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Ball Valves Under Pressure?

Recently, a failure to hold accumulator pressure was observed on three separate occasions on two different rigs, all with practically identical failure modes.

In the first case, while performing a dead man shear ram test, the shear ram accumulators were found to be bleeding off pressure. This, of course, prevented complete functioning of the rams.

In another case, after a BOP was retrieved and moved to its storage position, control fluid was observed flowing back up the rigid conduit line on the blue pod and out the top of the LMRP.

The third case involved pressure tests of the two rigid conduit lines against the flushing valves. It was observed that the rigid conduit check valve was leaking.

Luckily, in these cases the nonproductive downtime was minimal. If this were to occur during drilling operations, it could result in an unplanned LMRP/BOP pull and significant downtime costs, or worse, a loss of BOP function just when it is needed most.

Description of Issue

In each case, debris from damaged surface equipment, mostly ball valve seats, washed downstream through the control fluid conduit and lodged in the accumulator check valves, causing them to leak pressurized accumulator fluid (Figure 1). One case also involved a "mystery" object caught in the check valve with the broken valve seat material (Figure 2).

The ball valves were likely damaged, as often occurs, when the valve was opened. Because of high pressure behind the valve, personnel will often try to quickly crack open a ball valve, both to overcome sticking due to the static friction coefficient and to avoid seat erosion in a partially opened valve. The plastic valve seat cracks from the physical stress during the opening and/or the resulting hydraulic shock of the sudden rush of fluid.

Figure 1 – Teflon debris trapped in check valve

Solutions

A high pressure filter upstream of the conduit manifold can be fitted to catch debris before it enters the check valves, regardless of the source of the debris. However, the filter doesn't address the major root cause (damage to the ball valve seats).

Another solution would be to replace the ball valve with a gate valve. The downside of this solution is that it is often expensive and also more labor intensive to operate.

The option that WEST normally recommends is to plumb a small bypass ball valve in parallel with the larger ball valve. The small valve would be opened to equalize pressure on each side before opening the main valve, to minimize the risk of seat damage.

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

Figure 2 – Close-up of debris found in a check valve