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Multi Problem Resolver to Overcome Gas Interference and Sand Problem on Sucker Rod Pump in Pertamina EP Sangatta

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MULTI PROBLEM RESOLVER TO OVERCOME GAS INTERFERENCE AND SAND PROBLEM ON SUCKER ROD PUMP IN PERTAMINA EP SANGATTA

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PT Pertamina EP Sangatta Field[1]

Abstract

Sangatta Field is one member of Pertamina EP Asset 5, which is located in East Kalimantan. The First exploration well has been drilled at 1939 and start producing commercially on 1976 with initial production rate 5.034 BOPD along with peak production rate 9.125 BOPD on 1979. Nowadays, Sangatta Field only produce approximately 1.400 using Sucker Rod Pump (SRP) and gas lift.

Sangatta Field produce from Balikpapan Formation, which is dominated with sand. Due to high pressure decline, bonding among sand grains no longer strong and become easily separated from each other. On the other hand, solution gas trapped in oil has been liberated due to pressure drop below bubble point. This phenomenon leads to another problem which is simplified using term *gas interference*. Previously, sand problem and gas interference been solved using different tools, sand trap and gas anchor cup type (GACT) which is not really reliable to handle those two problems at the same time. We introduce a tool to overcome that problems named MPR (Multi Problem Resolver).

This paper will discuss about concept, design, and how to install this MPR on SRP so that sand problem and gas interference can be handled at the same time with longer lifetime than using conventional sand trap and GACT. Also we want to present success story when using this MPR on Sangatta Field.

Keywords: sand problem, gas interference, sand trap, Gas Anchor Cup Type, MPR (Multi Problem Resolver)

1. Introduction

Oilfield industry is a place where high cost, high risk, and high technology been applied in all sectors. The effort to optimize every single operation to get bigger production rate and longer lifetime of the field need to be invented. Besides, HSSE (health, safety, security, and environment) aspects also become main concern.

Sangatta is one member of Pertamina EP Asset 5 located in East Kalimantan, more specifically this field is about 300 km from Balikpapan in north direction. Sangatta Field has been produced commercially from 1976 and now is experiencing decline stage.

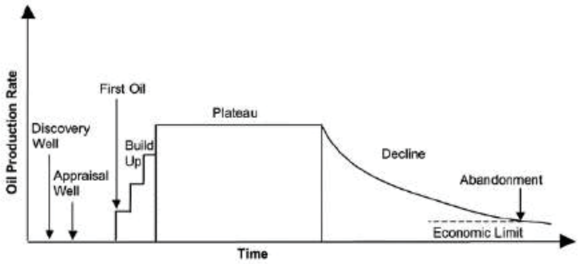

Figure 1. Theoretical production profile of an oilfield, describing various stages of development in an idealized case. Adapted from Robelius (2007) [1]

As mature field, nature flow is no longer occurred in Sangatta. Most wells produced using Sucker Rod and several wells in Semberah Area produced using Gas Lift. The population of artificial lift detailed as below:

- Sucker Rod Pump (SRP) 63 ea
- Gas Lift 1 ea

Due to high population of SRP in Sangatta, all problems related with SRP become our main concern. High pressure decline phenomenon make bonding among sand grains no longer strong and become easily separated from each other. On the other hand, solution gas trapped in oil has been liberated due to pressure drop below bubble point. This phenomenon leads to another problem which is simplified using term *gas interference*. Previously, sand problem and gas interference been solved using different tools, sand trap and gas anchor cup type (GACT) which is not really reliable to handle those two problems at the same time. We introduce a tool to overcome that problems named MPR (Multi Problem Resolver).

This paper will discuss about concept, design, and how to install this MPR on SRP so that sand problem and gas interference can be handle at the same time with longer lifetime than using conventional sand trap and GACT. Also we want to present success story when using this MPR on our SRP.

2. Basic Theory

Sucker Rod Pump using rotational movement into up-down movement of the rod to suck liquids from the wellbore. Sometimes the liquid is not clean enough that can affecting pump efficiency to lift. Sand and gas interference are two main things need to be handled if we want to have good efficiency of the rod pump.

Sand can be separated using centrifugal and gravitational force. Meanwhile gas content can be separated from the liquid using some mechanical concept. Gas tend to be trapped inside liquid column, which is why we need to break that column to let the gas flow.

Basically, lighter component will go up, otherwise heavier component tend to go down.

3. Methodology

Main aspiration for our tools adapted from solid control equipment on drilling mud. Mud after circulation also have solid contents, which is represent sand, and gas contents, which is represent solution gas on crude oil. Sand and gas content need to be extracted from the mud, exactly the same as the problem when using SRP. Sand and gas need to be separated from the oil in order to prevent further problems.

