MI SWACO
A Schlumberger Company

WELL COMMANDER

Versatile multi-cycle ball-activated drilling valve for mitigating downhole hazards

Note: Operating instructions updated July 2014

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Mitigating drilling and completion hazards before they get out of hand means the difference between a well that is constructed efficiently and one fraught with non-productive time (NPT) and severe cost overruns. Potential issues are magnified in select applications such as extended-reach drilling (ERD), tortuous well paths, spotting lost circulation material (LCM) in loss-prone/fractured intervals, and underbalanced and managed pressure drilling, to name a few.

However, all-too-often a restrictive BHA limits the flow rate and annular velocity required to clean the hole during drilling or displacement operations. BHA restrictions can also limit the size and concentration of LCM and wellbore strengthening material (WSM) needed to seal troublesome zones.

Sidestep BHA restrictions to increase flow, precisely spot pills on demand

Features

- Multiple ports provide generous bypass flow area
- No internal tool connections
- Can be run in multiple trips with no re-dressing up to the maximum circulating hours
- Tool activation mechanism locks into open or closed position
- Lock open position allows reverse circulation, if required
- Ball catcher permits smaller ball and/or limited wireline access below the tool, even after activation
- Tool activation mechanism isolated from drilling fluids prevents failures due to solids accumulation
- Optional shut-off ball prevents coarse LCM from entering LWD/MWD, core barrel, mud motor, and other sensitive BHA components

Benefits

- Boosts annular velocity to enhance hole cleaning or facilitate cuttings-bed removal
- Stimulates turbulent flow by combining the pipe rotation with the increment of annular velocities
- Increases annular velocities above an under reamer
- Reduces downhole pressure effects associated to increase rates
- Functions effectively independent of the fluid type
- Provides BOP jetting functionality
- Promotes draining the work string while tripping, saving tripping time

With our multi-cycle, ball-activated WELL COMMANDER† drilling valve, M-I SWACO, a Schlumberger company, provides an alternate circulation path that effectively bypasses BHA restrictions. Ideal for use with all types of drilling fluids and clear brines, the WELL COMMANDER tool is positioned above sensitive BHA components, measurements-while-drilling (MWD) tools, logging-while-drilling (LWD) tools, core barrels, mud motors, and the like. Once in place, the advanced hazard-mitigation tool can be opened to create an alternate path used to boosts annular velocities that prevent drilling hazards such as the build-up of cuttings beds during drilling or debris removal in completion operations. Additionally, this state-of-the-art drilling valve allows you to spot lost circulation and wellbore strengthening pills exactly where you want them, without having to worry about exceeding the size and concentration limit of tools in the BHA prone to plug.

The ultra-versatile WELL COMMANDER tool has demonstrated unmatched efficiency in a host of critical applications, including:

- Drilling ERD and tortuous wells
- Spotting high concentration LCM or kill-weight fluid
- Removing cutting beds
- Operating in high-pressure applications
- Combining a drilling valve with other ball activated tools
- Boosting annular velocities in under reaming operation
- Conditioning fluid and displacing at high flow rates.

The WELL COMMANDER drilling valve has a generous area port designed to deliver high flow rates that save time while spotting LCM treatments or kill-weight fluids; its large total flow area allows the tool to be used to spot very aggressive treatments. The WELL COMMANDER tool also helps avoid problems such as cuttings beds and pack offs in high-angle, tortuous path and ERD wells, while reducing circulating time during large volume fluid conditioning and displacements.

In addition, by bypassing restrictive BHA equipment, the tool allows you to drain even small-diameter work strings during a trip. The WELL COMMANDER drilling valve avoids the risk of spilling drilling fluid at the rotary table by ensuring the viscous pill functions properly every time and at any angle, thus promoting a safer and cleaner work environment.

When risks are around the corner, the WELL COMMANDER valve is a driller's best friend

The WELL COMMANDER drilling valve is field-proven as the ideal tool for mitigating the host of hazards in operations prone to lost circulation, wellbore instability, or in wellbores with inherent hole-cleaning challenges. The WELL COMMANDER tool assists in removing cuttings beds in high-angle/horizontal wells by boosting annular velocities.

