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## Screen Liner Application in Down Hole Pump Assembly in Air Serdang Wells, PHE Ogan Komering

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# SCREEN LINER APLICATION IN DOWNHOLE PUMP ASSEMBLY AS OPTIMAL AND EFFICIENT WAY OF PRODUCED SAND PROBLEM HANDLING IN AIR SERDANG WELLS, PHE OGAN KOMERING

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**Abstract**

Ogan Komering Block, operated by Pertamina Hulu Energy (Ogan Komering) Ltd., is located in South Sumatera, approximately 40 km south of Prabumulih, covered 1,155 km² working area. The Air Serdang field as one of fields in PHE Ogan Komering Area has been producing from Baturaja Formation (BRF carbonate) and Talang Akar Formation (TAF sand) which is consist of sand-stones with range from fine to coarsely grained, and are generally well sorted with good porosity (14% - 22%) and permeability (10 mD - 300 mD). The sand produced from Talang Akar Formation has been influencing performance of the wells due to decreasing well production, formation damage and equipment failures. Several efforts in sand control methods have being tried to reduce the problem. Through the new application of wire-wrapped screen liner installed in the downhole pump, it minimizes the sand problem, improve the oil production and save the well cost operation due to well & equipment failures. This application is to easy, practice in installation & operation and cheaper than other applied sand control methods. In this paper, the successful of this application will be compared with the previous sand control method (sandtrap) based on run life of the well, production impact and cost saving due to reducing impact of well & equipment failures. It also compares the best of wire-wrapped screen slot opening size based on slot opening size ever installed in the oil well to look for the appropriate screen liner size for the future of better sand control method at wells in Air Serdang Field area in particular and Ogan Komering block in general.

Keywords: sand, grain, failure, screen liner, wire-wrapped, slot opening

## 1. Introduction

Sand produced from formation alongside formation fluids (oil, gas and water) is one of the oldest problems in the oil industry and brings the impacts on safety, economic and environmental problems as its consequences. Sand production happens in oil and gas wells when the formation has low strength and load that causes releasing sand particles flowing with reservoir fluids from formation to the wellbore until the surface.

Preventing the produced sand is very important because it cuts the tubular and surface equipment causing loss of well integrity, reduced oil and gas production, reducing the company profit and the worst things can cause fatalities in the field operation.

Ogan Komering blok has several active fields, such as Air Serdang as a main productive field, Guruh, North Central Air Serdang, South Air Serdang and Mandala. Figure-1 shows Ogan Komering block area map and active productive fields. Total oil production from this block is about 2,331 BOPD. The block is being produced from Baturaja Formation (BRF carbonate) and Talang Akar Formation (TAF sand) which is consist of sand-stones with range from fine to coarsely grained, and are generally well sorted with good porosity (14% - 22%) and permeability (10 mD - 300 mD). The sand produced from Talang Akar Formation has been influencing performance of the wells, especially in area Air Serdang and South Air Serdang. The block, especially Air Serdang field has been producing since November 1989.Total development wells in Ogan Komering block is 177 wells, both producer and injector wells where active well producer wells are 51 wells up to date. 87% of producer wells using artificial lift ESP and 13% remaining using Pumping Unit. The Talang Akar formation is being produced by 7 active wells and contributing about 200 BOPD. This formation is facing sand problem creating well failure and increasing cost of operation and reducing oil production, especially ASD-14 well. Figure-3 illustrates well schematic of ASD-14 well. In this paper will discuss couple sand control techniques installed at ASD-14 wells with very low cost operation but giving very effective produced sand prevention with very optimal result in run life, efficient operating cost and keep oil produced.

## 2. Methodology

There are numerous techniques are available for handling with sand production from the wells. These range from simple application to expensive methods. The selected sand control methods depend on specific site conditions, operating practices and economic considerations[1)]. The methods that are employed to control sand production among others.

- Maintenance and workover
- Rate exclusion
- Selective completion practices
- Plastic consolidation
- High energy resin placement
- Resin coated gravel
- Slotted liner or screens without gravel packing
- Slotted liner or screens with gravel packing

As selected sand control techniques are chosen based on specific conditions and operating, the best technical solution of sand control may not be the best economic solution. In Air Serdang field, the real issue is which operating practice is the most economic for the field condition due to mature field with low oil production by wells and limited rig equipment and crew's skills in working with down hole sand control equipment.

