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Achieving Top Performance Installation of Conductor Pipe Partition Separation System in Offshore Mahakam: Beyond the Learning Curve

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Abstract. Conductor Pipe Partition System (CPPS) is a system that allow drilling 2 wells from one conductor pipe. This system could bring noteworthy advantages for the development of oil and gas field by decreasing the size and/or number of platforms and to offer additional reserves access from current platform. CPPS have been utilized in Offshore Mahakam since 2005. 10 years of installation from 2005 – 2015 experience a lot of operation problem during installation due to various factor.
This paper describes trouble-free technique and procedures for conductor pipe partition system installation. Misalignment, twisting CPPS, turning pipe are common problem during installation. Failed troubleshoot might result in loss of new slot for 2 wells. Conductor pipe shall be cleaned out properly to ensure smooth wall at inner part of conductor pipe with proper mud inside. Running procedure of conductor pipe partition system development involves preparation in warehouse, high competence personnel on board and also procedures in place to solve the problem when obstruction during running occurred.
Since 2018 until 2022, CPPS are installed on 10 slots and 20 wells have been successfully drilled and completed. Procedure development resulted efficient learning curve from 5 days installation into 2 days installation. As a consequence, 6 million dollars of cost-saving are achieved comparing to previous procedure. With current CPPS performance, future offshore Mahakam platform will utilize CPPS in order to optimize number of slot and well can be drilled from the platform.

Keyword(s): Conductor Pipe Partition System, Splitter Wellhead, Cost Saving, Offshore Platforms

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1 Conductor Pipe Partition System Introduction

Mahakam offshore field has been operating for 50 years with 4 fields production area, they are Bekapai, Peciko, South Mahakam, and Sisi-Nubi. The first discovery on 1972 in Bekapai field and the first oil production on 1974. With the current condition, the Mahakam field is a marginal field. Refer to SPE International, Marginal field is the field which have not been exploited for long, due to one or more of the following factors:

1. Very small sizes of reserves/pool to the extent of not being economically viable
2. Lack of infrastructure in the vicinity and profitable consumers
3. Prohibitive development costs, fiscal levies and technological constraints

However, should technical or economic conditions change, such fields may become commercial fields.

To carry out the development of marginal fields, there are quite a few challenges and innovations that are needed, so that fields can be produced economically. One of the challenges in the Mahakam offshore field with marginal field conditions is the limitation of slots that will be drilled from a platform.

In the current condition, it is necessary to modify (optimize) the platform, so it can still be produced economically. If continue to utilize the old design platform, it will result in the field being unable to be produced economically, so optimization of the platform used offshore Mahakam at its current condition is needed. With this optimization, the size of the platform becomes smaller and has an impact on the number of slots on the platform. There is a reduction in the number of slots on the platform at this time, if previously there were 9-15 slots on one platform, for the current platform there are only 3-6 slots on one platform, so there is a slot limitation for drilling on a platform on at the moment.

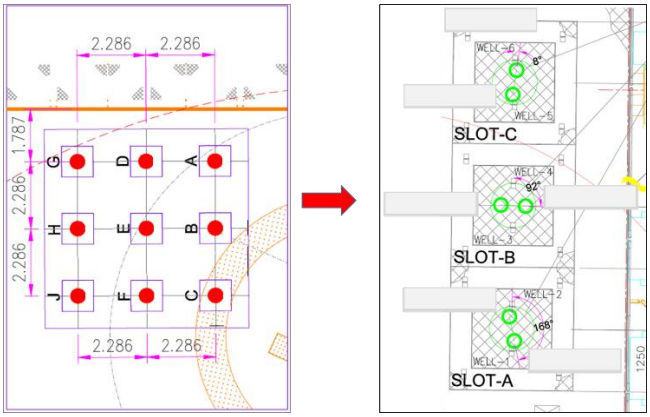

Figure 1 Well Slot Optimization

To still be able to carry out drilling optimally to produce from one platform with slot limitation conditions, the improvements are implemented by utilizing Conductor pipe partition system (CPPS). CPPS is a system that allow drilling 2 wells from one conductor pipe. This system could bring noteworthy advantages for the development of oil and gas field by decreasing the size and/or number of platforms and to offer additional reserves access from current platform.