The extremely versatile and reliable tool also permits easy spotting of LCM during drilling or WSM during an M-I SWACO I-BOSS† wellbore strengthening operation. The WELL COMMANDER tool enhances hole cleaning during hole-opening/under reaming applications; this is only possible due to the unique design of the bypass ball catcher, which allows the placement of other ball drop operated tool below the WELL COMMANDER tool. The WELL COMMANDER drilling valve combined with an under reamer is powerful because the operator no longer has to choose between a circulating valve or an under reamer.

In ERDs and wells affected by low fracture pressure gradients, the WELL COMMANDER tool can help spot WSM pills in problematic zones without having to route treatments through the BHA and bit. To simplify underbalanced and managed-pressure drilling (UBD/MPD) operations, the WELL COMMANDER tool can be opened to permit the spotting and removal of kill-weight fluid in the vertical section prior to tripping and drilling ahead. It can remain open while tripping out of the hole to avoid swabbing and permit tripping dry.

As an added bonus, the WELL COMMANDER drilling valve is effective for use in conditioning wellbore fluids at high flow rates in any drilling or displacement string. The tool is also used to help drain the drillstring during trips, effectively minimizing swab pressures, while maximizing fluid discharge through the tool to enhance tripping efficiency.

Another example of the extreme versatility of the WELL COMMANDER tool is the design and positioning of the ports, which allow for jetting BOP cavities at high flow rates when tripping out of the hole, saving a dedicated BOP clean out trip.

The WELL COMMANDER drilling valve proves itself in the field

Alaska: Radioactive sources retrieved through the WELL COMMANDER valve averts major difficulties

The Situation

The rig encountered a drilling break in the 6 1/8 in section of the Prudhoe Bay well and took a kick 200 ft below the casing shoe. The rig pulled up 20 ft (6 m) off bottom. After the well was shut in, it was confirmed that it was not static and instead was taking gains. After pumping kill mud and controlling the well, the crew tried to pull on the drillstring during on-bottom circulation, at which time it was discovered the BHA was differentially stuck. A joint decision was made to try to fish the radioactive source through the BHA. The radioactive source was stuck 110 ft below the casing shoe and regulations dictated that a cement plug had to be set 200 ft above the source. If the sources were not removed, the well had to be abandoned.

The Solution

The fishing assembly selected to recover the lost radioactive sources would need to pass through the 5 in WELL COMMANDER ball-activated drilling valve and the bypass ball catcher. A team of Schlumberger and M-I SWACO engineers tested the selected fishing assembly at the local M-I SWACO facility. After confirming the 1.2835 in OD fishing assembly would pass through the 1.30 in drift of the ball catcher, the radioactive fishing operation commenced.

The Results

The radioactive sources were successfully fished through the 5 in WELL COMMANDER tool on the first attempt. The BHA was then backed off on top of the ball catcher and left in the hole after being cemented. This allowed the operator to sidetrack the well in open hole and continue drilling, thus avoiding major complications with the well and regulatory authorities.

Texas: WELL COMMANDER functions flawlessly in HPHT test at 30,000 psi, 265°F

The Situation

The operator requested a high-pressure, high-temperature function test of the WELL COMMANDER drilling valve for an upcoming well in the Gulf of Mexico. The request was spurred after the incumbent drilling valve provider experienced failures at pressures above 22K psi.

The Situation

The testing facility was selected on the basis of its capabilities to pressure up a 14 in diameter vessel to 40,000 psi at 540°F (282°C). The predicted hydrostatic of the upcoming well was calculated to be over 28,000 psi, with borehole temperatures of 265°F (129°C). The test was performed at 30,000 psi to account for future expected well conditions. The test was designed as a sequence of pressure buildup steps of 20K, 25K, and 30K psi at ambient temperature before the main test at 30K psi and 265°F. To ensure the test resembled actual wellbore operation as much as possible, an activation ball was dropped and the wellbore was pressured up to shift the tool in the same way it would be operated at the wellsite, using a specially designed lifting/test cap.