Based on these conditions and operations, the assessments and evaluations have been identified to choose the optimal sand control methods. Maintenance and workover method through sand bailing, washing and cleaning of surface facilities on a routine basis to maintain well productivity looks the simple and cheap method which is suitable with the operating condition of rig equipment and crews' skill, but it will give the negative impact on high well failures, more rig service needed, low production performance and plugging on surface pipe or surface equipment. This alternative doesn't match with expectation to be implemented in Ogan Komering area. Production rate management and selective completion practices for getting optimal oil rate without sand production will reduce the ability of maximum Talang Akar formation production which also has declining reservoir pressure. Plastic consolidation, placement resin, slotted / screen liner with or without gravel packing becomes challenges in economic consideration which is relatively too expensive for low production wells and creating high reducing pressure drop at low reservoir pressure at Talang Akar formation and more investment in rig equipment to provide the tools to install or doing the well services for screen liner with or without gravel packing installation. It becomes challenges in economical consideration.

The best selected sand control method applied in Air Serdang field is to install the mechanical sand control unit below the down hole pump since the sand production is not too big where the application is cheap and simple in operating. There are 2 types of down hole sand control units installed below down hole pump are discussing in this paper. The previous model is called sandtrap which is known and sold in the market meanwhile another one as a new designed by the author working together with the screen manufacture which uses wire-wrapped screen with pipebase installed in down hole pump.

### 2.1 Sandtrap

The sandtrap downhole desander is run in the tubing below a downhole pump. Centrifugal action separates solids such as sand, scale from the fluids. The solid particles settle by gravity into the bull-plugged mud anchor joints or the rathole.

Figure-4 illustrates sandtrap model and figure-5 describes the flowpath of sandtrap mechanical work where formation fluid enters the tubing thru the inlet slots. The fluid must flow down thru a spiral to enter the orifice tube and flow upward to the pump. Centrifugal action created by the fluids flow thru the spiral push solids away from the fortex flow of the orifice tube. Solids settle into the mud anchor or rathole. The clean fluids flow upward thru the orifice tube to the pump[2)]. The price of this sandtrap is about USD 2,000,- per unit.

### 2.2 Wire-wrapped screen liner

The wire-wrapped screen liner (WSL) was chosen as to filter formation fine from the produced fluid, with the assumption that formation material is continually being deposited on the outer surface. In order for the screen to function properly, it must provide high-sustained flow rates without being eroded. The screen is manufactured by wrapping a triangular shaped (keystone) wire into a section usually referred to as a jacket which the keystone shape minimizes plugging. The jacket can be welded to a pipe base containing 70-140 holes per foot which serves as a structural support and provides filtration. The slot opening can also be wrapped to a specified width, which is typically –0.002 to +0.001 inch)[3)]. Figure-8 shows a drawing design of typical wire-wrapped screen. This unit is costly USD 5,500.- per unit and designed by the author with one of screen liner manufacture in Indonesia.

There are 2 type of wire-wrapped screen liner opening size models which was installed at the same well (ASD-14 well) in different production periods. These 2 opening size will also be compared its result to get the best appropriate screen liner slot opening size for Air Serdang field.

## 3. Ogan Komering Sand Problem and Selected Mechanical Sand Control Method

During 2017, there were 57 workovers (mostly well service activities) by rig in PHE Ogan Komering area as shown in figure-2. One of 3 top well failures during 2017 was ASD-14 well caused by sand problem trapped inside tubing pump. The well is being produced using pumping unit and downhole tubing pump with sandtrap installed below the pump to reduce produced sand. Look at figure-6, the historical well failures at ASD-14 well when the run life of the well is very short and couple WS history showed that the run life was only 1-2 days after put on production after well service. The produced sand flowing inside the barrel of tubing pump in this well as main factor creating the well failure due to pump stuck. Figure-7 showed every well service at ASD-14 always found sand and solid material such as scale trapped inside the barrel. The problem created lost value in money and production opportunity as showed in table-1.

By this condition when current mechanical sand handling (sandtrap) as previous chosen sand control techniques in PHE OK area couldn’t handle at well ASD-14, there is opportunity to improve it. Assessment was conducted to technically improve the cheap mechanical sand control techniques but giving the optimal sand production handling. Sandtrap model was observed that its big and length hole caused the fine sand went to the inside of the pump easily. The sand with very small size combined with carbonate material from Talang Akar formaton is also very hard to be removed through gravitational process in sandtrap. Therefore, wire-wrapped screen liner was developed to change the mechanical sand handling process for separation through gravitational process changed to creating the barrier not to allow coarse sand size flows to the inside of tubing pump. The idea using wire-wrapped screen is to control opening slot which will not allow the sand passing and produced through the pump barrel which will cause pump stuck. This alternative will not also need the high cost since the wire-wrapped with pipebase screen not installed in the wellbore but it will be installed below the downhole tubing pump.