Drilling operation in offshore Mahakam has been utilized the Conductor Pipe Partition System (CPPS) since the development well in Peciko gas fields on 2003 with the application in 30" conductor pipe dual splitter wellhead. From the CPPS operation on 2003 need evaluation to improve the operation performance and aim the objective to drill the well safely and economically. The things that can be improved after CPPS operation in Peciko on 2003 are (1) standardizing the design of the CPPS to improve compatibility with wellhead equipment; (2) reducing the time required to run CPPS in each well; (3) applying installation CPPS for 36" CP, it will relate to well schematic and well type.

CPPS installation is very critical in splitter well, this is because while running CPPS has the potential to be twisted. If CPPS is twisted, it will have an impact on RIH BHA which makes BHA unable to pass thru CPPS. If this is not repaired, it will lose the slot and certainly lose the well due to not being able to do the drilling. However, if want to solve the CPPS twist tendency, it takes additional time to repair it by taking time for POOH CPPS and RIH back which will take quite a lot of time and result in Well costs.

This happened in one of the wells in the Bekapai field. It took time 168 hours to solve the CPPS twist tendency. Assuming the drilling operation spread rate cost per day is $175,000, an additional cost of up to $1,222,000 is required to repair it. If compares to the average CPPS installation duration if it is smooth, it is 25 hours or the equivalent of about $182,291. So, the CPPS installation is quite critical in offshore drilling operations with splitter well because it will have an impactful on further operations.

Currently, to find out whether the CPPS is a twist or not, a gyro survey will be performed in the tubing booster line. The gyro survey results will be imported to the tool to analyze whether the CPPS tendency is a twist or not. The following is an example of the CPPS being twisted and not twisted.

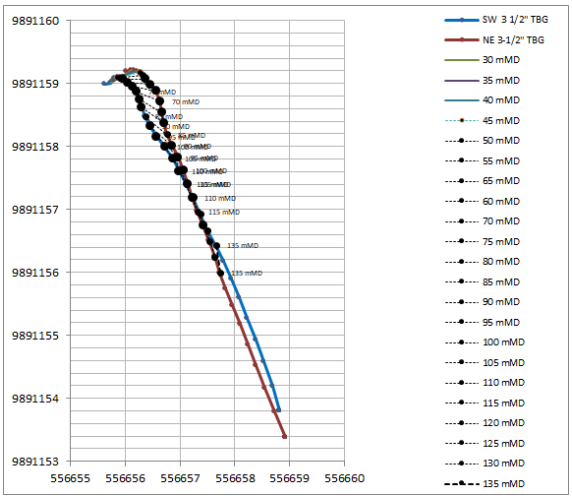

Figure 2 CPPS Twist Tendency

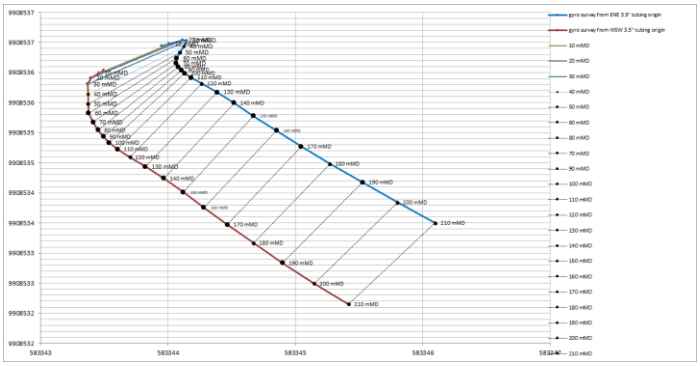

Figure 3 CPPS Not Twist Tendency

These tools help drilling engineers to take decisions more quickly and effectively, so as not to interfere with the drilling operation process.

Recently, the CPPS application in offshore Mahakam in 36” conductor pipe and has several improvement to ensure have better performance and reduce the risk that can occur while CPPS operation, utilize the tools to find out the gyro survey inside tubing booster line result, and all the improvement that has been implemented in offshore Mahakam will give the impact to reduce operation cost.

2 Conductor Pipe Partition System (CPPS) Improvement

Since 2003, more than hundred wells have been completed with CPPS / CSW system. Along utilization, gradual improvements have been performed.