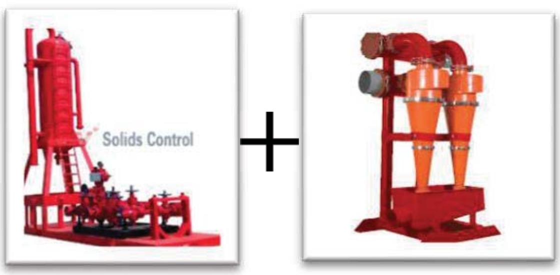

Figure 2. Solid control on Drilling Mud, this tools also removes gas content using separator-shape mechanism

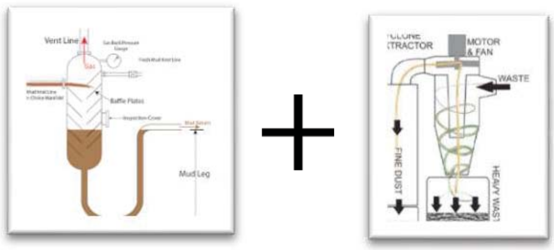

Figure 3. Separator-shape solid control to remove gas content and cyclone-shape to remove dust/sand

Multi Problem Resolver (MPR) combine this two mechanisms in one tools. This tools consist of tubing OD 3-1/2 inch with cappilary tube OD 1-3/4 inch and ID 1-1/4 inch inside of it. Then some metal plates plug in surface of the cappilary tube. On the end of the tube, we make some screw-shape welded part to make vortex flow. For intake, we make 2 holes in the upper part of the MPR. Above intake, there is another 2 holes to release gas which is accumulated from liberated gas from crude oil. This MPR installed below the downhole pump.

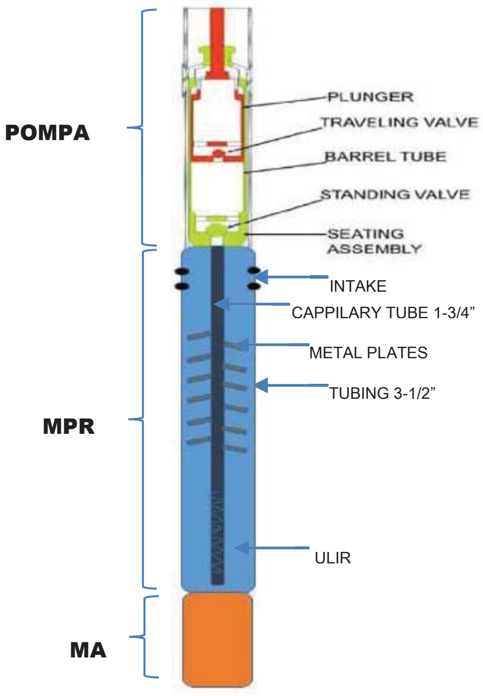

Figure 3. Design MPR, installed below downhole pump

Crude oil entering pump through intake. Liquids crash some metal plates and solution gas trapped inside crude oil liberated and fill the upper part of the MPR. When gas accumulated enough to reach holes above intake, the gas release to the anulus through those holes. After then, gas can be release via casing. On the other hand. liquid go down to the screw-shape at the end of the capillary tube. Here, vortex low appeared and sentrifugal force leads solid content (sand) to the edge of the flow (wall of the tubing). Sand deposit inside MA (Mud Anchor).

The main design of this MPR is calculation for the minimum length of capillary tube. Every 1 stroke of the pump needs to be conditioned to suck only the volume of the capillary tube. By this methods, some liquids need to queue before entering the tube. During this process, solid content dissolved in the fluid also separated by gravitational force which give solid content separation better result.

Calculation for minimum capillary tube shown as below:

Volume 1 stroke = Volume Cappilary Tube

$$= \text{SL x plunger area}$$

$$= 86\text{''} \text{ x } \frac{\pi \times (2.25")^2}{4}$$

$$= 342\ in^3$$

Minimum Capillary tube length =

$$\frac{volume\ 1\ stroke}{cappilary\ tube\ area}$$

$$= \frac{342}{\frac{\pi}{4} \times (1.25")^2}$$

$$= 435.4 \text{ in} = 11 \text{ m}$$

Here, we use THM 2.5 inch, plunger 2.25 inch with stroke length 86 inch. Longer cappilary tube provide longer time for settling process which leads to better separation result.

4. Result and Discussion

Liquid produce from the reservoir enter pump firstly through intake, which is MPR itself. By using MPR, the quality of this liquid is better than without using it. MPR become screen-like tools to differ liquid, gas, and solid content (sand).

MPR has been installed in Sangatta well-A and provide better lifetime. Before using MPR, well service conducted every 5 months and after using MPR, well service has become only once every 10 months.