To design this kind of wire-wrapped screen liner, Talang Akar formation sand samples was sent to the laboratory for sieve analysis (see table-3). Based on the sieve analysis data, 50 % sand size distribution is < 0.15 mm (100 US Std Mesh or 0.0059 inch) which is grouped as fine sand. Because it will be installed below the tubing pump, so 2-7/8" pipebase was selected with72 hole/ft in 20 ft length. The slot opening was chosen in 2 types which are 0.0394 inch and another type is 0.012 inch. The consideration to choose these size is hoping the fine sand size still pass the screen and will be produced to surface without disturbing the pump but still produce oil optimally and the coarse sand which can disturb the tubing pump will be stopped at outer surface of the screen. If the slot opening is designed smaller than those size, it will possible create the bigger pressure drop and oil probably couldn't pass the slot opening which causes decreasing the oil production. Figure-9 shows the differences between sand trap and wire-wrapped screen liner where wire-wrapped screen liner has longer length intake and smaller slot opening which will give advantages in blocking the coarse sand & other solids material than sandtrap but giving bigger production due to longer length intake design.

## 4. Result and Discussion

Refer to table-2 where historically repeated sandtrap installed below 2.5" tubing pump before well service on 25 November 2017 showed not giving the optimal solution in sand control handling at ASD-14 well. Many times, this technique only has run life less than 2 days. The oil production is only 40 BOPD average, but it lost oil production during well down and taking couple days to activate the rig for well service before putting back on production.

On 25 November 2017, when first wire-wrapped screen liner 2-7/8" PBS with 0.0394" slot opening was installed below the 2.5" tubing pump and it could run 99 days. It showed better result compared run life of sandtrap. Oil production and fluid production also showed better result which is almost double about 80 BOPD average.

On 16 March 2017, another slot opening wire-wrapped screen liner 2-7/8" PBS 0.012" with smaller than previous type was installed with 2.5" tubing pump during well service. This type showed not optimal result in oil production when its production is about 28 BOPD average, increasing the gas production from 36 MSCF average to 46 MSCF average. Increasing the gas number showed that oil is more difficult to pass the screen meanwhile the gas is easier to pass the screen as mechanical barrier to flow inside the downhole pump. This condition will not only create more plugging at outer the screen liner but also create possible gas lock inside the tubing pump when more gas flow to the pump while less fluid production.

Figure-10 shows sand and solid plugging on outer surface of wire-wrapped screen liner that proves mechanical barriers to handle sand production at well ASD-14 well is effective enough.

## 5. Conclusion

Based on the data installation results of sandtrap, wire-wrapped screen liner 0.0394" and 0.012" slot opening can be concluded as follow:

a) Sandtrap with price USD 2,000,- per unit is alternative cheap sand control method, although in certain condition it's not effective due to giving short run life.
b) Wire-wrapped screen liner with 2-7/8" PBS in 20 ft lentg 72 hole/ft 0.0394" slot opening gives the optimal result in run life 99 days, increasing double production from 40 BOPD to 80 BOPD comparing with both 0.0012" slot opening and sandtap.The unit is also cheap USD 5,500,- per unit.
c) Wire-wrapped screen liner with 2-7/8" PBS in 20 ft length 72 hole/ft 0.012" slot opening also can extend the production 96 days on 1st installation but only 7 days in run life for the 2nd installation. The smaller slot opening size reduced the production almost a half compared with the slot opening 0.0394" and also increased the gas production. The condition will probably create not only more solid material plugging but also probably gas lock condition will more happens.

## 6. Recommendation

Based on the above conclusions, authors therefore recommend that the wire-wrapped screen liner with 2-7/8" PBS in 20 ft lentg 72 hole/ft 0.0394" slot opening is the optimal and efficient sand control technique for sand control method to be applied in Ogan Komering area. This technique is simple in operation and inexpensive ways where it is very adequate for the mature fields with low oil production wells.