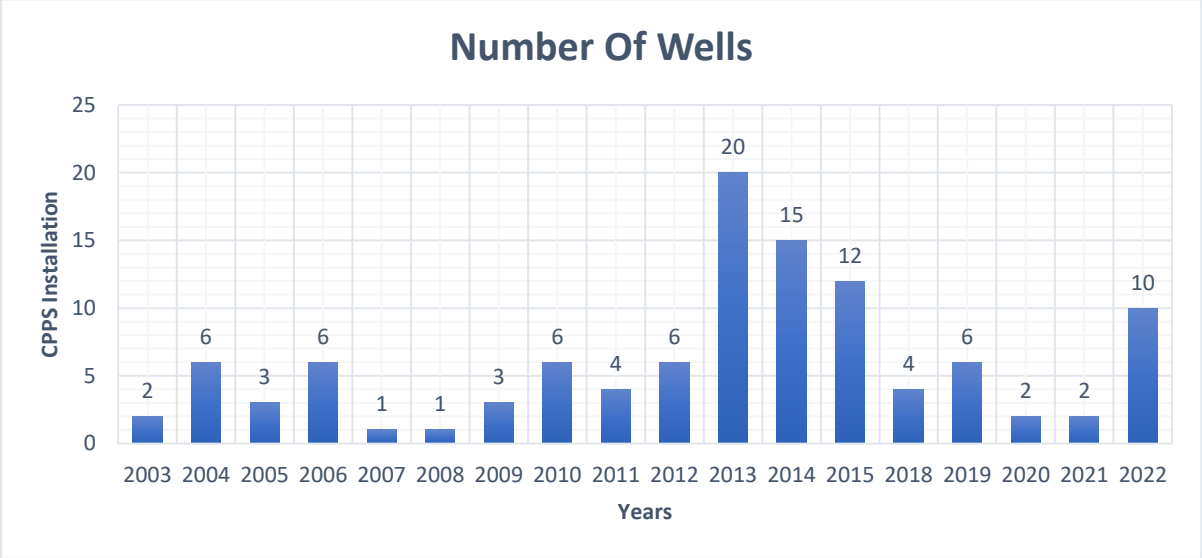

Figure 4 Number of Wells have been Completed with CPPS / CSW System

a. Accuracy of CPPS installation
   In the beginning phase of CPPS, improvement was performed in the operation side, with focusing on quality of the execution, such as booster line and CPPS centrality. This demand shall be paid off by adequate rig time to accommodate correction due to "trap torque" with "twisting" risk. As base case, it was about an hour taken to install 1 partition. In a well, estimate partition required is 85 – 100 partition. No wonder, it took 3 days for 1 operation of CCPS. It was accepted, considering risk of NPT or ILT that might be resulted for next phase of drilling, 16" BHA pass through CPPS.
b. Partition Design Improvement
   In the beginning partition utilization, the design was robust and relatively "bulk". This is quite time consuming to allow operation safe in term of handling risk. Improvement then performed to reduce the thickness, without jeopardizing the objective.
   In 2022, another design approach is launch by another provider. It is not only about the thickness, but also installation design which need only 4 bolts instead of 8 bolts to set.
c. Tubing Booster Line Optimization
   Bottom most of tubing booster line is equipped with mule shoe and perforated joint above it to provide circulation means later on during cementing operation
d. Operation Optimization
   In the operation side. Several modification was performed to reduce the time required.
   1. Clean Out
      Cleanliness of inside CP also contributes to the duration of CPPP run. Any soil left may increase "risk of twist". In 2022, clean out BHA inside CP then modified to have only 0.1" clearance.
   2. Running Operation

Since initial phase, every partition run shall be string up and down to release possible "torque" trap to prevent CPPS twist. This approach then be performed no more. Unless twist tendency occurs.

3. Optimize duration by reducing frequency of reciprocating
   Once CPPS showing twisting tendency (hatch cover not tightly closed), directly re-align tubing with chain block and do reciprocating as required until hatch cover can be closed properly. Reciprocated too frequently may cause more operating time for the CPPS installation.

3 CPPS Operation

3.1 CPPS Installation Procedure

Improvement in CPPS is extended to not only limited in the CPPS design, but also in the installation procedure. An optimization in CPPS installation procedure is developed with the aims to further reduce the CPPS installation duration. The lesson learned and room for improvement in every drilling campaign is captured and evaluated to continuously improve the procedure. As of now, the optimized CPPS installation procedure are as follow:

