream, sending the sand downward and gas upward. Hydraulically balanced water spillover outlets divide the flow equally to one or more downstream HWSB® oil-water oil skimming

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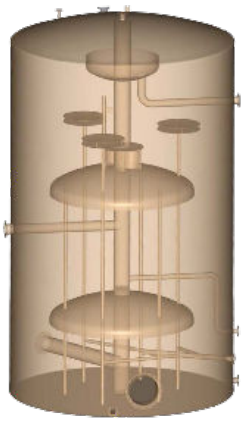
separation tanks. These uniquely efficient KBK patented HWSB® tank systems capture at least 99.99% of all oil, often leaving only twenty-five parts per million or less in the effluent water stream. The HWSB® separates virtually all oil and stores it long enough it can be sold at normal WTI prices. Capturing and selling this oil means added oil revenue. It also means that oily water is no longer sent to disposal or injections wells, eliminating costly acid stimulations or workovers.

A TWO-PRONG APPROACH

Today, oil producers can take advantage of two 21st century process tank designs by feeding sandy, oily, and gasified water first into KBK's DFSD® which separates sand and gas, and second, into KBK's HWSB® skim tank. The HWSB® design is quite unique, as is obvious in the graphic here at the right. Each is ultra efficient at separating all oil carried over from the production facilities upstream (separators and treaters). The combination of these two process tank systems removes all gas, sand, and equally divides the flow so no oil is lost. During IP, recovered oil has been documented at from 5 to 15 barrels each hour! All of the recovered oil flows to sales oil tanks rather than to water disposal wells where it is lost forever!



As inlet water flows through the DFSD®, all frac and produced sand is collected. A cone bottom design is often used so sand can be hauled off using vacuum trucks and without having to shut down the DFSD® or any other portion of the facility, further eliminating any unnecessary downtime.

COSTLY DOWNTIME ELIMINATED

With oil prices at or near $80+/barrel, these CTBs and SWDs can generate huge incomes for their owners, but when they experience a downtime event, the cost can be crippling. A CTB processing 5,000 BOPD of oil at current oil prices is generating $335,000/day; that's $2.3 million per week. Avoiding the loss of this revenue is the driving force for avoiding all downtime, which

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has now become the highest cost item in oilfield operations, more than justifying the use of DFSD® and HWSB® systems in every CTB.

In the past oily water was sent to SWD plants and pumped downhole. Today, high volume flows are divided equally into multiple HWSB®s located in the CTB. Each is rated for 15,000 BWPD. By capturing all otherwise lost oil each HWSB® adds a significant revenue stream. For instance, in a new central tank battery (CTB) processing 45,000 BWPD, its three HWSB®s will each capture at least five barrels of carryover oil per hour from the produced water stream. This oil is worth nine million dollars each year! And together the DFSD® and HWSB® will minimize costly downtime!

CONE BOTTOM DESIGN PAYS BIG DIVIDENDS

Each DFSD® is designed to collect produced sand and store it. When the DFSD® is fitted with a cone bottom, sand can be easily removed without having to suffer ANY downtime!

Most CTB and SWD operators also install electronic sand level detectors (often Emerson's guided wave radar) to automate an alert system so operators know when the time is right to have the sand removed from the DFSD®. It works like this:

> When the tank cone bottom fills with sand, the level detector sends a signal to the automation system, and the operator gets an alert that it is time to call for a vacuum truck to pick up and haul off the sand. When the vacuum truck arrives, it is connected to the dedicated sand outlet in the bottom of the cone. The sand outlet valve is opened and the sand can is vacuumed out of the cone. A water flush line is available to fluidize the sand inside the cone so the vacuum truck can remove all of the sand from the cone. The fluidizing water often comes from a bypass in the produced water transfer pumping system, a system designed to move produced water from the CTB to a nearby SWD plant. All of this happens without a single minute of downtime!

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The DFSD® is designed to eliminate any sand related downtime altogether, keeping production on-line, and cash flow maximized.

ABOUT THE AUTHORS

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