## 7. Acknowledgement

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## 8. References

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5. **"Production Data Report",** PHE Ogan Komering

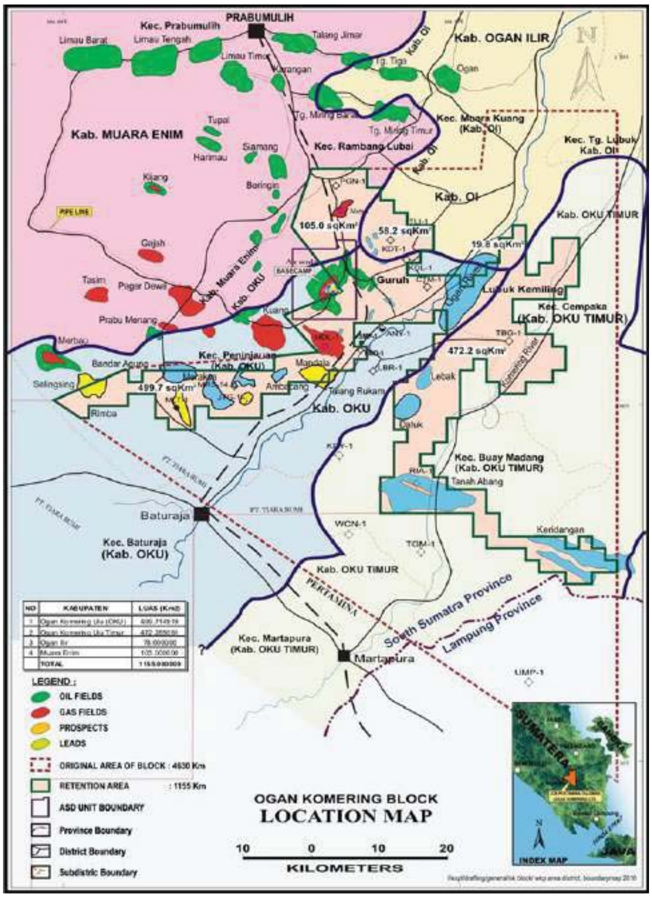