1. Drill 2 alignment pin holes on top of Conductor Pipe (CP) as place to install bolt to sustain funnel entry guide. The position of the pin holes is perpendicular with actual azimuth on CP shoe, which will be reference as CPPS & tubing booster line orientation.
2. Install funnel entry guide on top of CP, sustained with the bolt installed at pin holes. Funnel entry guide will be the base to install split hatch cover.
3. Install split hatch cover on top of funnel entry guide. Split hatch cover will be used as an indicator that the CPPS and tubing booster line is not twisting.
4. Install split weather deck landing ring on platform top deck, with direction align with pin hole orientation on top of CP. These part of equipment are used to guide and align tubing booster line prior CPPS installation on top of CP.
5. Set dual spider slip on rotary table with direction align with pin hole orientation on top of CP.
6. Make up and run in hole tubing booster line until last joint of tubing is above the split hatch cover on top of CP and continue to install CPPS between tubing booster line.
7. Continue make up & run in hole tubing booster line and install CPPS. Historically, CPPS spacing was initially installed every 8 m gap. However, due to CPPS twisted issues, CPPS spacing is reduced and will be determined by well inclination. CPPS will be installed every 2 m at depth interval with less than 2° inclination and every 1 m at depth interval with more than 2° inclination. This practice is considered the most reliable one as of now, as it provides more stiffness and less tendency of CPPS twisting.

CP Inclination	Down Hole Guide Spacing
Inc < 2°	2 m
Inc > 2°	1 m

8. On each CPPS installed, the split hatch cover needs to be ensured that it can be closed tightly, as indication that the tubing booster line is not twisted. During the beginning of CPPS utilization, the tubing was reciprocated every 6 m running as the mitigation to minimize CPPS twisting tendency. However, this practice is very time consuming and does not give additional value if the twisting tendency is not observed. Therefore, the practice is optimized by utilizing chain block to correct the CPPS orientation whenever a twisting tendency is observed. Tubing reciprocation will be only done as necessary if the twisting tendency still occurred after correcting the CPPS orientation with chain block.

9. After tubing booster line has been run to target depth and all CPPS has been completely installed, run gyro survey to check the CPPS final CPPS orientation.
10. If the CPPS orientation is good, continue to lower down landing ring from platform top deck on to top of CP. Proceed to cut tubing, install pin connector and continue to drilling surface section operation.

4 Summary / Conclusion

CPPS application not only contributes to cost savings but also opens a window to develop offshore Mahakam more efficiently. Along the implementation, continuous improvement is applied, either an engineering or operation approach can reduce the installation duration of CPPS and also for the well cost. The state-of-the-art and new benchmark may be an option for the development offshore fields in Indonesia.

