

Liner drilling technology being prepared for offshore

AN OFFSHOOT OF Tesco Corporation's Casing Drilling™ operations with ConocoPhillips in the South Texas Lobo field may have applications offshore with many of the same benefits. The operator drilled about 700 wells in the field before well costs rose too high in relation to the size of the reservoirs discovered. Casing Drilling operations were then introduced, resulting in reduced well costs primarily due to fewer wellbore problems.

The operator is working with Baker Hughes Incorporated, Tesco Corporation and the Department of Energy to bring the technology offshore, which is expected to result in both reduced cost and improved certainty regarding the cost of the well.

Depending on the circumstances, complete evolution and application of the Casing Drilling techniques to Close Tolerance Liner Drilling™ techniques offshore for the entire well could save ConocoPhillips as much as \$18 million compared to traditional techniques when drilling a 30,000 ft well in 6,000 ft of water. The operator would AFE such a well for about \$50 million, however, the cost of this kind of well in the Gulf of Mexico can be double that. On average, industry exceeds deepwater, deep well cost estimates by 60%.

CASING DRILLING BENEFITS

Casing Drilling™ methods provide numerous benefits, of which the primary is that all trips to run and cement casing are eliminated, along with the exposure to hole problems while tripping the pipe.

A secondary benefit is that the casing is always near the bottom of the wellbore, enabling an operator to case off a section rather than fight a potential wellbore problem.

“Those benefits alone encourage us to apply this technology in the much more challenging and expensive deepwater

environment,” said Kenneth L. Smith, Principal Drilling Engineer for ConocoPhillips in Houston.

Lost circulation and well control incidents have virtually disappeared in the Lobo field. This may translate into

reduced unplanned downtime for these inherently risky operations in deepwater. Significantly fewer wellbore problems means significantly reduced costs.

DEEPWATER DRILLING

Rather than target all deepwater well casings at the same time, ConocoPhillips will focus on the 11 3/4-in. casing. It will be run inside the 13 5/8-in. casing to drill through a very problematic subsalt rubble zone. This zone has resulted in two-month flat spots on the drilling curve.

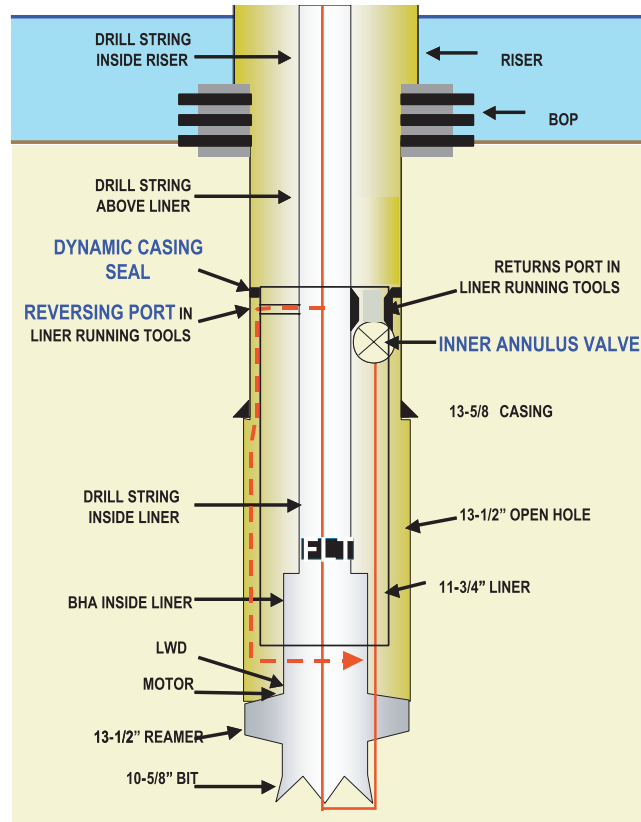
With Casing Drilling operations in the Lobo field, there is a profile nipple at the top of the casing. The bottom hole assembly is run on wireline through the casing and latches in the profile nipple where torque and axial loading can be transmitted.

Below the casing, ConocoPhillips runs a reamer, MWD tools, motors and directional assemblies and the bit. The casing is the “drill pipe”.

Onshore Casing Drilling operations have the casing in the rotary table while liner drilling offshore has drillpipe in the rotary. The biggest difference in deepwater is annular clearances.

For example, the annular clearance between the 11 3/4-in. liner and the 13 5/8-in. casing is far too tight to be able to circulate the mud and cuttings conventionally. Instead, the well has to be circulated up the inside of the 11 3/4-in. liner.

In Close Tolerance Liner Drilling operations, the drillstring extends through the liner with the drillstring components, the BHA with formation evaluation tools, mud motor, etc., extending through the liner. In this configuration, the drilling torque is taken by the drilling assembly.



With the Close Tolerance Liner Drilling System, the circulation path is down the drill string and returning up the drill string by the liner annulus. A portion is diverted at the top of the liner down the backside. The liner top is isolated by the Dynamic Casing Seal. An Inner Annulus Valve can isolate the area above the liner from flow through the liner.

“However, we observed many more benefits in Lobo that make this goal even more compelling.”