Figure-1. Ogan Komering Block Map

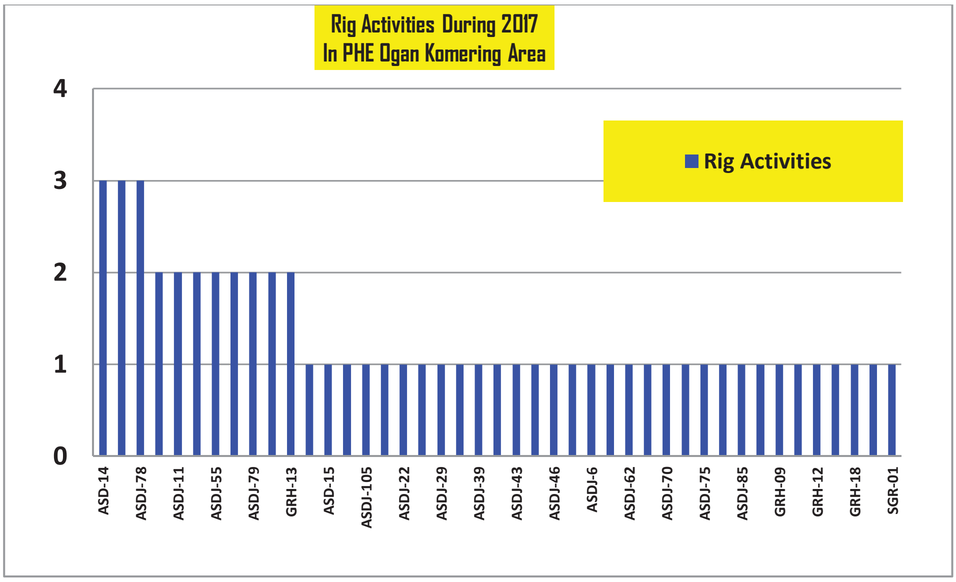



Figure-2. PHE Ogan Komering Rig Activities in 2017

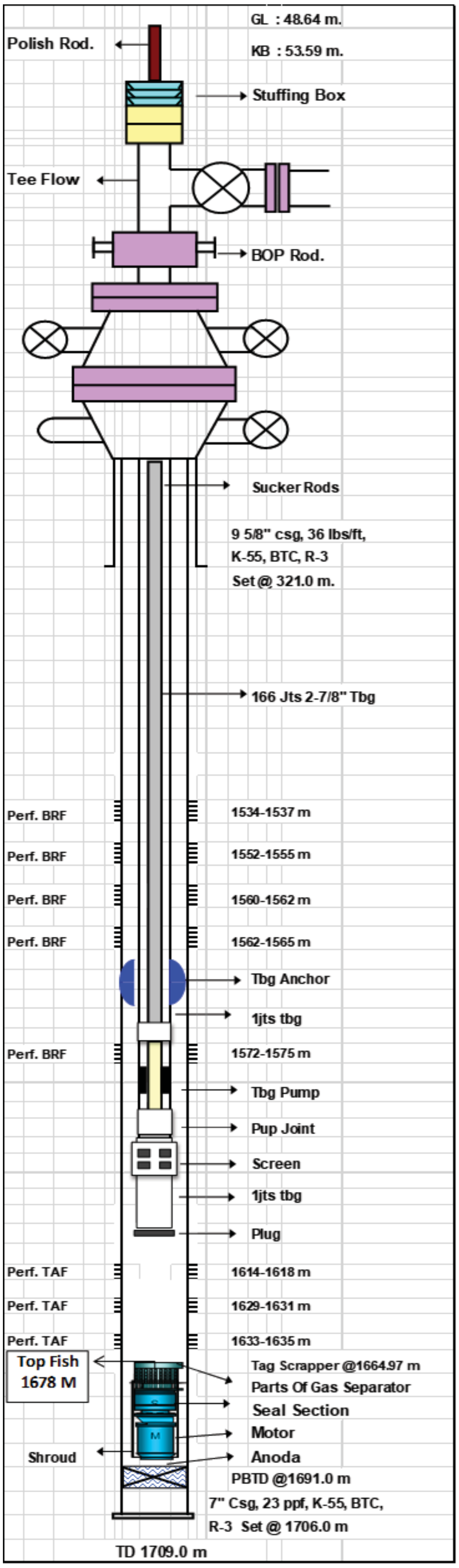
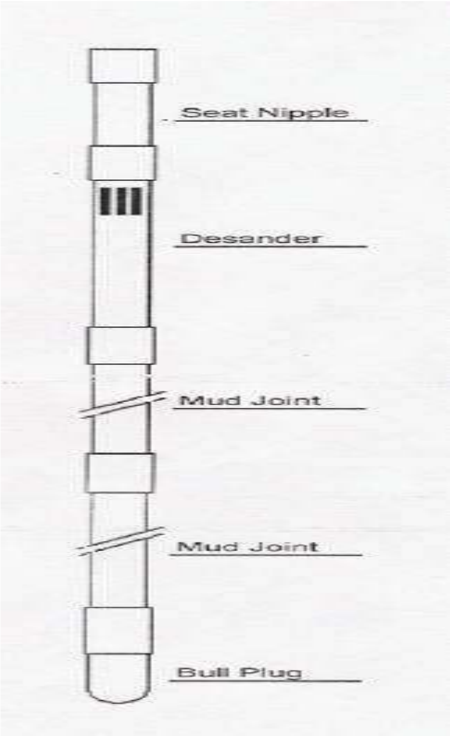



