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# Production Optimization Gassy & Sandy Well By Using Helical Diptube Gas Anchor

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**Abstract.** Mature Field had some problems in Operation and Production, especially Wells with Sucker Rod Pump. Field's problems that mostly occurred were gas interference and sand problem, sometimes these problems happened simultaneously in one Well. Gas Interference and sand problem could be fixed by the different tool, gas interference used Gas Anchor and sand problem used sand screen or desander.

In order to reduce Well Service activity for wells that had problems with gas interference and sandy well, the Authors modified the tools by combining the Gas Anchor and Desander. To optimize the separation, the Authors added a suction pipe (dip tube). The first step was calculating a minimum length of the dip tube and the Desander whorl. The next was fluid flow simulation in the Desander whorl. From the simulation, the optimum length of the whorl was known to form the vortex flow at the end of Desander. Vortex flow used for sand and fluid separation with the utilization of their density difference with the centrifuge force, sand with the higher density would fall at the end of the vortex and went down to the Mud Anchor.

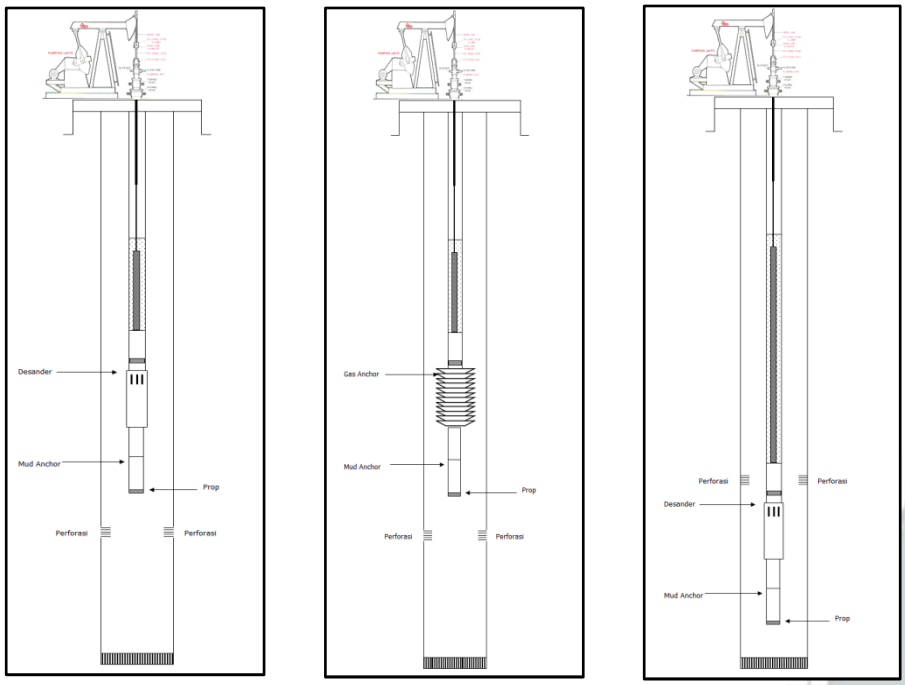
The design that got from the calculation and simulation was fabricated to validate of the result. The wells that used this down hole equipment could survive 87 days longer than usual. Pump efficiency increased up to 14.2 %.

**Keyword:** Gas Interference, Sand Problem, Vortex Flow, Diptube, Desander, Gas Anchor



## 1 Introduction

Mature field means depleted reservoir. Consequence of depleted reservoir is particle gas liberated from the oil and poor bond of sand grains that occurred fine sand also produced to the surface. Due to economical operational and handling mature field, many oil and gas company using sucker rod pump (SRP) as artificial lift if natural flow couldn't lift fluid to surface. However, SRP doesn't compactible if the well also produced gas or fine grain sand. The phenomenon usually called gas interference and sand problem or stuck. There is possibility in one well will occurred both of the problem.
Previously, gas interference and sand problem has been solved by using different method and tools. Method to handling sand problem usually increase pump intake and using sand trap like sandscreen or desander (A), on the other hand, to handling gas interference usually set pump intake below perforation (C) or using gas anchor if pump intake above perforation (B).




A B C

Fig. 1 Method to Handling Sand Problem & Gas Interference

However, All of the method not really reliable to handle those two problem in the same time. Here, we will introduce another tools named helical diptube gas anchor to handling both.

## 2 Methodology

Main inspiration helical diptube gas anchor adopted from tools or subsurface SRP tools to handling sand problem & gas interference (desander & gas anchor).
Philosophy of desander is fluid trough the inlet in a centrifugal direction so that the solid particle dropping gravitationally to the mud anchor (end of SRP string) and then the fluid and fine particle rise through SRP string.