The Results

The WELL COMMANDER valve functioned as expected for several high-pressure tests of 25K and 30K psi, at ambient temperature, and at 30K psi at 265°F. The tool was successfully activated in each step of the test by dropping an activation ball through the specially designed lifting/test cap. Pressure was applied to both the main vessel as well as inside the tool via a separate independent line. After the tool was at 30K psi and 265°F for approximately 10 minutes, the procedure to activate the tool started. Once the required pressure and temperature were achieved, the pressure inside the tool (on top of the ball) was increased until the activation ball sheared and the tool shifted to the next position. The change of sleeve position (open or closed ports) was physically checked between tests to corroborate the proper activation of the tool.

How the WELL COMMANDER tool works

The WELL COMMANDER drilling valve is typically positioned above the BHA, where it is run in the hole with the ports locked closed. The tool is activated by dropping a ball; the ball lands in a seat creating a seal and the pressure increases inside the drillstring driving the activation sleeve down, which shifts the tool to the open position. The tool uses the same size operating ball to open and close the ports, with the capacity of the ball catcher (18 balls/9 cycles) being the only limitation. A smaller BHA shut-off ball can be dropped to prevent fluid flow or solids deposition at the top of the BHA. This ball is expelled with the subsequent operating ball.

The operating balls and BHA shut-off balls are collected in the ball-catcher assembly located below the tool. This bypass ball catcher captures the balls to one side of the inside diameter to facilitate the positioning of other ball-drop tools below it, as smaller activation balls can pass through the WELL COMMANDER tool and ball catcher.

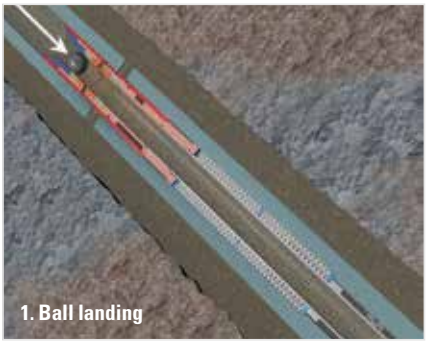
The valve is run in the hole in the closed position and remains inactive during normal drilling operations. When circulating ports need to be opened, an operating ball is dropped and pumped down to the WELL COMMANDER tool. When the operating ball lands on the seat, pressure is applied and the tool is primed open. Increased pressure drives the ball through the ball seat and advances the tool to the locked-open position. A pressure drop is observed as the operating ball is expelled into the ball catcher.

After the circulating ports open, the pump rate can be increased to circulate at higher annular velocities through the open ports. A small fluid volume circulates to the BHA to keep it lubricated.

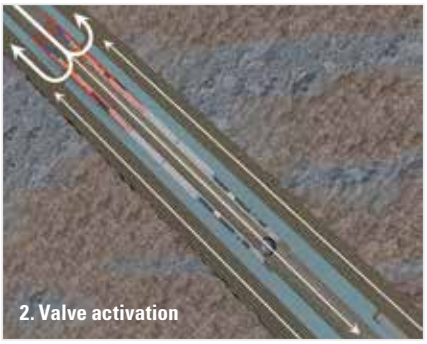
To head off the risks of particles damaging or plugging the BHA components, flow to the bit can be isolated by dropping a smaller, different colored BHA shut-off ball. Once in this position, the tool can be used to spot more aggressive LCM or WSM.

To close the WELL COMMANDER tool and restore all the flow through the BHA, another operating ball is dropped and pumped down to the tool ball seat. When the ball lands on the seat and pressure is applied, an indexing system primes it closed.