Figure-3. Wellbore schematic of ASD-14 Well



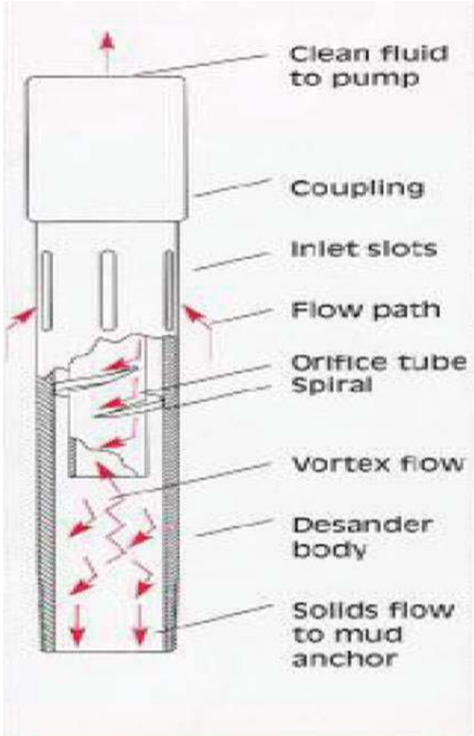




Figure-4. Sand trap model

Figure-5. The mechanical work of sandtrap

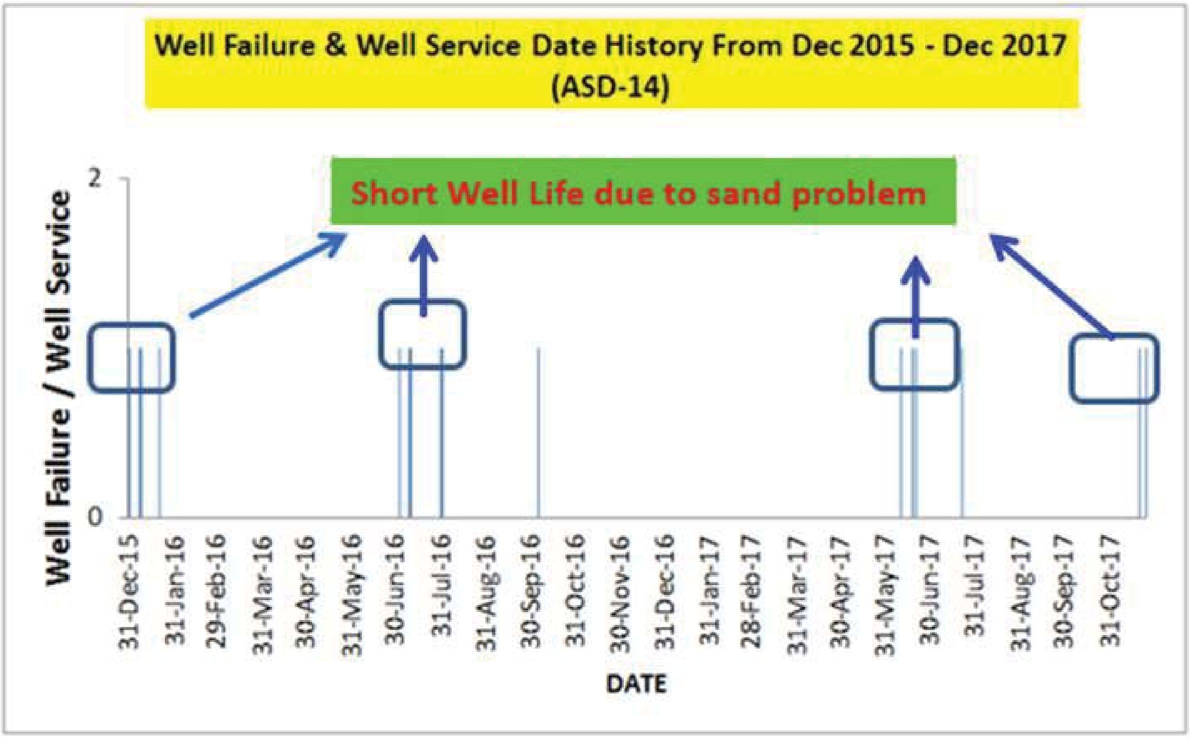



Figure-6. Historical well failure at ASD-14 we

Figure-7. Sand inside the tubing pump
during routine WS findings at ASD-14 well

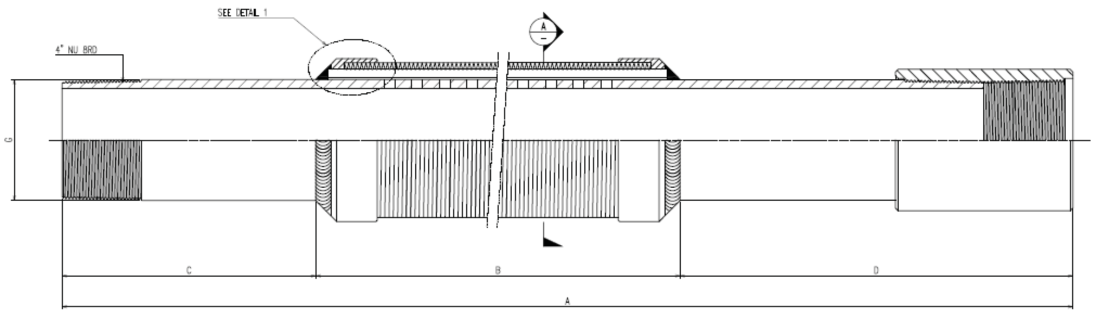



Figure-8. Drawing design of wirewrapped PBS 2-7/8" (slot opening 0.0394" & 0.012")

Figure-9. Comparison between sandtrap vs wire-wrapped screen with PBS 2-7/8"

