



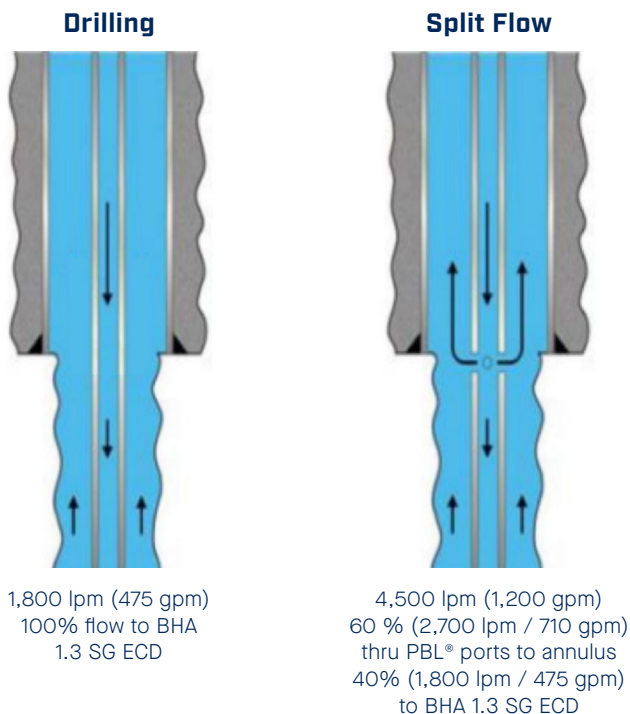
## Wired PBL® Multiple Activation Bypass System, Configured for Split-Flow, Increased Flow Rates by 110% in First UK/North Sea Application

### Challenge

A major global operator, drilling in the UK sector of the North Sea, set the 13 3/8 inch casing at 72° and successfully drilled the next section to TD with an 8½ inch bit. While drilling, the flow rate was 1,800 lpm (475 gpm). To clean up the shoe and casing string before displacing the well to the screen running fluid (SRF) and running the sand screen lower completion, they wanted to increase the annular velocity to a higher flow rate than the BHA would allow 2,140 lpm (565 gpm).

### Solution

A wired 7-inch PBL® Multiple Activation Bypass System, compatible with the IntelliServ drillpipe network, was placed 70 meters from the bit and set up for Split-Flow operations. This allowed the operator to choose between 100% flow rate to the BHA or split the flow to a pre-determined ratio to the BHA and to the annulus. In this application, the flow was configured to a 40% BHA and 60% PBL® annulus split.



### Execution

Once TD was reached and the BHA was pulled back, the PBL® tool was positioned at the casing shoe and the Split-Flow was activated. The Split-Flow dart was inserted into the string and pumped down at 940 lpm (250 gpm). To confirm that the dart landed in the PBL®, the MWD turbine speed was compared (2,851 rpm reduced to 1,640 rpm at the same 2,056 lpm (543 gpm) flow rate) and pressure was monitored (5 bar (73 psi) increase). The flow rate was increased to 4,500 lpm (1,200 gpm), giving 2,700 lpm (710 gpm) out the PBL® ports into the casing and 1,800 lpm (475 gpm) down to the BHA and through the bit. At this point, the MWD turbine speed increased to 2,890 rpm, then the string was reciprocated and rotated until 5 x B/U were cycled.

To deactivate and return to 100% flow to the BHA, the three deactivation balls were dropped and pumped down at 1,200 lpm (320 gpm). Upon landing in the PBL®, the pressure increased, indicating a successful landing location. As the dart sheared through the seat, the pressure dropped again. The MWD turbine rpm was again used as a reference to confirm deactivation and 100% of the flow through the BHA.

### Conclusion & Recommendation

The PBL® activated and then successfully deactivated at an inclination of 72°. The Split-Flow ratio allowed the flow rate to be increased by over 110%, not exceeding the maximum operating pump pressure and maintaining the same ECD. Allowing 4,500 lpm (1,200 gpm) to be pumped, with 2,700 lpm (710 gpm) targeted directly at a critical zone, enabled the operator to dynamically clean the casing before successfully running the lower completion (sand screens, swellable packers, etc.) with no hangups or contamination to SRF.

DSI performs pre-job hydraulic modelling prior to each deployment to ensure the correct hydraulic set-up is used. The pre-job simulation compared to the actual showed accurate results.

Flow Rate	DSI pre-job hydraulic simulation	Operator DDR
4,500 lpm (1,200 gpm)	238 Bar	238 Bar