For example, no tripping onshore means no trip margin is required in deepwater. With casing always on the bottom, there is less exposure to hole loss in deepwater. Lower circulation rates mean lower pump-and-dump volumes in upper hole sections in deepwater.

“One of the real surprises,” Mr Smith noted, “is that our mud weight was running up to about half a pound per gallon less than our traditional wells in South Texas. If we can do that offshore, that may mean fewer casing points.”

The liner is “along for the ride” and only experiences only the torque due to hole friction.

“This also means we have potential inertia issues,” Mr Smith noted, “and that leads us to the desire to rotate slowly because if everything locks up in the drill string, there is a lot of mass trying to unscrew itself.”

The circulation path is down the drill string and returns up the liner ID. A portion of the mud is diverted at the top of the liner down the backside where it joins the rest of the mud going through the drillpipe. To circulate down the backside, a Dynamic Casing Seal™ (DCS) isolates the liner top. An Inner Annulus Valve™ (IAV™) can isolate the area above the liner from flow through the liner.

Hole cleaning is easier because the biggest annulus in the well is the 13 5/8-in. by 6 5/8-in. OD, meaning circulation rates can be slower. With the reversing feature anything that comes in on the backside is flushed down the liner and then brought back up and out of the well.

TWO-TRIP SYSTEM

The team is initially building a two-trip system. The first trip is to drill, hang the liner and release from the liner. The liner top packer is then set and the drill string and BHA are pulled out of the hole. After the first trip, the well is mechanically cased off.

On the second trip, a cement retainer is tripped in and set, and the liner top packer and cement retainer are tested. Then, cement is pumped, bullheading it to the weakest formation in the well.

DRILLING PROCEDURE

Some drilling procedures with Close Tolerance Liner Drilling methods are quite different than onshore casing while drilling. While the drilling process is essentially the same, Close Tolerance Liner Drilling operations require a significantly more complex BHA since it will have 5,000 ft of liner attached to it in ConocoPhillips' well.

“We are going to err on the side of caution until we gain experience and become comfortable with the procedures,” Mr Smith explained.

“For example,” he said, “we won't drill shoe-to-shoe initially, and the liner length initially will be less than the water depth so that it can be placed above the blind shear ram.”

Close Tolerance Liner Drilling techniques use unconventional hydraulics and the drill string and liner dynamics are challenging. For example, one challenge is that equivalent circulation density (ECD) is increased. While some well control is different, there are no rig modifications required.

During the drilling process, tripping becomes an unplanned event. Something has to break before tripping becomes necessary.

“A goal is to get as much of the troublesome formations behind us before we get a stuck pipe situation,” Mr Smith explained.

“It also means if we do get pipe stuck, the only thing that is really stuck is the BHA below the liner. Everything else is in cased hole, so we're not going to lose many BHAs. None of this is true with conventional drilling.”

That also means that there are no trip margins or swab issues with which to be concerned and drilling blind is not catastrophic.

WELL CONTROL

Some well control procedures are different with Close Tolerance Liner Drilling operations compared with conventional drilling methods. ConocoPhillips has modeled 1.5 to 70 barrel kicks at drill-out and at TD, which is something that the operator considers to be a reasonable case.

The company's conclusion is that there is nothing dramatically different for most kicks. For example, the Driller's method will work to contain kicks in that range.

Choke pressures and gas rates are low, and kicks are more likely to be taken during connection due to high ECD. Additionally, if a small influx is not detected initially, it won't be detected until it reaches the rotary table. All of these aspects are typical of conventional deepwater drilling.

There is a unique case and that is with the liner and drill string across the BOP.

The issue is that the BOP will not shear both the liner and the drillpipe. However, Mr Smith noted, such an occurrence is a very low probability event. Something in the liner drilling system or BHA must fail, necessitating the trip.

Further, a permeable zone must be open, and the kick would have to begin migrating after going undetected for several thousand feet of tripping. So if a kick with the liner across the BOP did occur, it would likely be a low intensity kick. However, the potential situation led to the development of the IAV to isolate the riser from such a kick, and procedures have been developed for its use, and its failure.

PROJECT SCHEDULE

ConocoPhillips, Tesco and Baker Hughes were in the middle of manufacturing and shop testing equipment late last year with the aim of drilling a test well early this year at Tesco's Houston facility. The goal is to be prepared to spud the first offshore well with the technology in April 2004.

Goals during the test well include understanding surge and swab hydraulics as well as rotational dynamics because of the close tolerance between the 11 3/4-in. liner next to the 13 5/8-in. casing.

“We are going to trip a lot to see if we can wear out equipment before we have to actually drill with it,” Mr Smith said.

Also, about 1,500 ft of open hole will be drilled and significant function testing will be performed.

FUTURE

“Close Tolerance Liner Drilling operations offer tremendous promise for us,” Mr Smith concluded.

Even seeing half the benefits offshore that have been realized with Casing Drilling techniques onshore will be a significant improvement upon conventional drilling methods and bottom line costs.

The mechanical design is advanced and the safety aspect is first and foremost, according to Mr. Smith, and drilling and well control procedures are practical and safe. A rigorous testing plan is in place and training of rig personnel in this new drilling method is also planned when it is taken offshore. ■