Figure-10. Wire-wrapped screen liner covered by sand and other solid materials on its outer surface after pulling out during well service at ASD-14

Table-1. Historical Run life, WS cost & Waiting rig for WS at ASD-14

| Well Off | Finding Problem | Waiting Well Service (Days) | Run Life (Days) | WS Cost (Rp Million) | Sand Control Methods |
|---|---|---|---|---|---|
| 31-Dec-15 | Pump stuck (sand) | | | | SANDTRAP |
| 07-Jan-16 | Well Service | 7 | | 461 | |
| 08-Jan-16 | Pump stuck (sand) | | 1 | | SANDTRAP |
| 21-Jan-16 | Well Service | 13 | | 270 | |
| 03-Jul-16 | No Liquid Flow (sand) | | 164 | | SANDTRAP |
| 10-Jul-16 | Well Service | 7 | | 280 | |
| 11-Jul-16 | No Liquid Flow (sand) | | 1 | | SANDTRAP |
| 31-Jul-16 | Well Service | 20 | | 95 | |
| 01-Aug-16 | No Liquid Flow (sand) | | 1 | | SANDTRAP |
| 06-Oct-16 | Well Service | 66 | | 201 | |
| 11-Jun-17 | No Liquid Flow (sand) | | 248 | | SANDTRAP |
| 19-Jun-17 | Well Service | 8 | | 260 | |
| 21-Jun-17 | Pump stuck (sand) | | 2 | | SANDTRAP |
| 22-Jul-17 | Well Service | 31 | | **330** | |
| 20-Nov-17 | No Liquid Flow (sand) | | **121** | | SANDTRAP |
| 25-Nov-17 | Well Service | 5 | | **231** | |
| 4-Mar-18 | No Liquid Flow (sand) | | **99** | | WSL with PBS 2-7/8", 0.0394" |
| 16-Mar-18 | Well Service | 12 | | **250** | |
| 20-Jun-18 | No Liquid Flow (sand) | | **96** | | WSL with PBS 2-7/8" 0.012" |
| 4-Jul-18 | Well Service | 14 | | | |
| 11-Jul-18 | No Liquid Flow (sand) | | 7 | | WSL with PBS 2-7/8" 0.012" |
| No Tubing Pump Stock for WS | | | | | |

Table-2. Production Comparison Among Selected Sand Control Methods at ASD-14 Well (Sandtrap, Wire-wrapped PBS 2-7/8” 0.0394” and 0.012”)

| DATE | OIL (BOPD) | LIQUID (BFPD) | GAS (MSCF) | WATER CUT (%) | PERIOD | RUN LIFE | WS COST (Rp. Million) |
|---|---|---|---|---|---|---|---|
| 19-Jun-17 | No Test Data Yet | | | | SANDTRAP | 1 days | 260 |
| 27-Jul-17 | 29 | 42 | 27 | 31 | | | |
| 11-Aug-17 | 38 | 68 | 39 | 44 | | | |
| 22-Aug-17 | 38 | 87 | 33 | 56 | | | |
| 8-Sep-17 | 34 | 83 | 33 | 59 | SANDTRAP | | |
| 9-Sep-17 | 26 | 80 | 33 | 68 | | 121 days | 330 |
| 18-Oct-17 | 57 | 246 | 33 | 77 | | | |
| 19-Oct-17 | 53 | 110 | 33 | 52 | | | |
| 30-Nov-17 | 88 | 193 | 34 | 54 | | | |
| 12-Dec-17 | 80 | 162 | 40 | 51 | PBS 2-7/8", 0.0394" | 99 days | 231.3 |
| 26-Dec-17 | 72 | 143 | 34 | 50 | | | |
| 19-Mar-18 | 32 | 53 | 56 | 40 | | | |
| 31-Mar-18 | 16 | 162 | 54 | 90 | | | |
| 28-Apr-18 | 32 | 93 | 35 | 66 | PBS 2-7/8" 0.012 | 96 days | 250 |
| 18-May-18 | 33 | 101 | 38 | 68 | | | |
| 9-Jul-18 | 44 | 66 | 55 | 33 | PBS 2-7/8" 0.012 | 7 days | |
| TUBING PUMP PROBLEM AND NO STOCK TUBING PUMP | | | | | | | |

Table-3. Sieve analysis of Talang Akar formation sand

TABLE 1A: GRAIN SIZE ANALYSIS DATA

WELL/FIELD : J-104 DEPTH : 1672.42 M

LOKASI : JOB PERTAMINA-TALISMAN (OK) LTD.