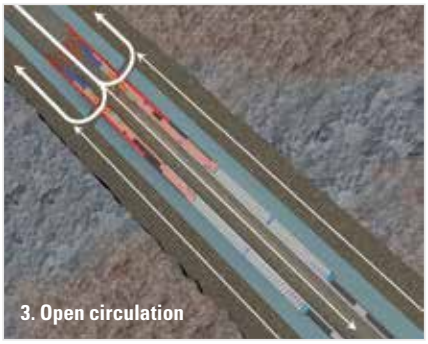
Increasing pressure drives the ball through the ball seat, where a pressure drop is observed. The operating ball and the BHA shut-off ball are both expelled into the ball catcher and the valve returns to its original, closed position. The open and closed cycling can be repeated on a single trip until the maximum capacity of the ball catcher is reached. The ball catcher can be emptied at surface during each trip. The WELL COMMANDER drilling valve can be run on multiple trips without requiring redress, up to the recommended maximum circulating hours.



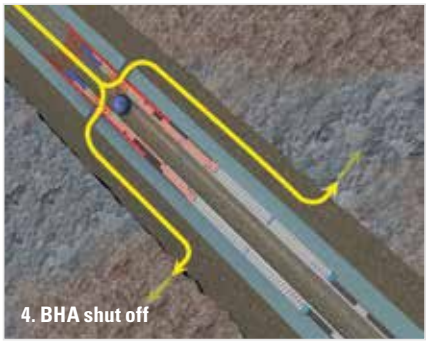
Drop ball on connection and pump down to tool. Ball lands on seat. Pressure is applied.



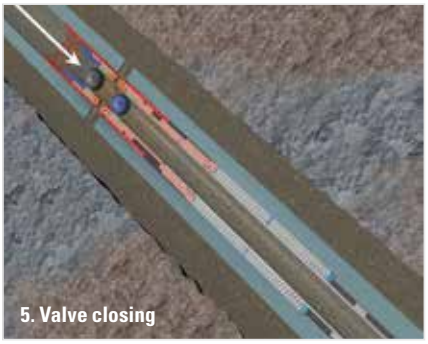
When pressure exceeds activation pressure, ports open and ball proceeds to ball catcher below tool.



Majority of flow passes through the ports with lower pressure to allow increased pump rates, while some flow is maintained through the bit for lubrication.

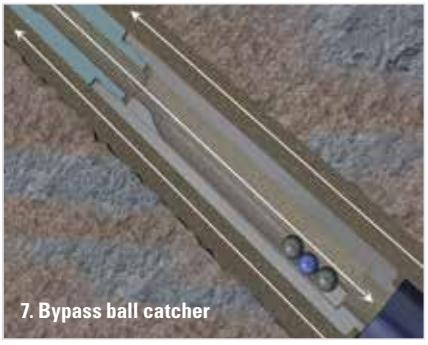


Optional shut-off ball can be landed on lower ball seat to prevent LCM or WSM from entering the BHA while treating the formation.

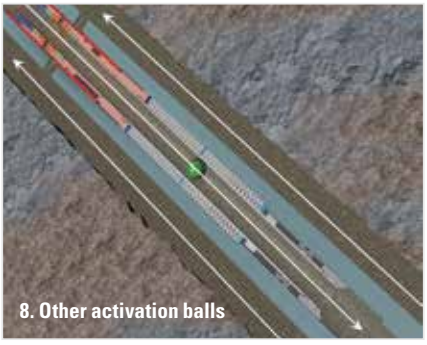


The BHA shut-off ball is removed when subsequent activation ball closes the ports.

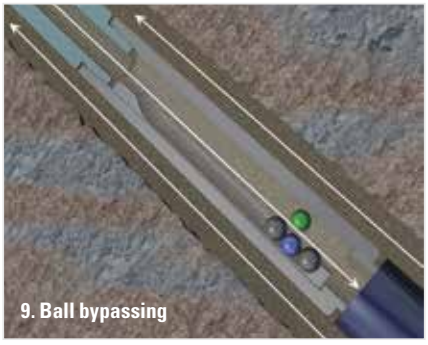
After pressuring up on the activation ball, the BHA shut-off and activation balls move to the ball catcher.



Bypass ball catcher captures activation and BHA shut-off balls to the side permitting high flow rate with minimal pressure loss and allowing smaller balls to pass through it.



Other ball activation tools that use smaller diameter balls can be positioned below the WELL COMMANDER tool as the ball will not activate it.



The activation balls for these other tools will pass through the bypass ball catcher.

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