MPR provide better lifetime and minimizing downtime due to well service operation hence there are opportunities for rig to move to another well and also economical benefits. Downtime well become shorter because well service rarely done.

5. Conclusion

1. MPR use solid control mechanism to separate sand and solution gas in crude oil.
2. MPR use some metal plates to remove gas trapped in crude oil, while sand separate from crude oil by utilize centrifugal and gravitational force.
3. The longer capillary tube, the longer time for sand to be settled hence make the separation process better.
4. MPR need to be installed in a well with good submergence because back to basic, downhole pump need to be sink inside liquid column.

6. References

Robelius, F. (2007): Giant Oil Fields - The Highway to Oil: Giant Oil Fields and their Importance for Future Oil Production, Uppsala University, Sweden

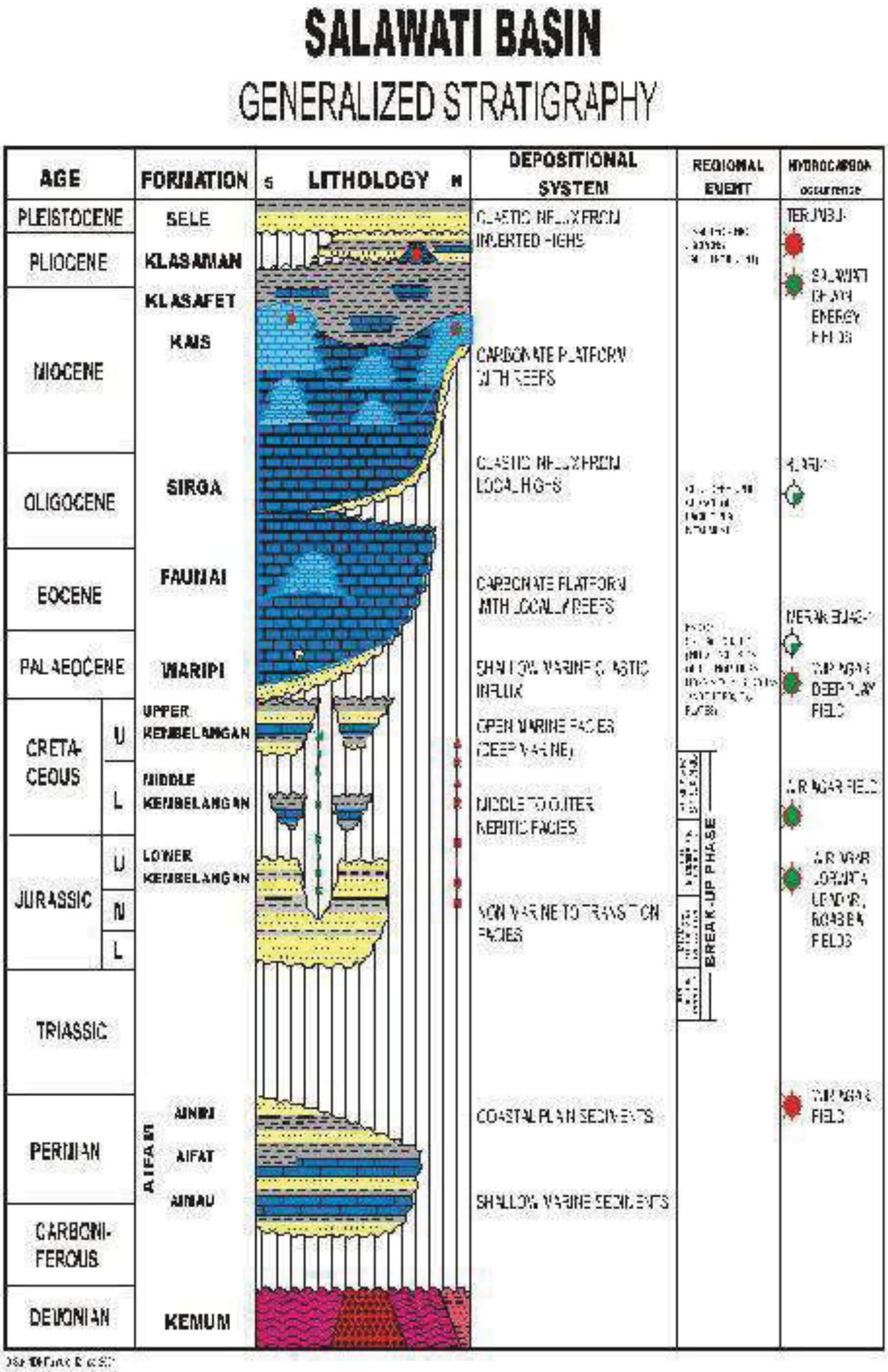

Figure 4 Well X-25 Stratigraphy