| US STD MESH | WENWORTH SIZE CLASS | GRAIN SIZE INTERVAL (mm) | GRAIN SIZE INTERVAL Φ | WT (gr) | WT (%) | CUM. WT (%) |
|---|---|---|---|---|---|---|
| | | 4096.00 - 1 KM | -12 - -20 | | | |
| | Boulder | 1024.00 - 4096.0 | -10 - -12 | | | |
| | | 256.00 - 1024.0 | -8 - -10 | | | |
| | Cobble | 64.00 - 256.00 | -6 - -8 | | | |
| | | 16.00 - 64.00 | -4 - -6 | | | |
| 5 | Pebble | 4.000 - 16.00 | -2 - -4 | 4.09 | 4.10 | 4.10 |
| 6 | | 3.360 - 4.000 | -1.75 - -2.00 | 0.58 | 0.58 | 4.69 |
| 7 | Granule | 2.830 - 3.360 | -1.50 - -1.75 | 5.08 | 5.10 | 9.79 |
| 8 | | 2.380 - 2.830 | -1.25 - -1.50 | 0.98 | 0.98 | 10.77 |
| 10 | | 2.000 - 2.380 | -1.00 - -1.25 | 0.42 | 0.42 | 11.19 |
| 12 | | 1.700 - 2.000 | -0.75 - -1.00 | 0.71 | 0.71 | 11.90 |
| 14 | Very Coarse Sand | 1.400 - 1.700 | -0.50 - -0.75 | 0.78 | 0.78 | 12.69 |
| 16 | | 1.180 - 1.400 | -0.25 - -0.50 | 0.75 | 0.75 | 13.44 |
| 18 | | 1.000 - 1.180 | 0.000 - -0.25 | 1.15 | 1.15 | 14.59 |
| 20 | | 0.850 - 1.000 | 0.250 - 0.000 | 1.29 | 1.29 | 15.89 |
| 25 | Coarse Sand | 0.707 - 0.850 | 0.500 - 0.250 | 0.42 | 0.42 | 16.31 |
| 30 | | 0.600 - 0.707 | 0.750 - 0.500 | 0.97 | 0.97 | 17.28 |
| 35 | 1/2 mm | 0.500 - 0.600 | 1.000 - 0.750 | 1.03 | 1.03 | 18.32 |
| 40 | | 0.425 - 0.500 | 1.250 - 1.000 | 1.10 | 1.10 | 19.42 |
| 45 | Medium Sand | 0.355 - 0.425 | 1.500 - 1.250 | 1.80 | 1.81 | 21.23 |
| 50 | | 0.300 - 0.355 | 1.750 - 1.500 | 2.55 | 2.56 | 23.79 |
| 60 | 1/4 mm | 0.250 - 0.300 | 2.000 - 1.750 | 6.00 | 6.02 | 29.81 |
| 70 | | 0.212 - 0.250 | 2.250 - 2.000 | 5.93 | 5.95 | 35.70 |
| 80 | Fine Sand | 0.180 - 0.212 | 2.500 - 2.250 | 5.48 | 5.50 | 41.26 |
| 100 | | 0.150 - 0.180 | 2.750 - 2.500 | 4.08 | 4.09 | 45.35 |
| 120 | 1/8 mm | 0.125 - 0.150 | 3.000 - 2.750 | 9.23 | 9.26 | 54.62 |
| 140 | | 0.106 - 0.125 | 3.250 - 3.000 | 4.69 | 4.71 | 59.32 |
| 170 | Very Fine Sand | 0.090 - 0.106 | 3.500 - 3.250 | 3.38 | 3.39 | 62.72 |
| 200 | | 0.075 - 0.090 | 3.750 - 3.500 | 2.80 | 2.81 | 65.53 |
| 230 | 1/16 mm | 0.063 - 0.075 | 4.000 - 3.750 | 2.99 | 3.00 | 68.53 |
| 270 | | 0.053 - 0.063 | 4.250 - 4.000 | 1.39 | 1.40 | 69.92 |
| 325 | Coarse Silt | 0.045 - 0.053 | 4.500 - 4.250 | 1.42 | 1.43 | 71.3 |
| PAN | | 0.037 - 0.045 | 4.750 - 4.500 | 28.55 | 28.65 | 100.00 |
| | | 0.031 - 0.037 | 5.000 - 4.750 | | | |