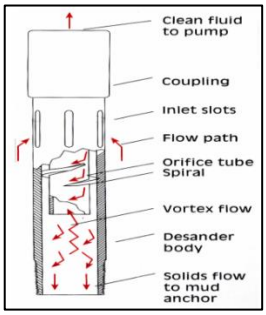



Fig. 2 Subsurface Desander

However, there is weakness in capacity of subsurface desander. if production doesn't appropriate with range production of desander then it doesn't work properly.

Philosophy of gas anchor is separated gas and fluid. Gas through into annulus then the fluid into SRP string through inlet from cup type.

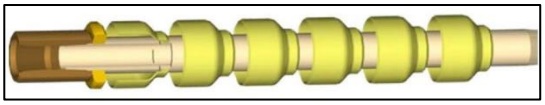


Fig. 3 Gas Anchor Cup Type

Here, helical diptube gas anchor combine both philosophy in one tool. This tool consists of gas anchor cup type to separation gas and fluid, suction pipe OD 1 inch and length as by request (diptube) to avoid gas into SRP string, then the end of suction pipe there is helical shape welded part to make vortex flow. Helical diptube gas anchor installed below downhole pump.

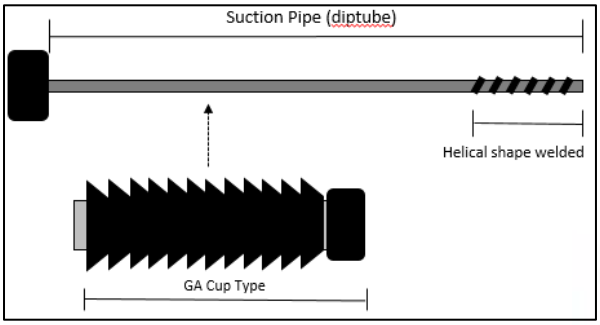



Fig. 4 Helical Diptube Gas Anchor

The main design of helical diptube gas anchor is calculated for minimum length of suction pipe to maximize separated gas and simulation fluid model to show vortex flow from helical shape welded effectiveness. The data to simulation is angle of helical shape 45-60$^{o}$ and length of helical shape welded 80 cm.

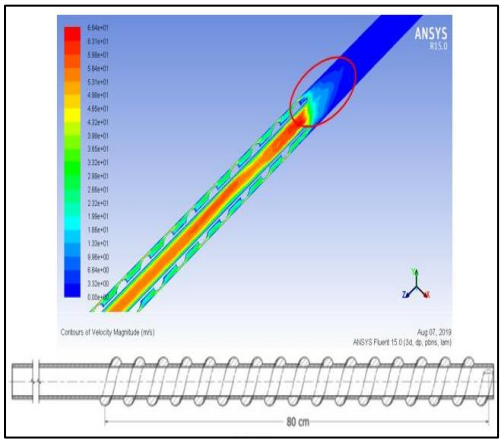



Fig. 5 Vortex Flow Simulation

The length of the diptube should be held to a minimum in order to reduce pressure drop, and thus gas breakout inside the diptube. On the other hand, the diptube must be long enough to provide adequate quieting volume between the bottom of the mud anchor slots and the top of the diptube slots so that separation of gas and oil will have adequate time to occur. The length of diptube may be calculated using this equation.

$$\boldsymbol{LDT = (2\,x\,SL\,x\,(D^2)x\,0.785)/AMA}$$

LDT : Length of diputbe
SL : Stroke Length
D : Pump diameter
AMA : Area of Mud Anchor

## 3 Result and Discussion

By using helical diptube gas anchor, pump efficiency, lifetime, production is better than without using it. Helical diptube gas anchor become the first protection to avoid gas into SRP string and solid content before fluid into SRP string.

Helical diptube gas anchor has been installed in Well-X and provide better lifetime. Before using it, every week stop operation to bleed off gas from anulus and tubing, then the accumulation every stop operation could make SRP string stuck. After using helical diptube gas anchor, production more stable, there is no need bleed of gas from annulus and pump efficiency increase 14.2% than before.

## 4 Conclusion

1. Helical diptube gas anchor use result of calculation diptube length to optimize avoiding gas into SRP string.
2. Based on simulation, vortex flow occurred perfectly when the angel of helical shape on the range $45^o$-$60^o$ and length 80 cm. better vortex flow better separation between solid particle and fluid.
3. Using helical diptube gas anchor, it would make gas accumalated in annulus. Hence, need to bleed off from annulus. Case in Well-X gas from annulus used to supply prime mover gas engine of SRP.

## References

[1] Pamungkas, Anggun Yogi. 2018.Multi Problem Resolver to Overcome Gas Interference and Sand Problem on Sucker Rod Pump in PERTAMINA EP Sangatta. Pertamina EP, Presented at SIMPOSIUM IATMI 2018,1-3 cktober 2018, Padang, Indonesia.

[2] J.H. Campbell, 1989, Engineering Approach to Gas Anchor Design. Paper SPE-18826. Presented at SPE Production operation symposium in Oklahoma City, 13-14 march 1989. Oklahoma. USA