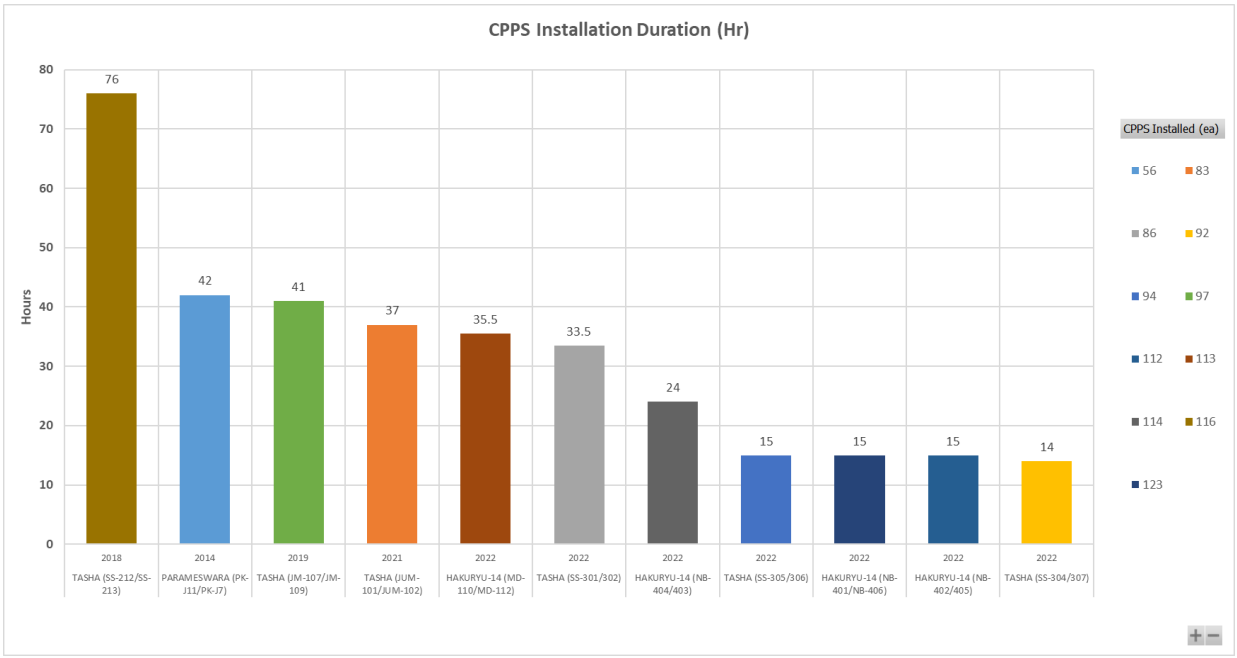

Figure 5 CPPS Installation Duration (Hr)

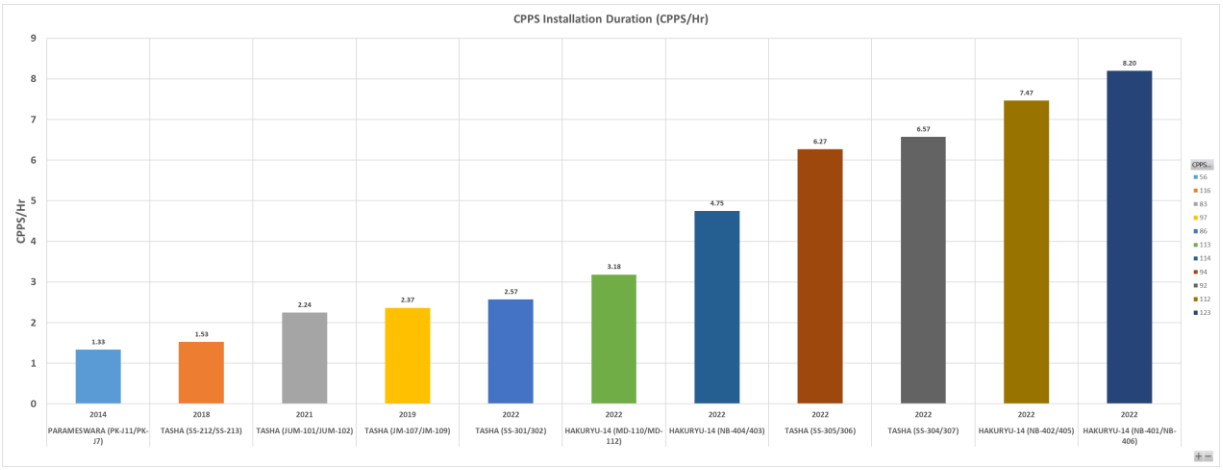

Figure 6 CPPS Installation Rate (CPPS/hr)

