

TECH TIDBITS, vol. 26

High Temperature BOP Seals

The plan for a new well in the North Sea had predicted a bottom hole temperature of 140-145°C (290°F). Predicted flowing wellhead temperature was 90-110°C (230°F). Therefore, high temperature seals were installed in the blowout preventer (BOP).

The well was successfully drilled to total depth. A temperature of 142°C (288°F) was recorded by wireline logging. The lower pipe rams, middle pipe rams and blind shear rams were successfully tested to 445 bar (6,500 psi) after the 9 5/8" casing was cemented.

The well was a discovery and progressed to a Drill Stem Test (DST). A 7" liner was run and cemented, followed by a successful pressure test and inflow test.

Due to the potential pressures in the event of a tubing leak during the DST, it was then necessary to displace the annulus to seawater before pressure testing the 9 5/8" casing and 7" liner to 485 bar (7,000 psi). As pressure reached 400 bar (5,800 psi), there was a return to the trip tank, and the shear rams were observed to be leaking at a rate of 2-3 bar/min (29-44 psi/min). Repeat tests were made with the same results, and it was concluded that the BOP would have to be retrieved for repair.

Description of Issue

Given the water depth of 400 m and the weather conditions, the estimated time for a round trip was seven to ten days. With a rig operating rate of \$1.25MM USD per day, a stack pull would cost approximately \$11 MM USD.

Before pulling the BOP, the drilling manager contacted WEST Engineering Services to diagnose the situation and discuss potential alternatives. It was revealed that the actual recorded temperature at the BOPs just below the lower pipe rams was 6°C (43°F). The high temperature ram seals installed for the well were rated for an operating range of 10-121°C (50-250°F), above the actual temperature of the BOPs during the test. After talking with WEST Engineering and the BOP OEM, it was established that this is a known issue in cold environments, and that the OEM has a procedure for testing in cold conditions.

Solution

A test procedure appropriate to the operating range of the seals was developed, and 10m³ of 90°C (194°F) water was circulated into the BOP, which increased the BOP temperature from 6 to 25°C (from 43 to 77°F). The blind shear rams were then cycled open/closed seven times to

heat up the seals (per the OEM procedure). On the seventh cycle, the rams were kept closed for 15 minutes with 3,000 psi closing pressure. The test was successful at 485 bar.

In normal well conditions for this well and others like it, operations such as drilling or circulating will circulate hot fluid and keep the well operating temperature and BOP within the operating range of the ram seals. For any other operating conditions, the new operating procedures include monitoring the BOP temperature. Hot fluid will be available to circulate if the temperature is seen to drop below 10°C.

For more information or technical questions, please contact WEST Engineering at west@westengineer.com, call 281-375-5515, or visit our website at www.westengineer.com.