Case study: Norway

PRIME Technology Platform executes metal milling operation with surgical accuracy to recover well access

A North Sea customer needed to pull a wireline retrievable down hole safety valve (DHSV) from a well in order to carry out a well intervention program to adjust gas lift valve (GLV) settings. Numerous wireline runs were made to attempt to pull the valve, but they failed to release the DHSV lock. Dump bailers were run to deploy acid – to attempt to remove suspected scale, and oil – to lubricate the lock, but these proved ineffective. After repeated and excessive jarring, the GS pulling tool was eventually unable to engage the fishneck.

A subsequent multi-finger caliper run showed the fish neck had worn. Also, a downhole camera run showed that the lock expander mandrel had moved up only partially, resulting in the lock dogs not being free to release. Several runs were then carried out using a mechanical spear. Once again, repeated jarring proved unsuccessful. This inability to retrieve the DHSV prevented the execution of the planned intervention, and a shallow plug was set securing the well until a solution could be found.

Solution

The client approached several companies in their search for a fix, choosing the solution proposed by our team. This comprised of a two-step operation:

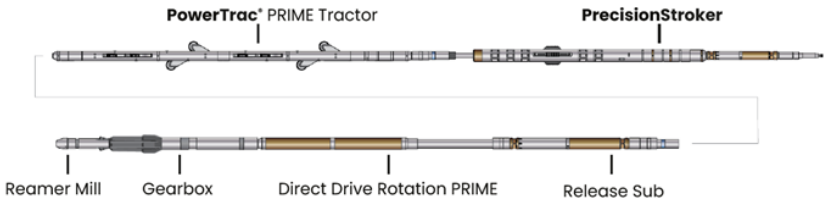
- Firstly to cut the inner lock mandrel using a modified **Downhole Electric Cutting Tool** (DECT) and retrieving this inner mandrel to expose the expander mandrel within.
- Secondly to back mill a minimum of 8mm from the lower part of the expander mandrel, leaving 1mm of the mandrel in place – this to ensure the dogs wouldn't release during milling, but would collapse with jarring of the mandrel during a subsequent DHSV retrieval run.

Precise depth positioning of the cutting and milling devices was crucial, as was the control and extent of both the cut and milling to be applied.

For the cutting phase, a no-go sub was added to the DECT to ensure exact placement of the blade at the bottom of the inner sleeve that was to be cut.

For the milling phase, the **PrecisionStroker** was utilized in conjunction with the highly instrumented **PRIME Technology Platform**. This was coupled with a specifically designed reamer mill, adapted from field proven technology used in coiled tubing applications. Again, a no-go housing was added to position the mill at the precise depth within the DHSV lock. Furthermore, the milling segments were designed to be retracted during run-in-hole, only to be extended on command using the PrecisionStroker once at target depth.

Toolstring for milling operations



Challenges

- A stuck wireline retrievable down hole safety valve (DHSV) needed to be pulled from a well to carry out a well intervention program
- Previous attempts and jarring had been unsuccessful
- A shallow plug was set securing the well until a solution could be found

Results

- Precise in-well machining of jammed lock mandrel component enabled removal of a retrievable downhole safety valve, facilitating well access for required gas lift valve adjustments
- Controlled millimeter precision delivered for component cutting and milling operations
- Bespoke reamer mill rapidly designed and engineered

The **PrecisionStroker** was also used to position the milling segments precisely against the expander mandrel to millimeter accuracy. Once in position, and with e-line tension holding the toolstring in place, the **PrecisionStroker** was then deactivated and the **PowerTrac PRIME** and **Direct Drive Rotation** device (PRIME DDR) powered up – the tractor to provide a free-rolling rotational anchor and the DDR device to provide the prescribed Torque and RPM. Stipulated winch tension would provide the required weight on bit.

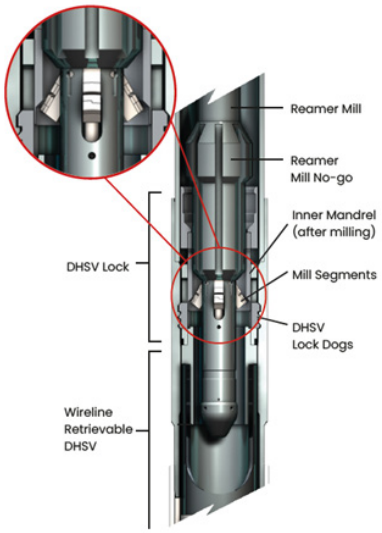
Results

Extensive full-scale testing was done in our test well prior to mobilization. A well specific procedure was compiled leaving nothing to chance. All steps of the operation were executed as prescribed, replicating the parameters established during the testing. Tool data and surface control available with the Cutter, Stroker, Tractor and DDR ensured all steps were monitored and controlled in realtime.

Upon successful milling of the expander mandrel, the DHSV lock required only two relatively light jars to release, and the retrievable DHSV assembly was successfully removed from the well. This enabled the client to proceed with the original intervention workscope, adjusting the GLVs as required. Following this, a new wireline retrievable DHSV was installed, and the well was put back onto production.

Crew pictured with Reamer Mill

Reamer mill and DHSV lock components - shown with milling of inner mandrel completed



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