Appendices

Figure 7 Conductor Pipe Partition System

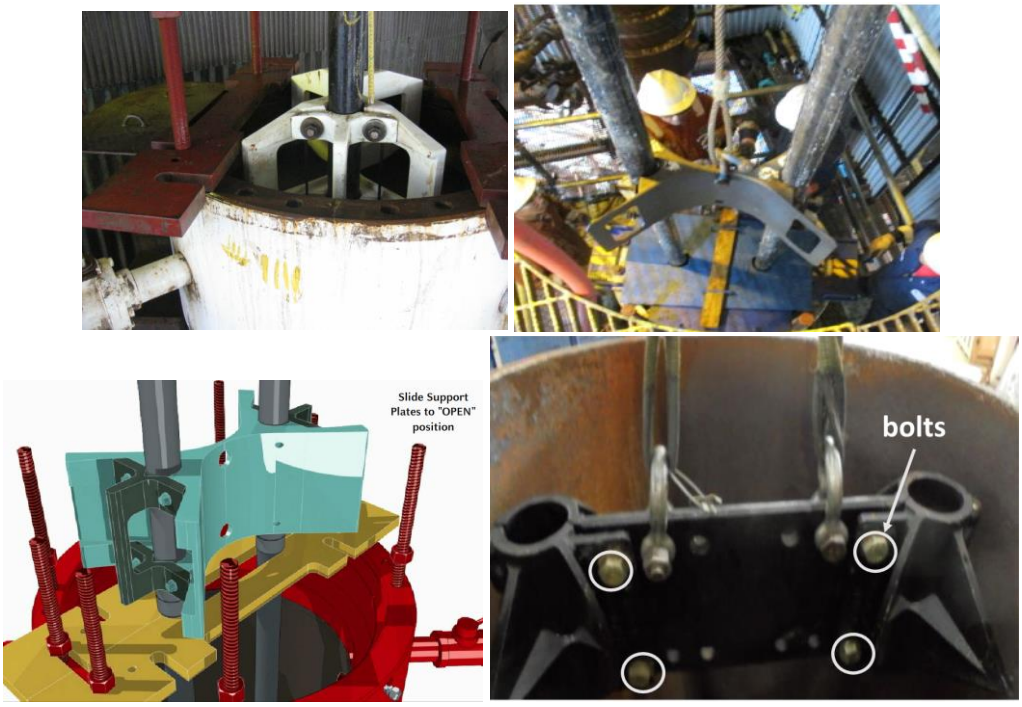

Figure 8 Partition Design Improvement

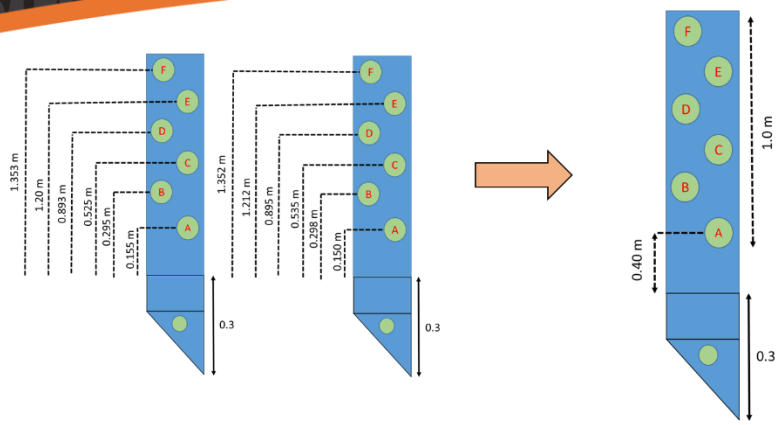

Figure 9 Tubing Booster Line Optimization

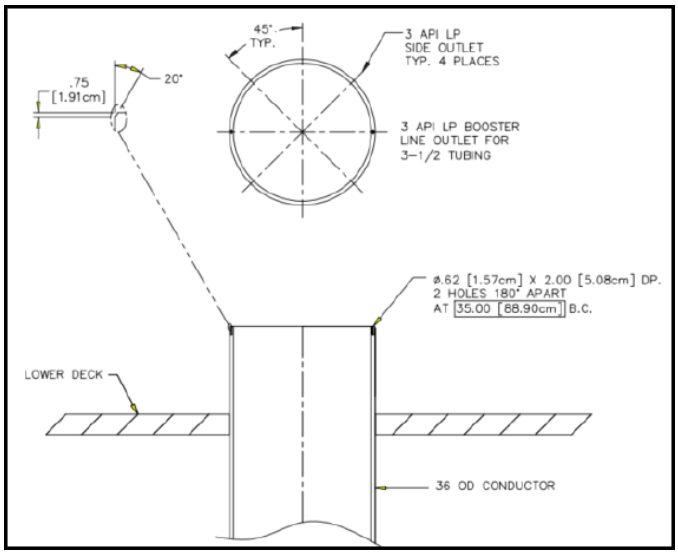

Figure 10 Drill Two Alignment Pin Hole

Figure 11 Install Funnel Entry Guide on Top CP

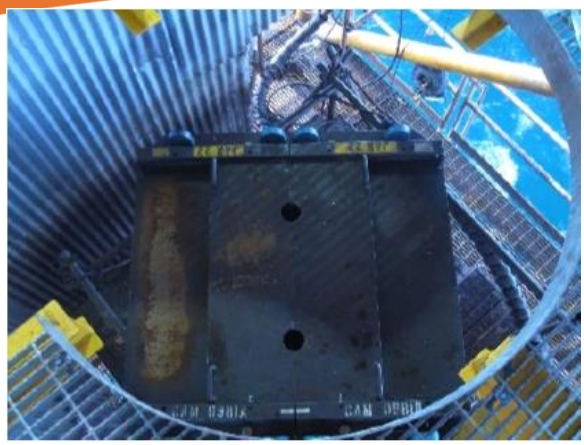

Figure 12 Install Split Hatch Cover on Top of Funnel Entry Guide

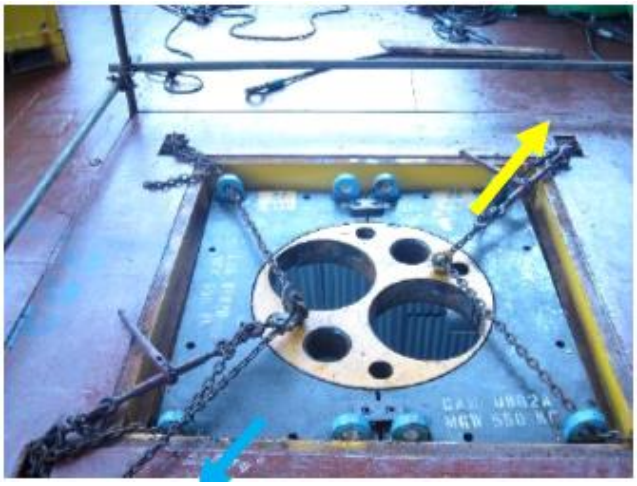

Figure 13 Install Split Weather Deck Landing Ring on Platform Top Deck

Figure 14 Set Dual Spider Slip on Rotary Table

Figure 15 Make Up & Run in Hole Tubing Booster Line and Install CPPS

Figure 16 CPPS Twisting Tendency and Chain Block Utilization While RIH CPPS

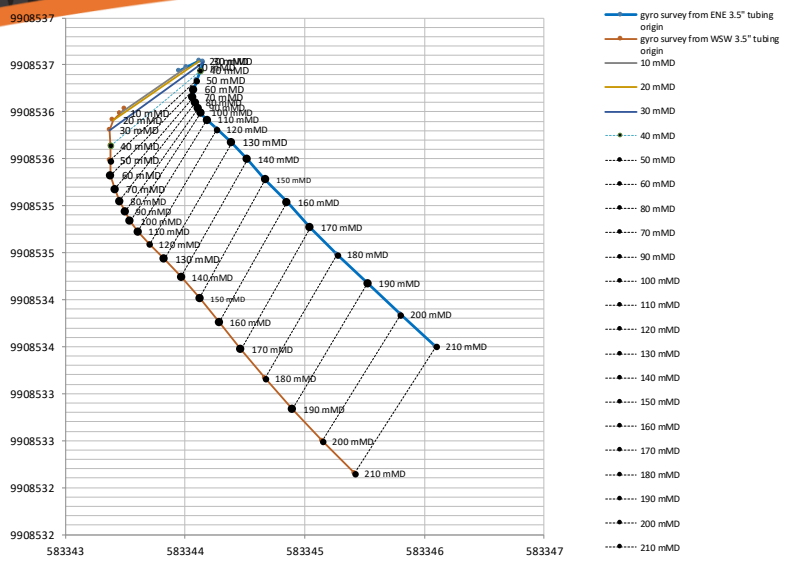

Figure 17 Example Gyro Result Inside Tubing Booster Line to Analyze Twisting Tendency of CPPS

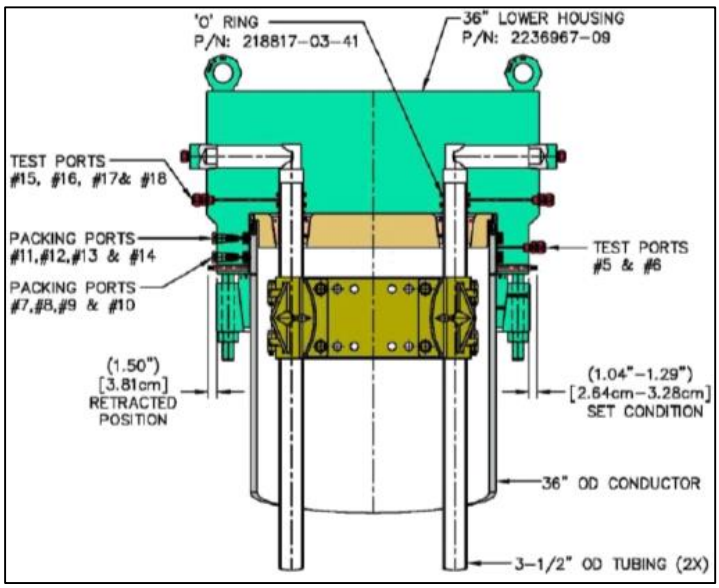

Figure 18 Installation of Pin Connector / Lower Housing

References

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