

Revolver with eMotion

Intelligent Deep-Set Completion Placement

INTRODUCTION

The following application demonstrates one practical situation where a Revolver with eMotion can be used to increase operational efficiency and significantly reduce costs. Here, the Revolver with eMotion is deployed at the bottom of the completion providing remote open/close well isolation without the need for any control lines from surface or intervention.

THE APPLICATION

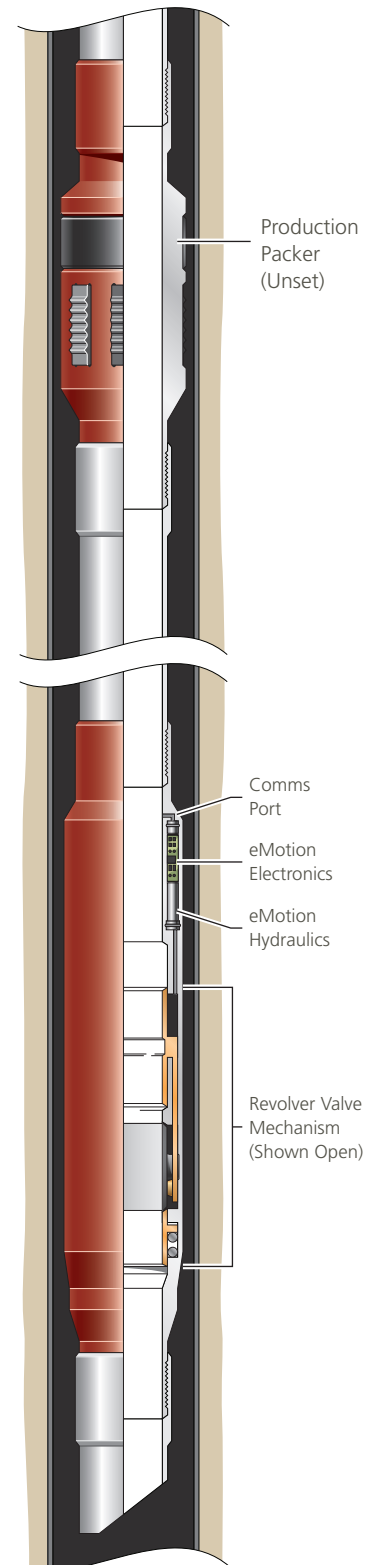
In this application, a Revolver with eMotion is permanently deployed below the main production packer, typically in the lowest part of the completion. The valve operates on a closed-loop hydraulic circuit that is powered and controlled by the integrated eMotion. The system is therefore not depth dependent or susceptible to contamination from well fluids. There are no connections to surface and no interventions are required to operate or communicate with it.

Prior to deployment, the eMotion is pre-programmed with the necessary instructions, including the trigger parameters and functions to be initiated when triggers are detected. The assembly is then permanently deployed as part of the tubing string with the valve set in the open position allowing the completion to self-fill for well control purposes. Once at depth, the open Revolver allows for any accumulated debris to be circulated from the well.

The eMotion then closes the Revolver using a delay timer as the trigger. Internal pumps circulate hydraulic fluid around the closed-loop circuit to shut the valve providing a downhole barrier capable of retaining pressure of up to 5,000 psi from above and below.

Since the eMotion only responds to pre-defined pressure being applied for a specific time, any pressure applied outside these values is ignored. This allows unlimited pressure tests to be applied to the tubing without initiating eMotion. Tubing integrity tests, packer setting and christmas tree commissioning can all be accomplished while the Revolver remains closed.

Having finished all necessary operations, the Revolver can then be re-opened by the eMotion, this time using a pressure/time signal as the trigger. The internal pumps circulate the hydraulic fluid in the opposite direction around the closed-loop circuit to re-open the valve.



CONTROL OPTIONS

The eMotion control system, can be programmed to open or close the Revolver on a host of different parameters giving maximum operational flexibility and the ability to mitigate unforeseen operational problems. This also allows multiple pressure tests to be applied to the closed-in tubing without inadvertently opening the valve. In this case, the eMotion could also have been set to re-open the Revolver on a timer instead of the pressure/time signal from surface. At any time the timer on the eMotion can be overridden, cancelled or reset.

The Revolver with eMotion assembly is left downhole, the open valve providing maximum flow-through to maximise production or injection rates and giving full bore access to equipment further down the well.

CONVENTIONAL vs REVOLVER WITH eMOTION OPERATIONS

The following table compares the operational steps involved in a typical conventional operation versus the same operation undertaken using a Revolver with eMotion.

CONVENTIONAL OPERATION		REVOLVER WITH eMOTION OPERATION		TIME SAVED*
	Make up and run completion		Make up and run completion (Revolver open)	-
Run 1	Rig up PCE and wireline	-		6 hrs
	Run plug	-		6 hrs
Run 2	Run prong		Close Revolver using timer	6 hrs
	Set production packer		Set production packer	-
Run 3	Retrieve deep set prong		Apply command to open Revolver	5 hrs
Run 4	Retrieve deep set plug	-		6hrs
	Rig down PCE and wireline	-		3 hr
	Recover BOPs		Recover BOPs	-
Equates to FOUR wireline runs		Equates to ZERO wireline run		32 hrs

* The time saved estimate is based on Red Spider experience in the North Sea and an assumed water depth of 1,000 ft and well depth of 8,000 ft. Time allowed for single eMotion operation = 1 hour.

THE RED SPIDER ADVANTAGE

A deep-set Revolver with eMotion provides intelligent well-type flow control without the need for any control lines. This dramatically reduces deployment rig time while also removing control line costs, the risk of damaged lines, and simplifies the tubing hanger design. In addition, no interventions are required to operate the Revolver, saving on costs, especially rig time, and all associated risks.

In this case, a Revolver with eMotion eliminated four wireline interventions plus all the associated costs and risks, providing an estimated saving of \$640,000.

Typical cost saving based on a daily rig rate of \$500,000 (approx 20,000 per hour) = 32 x 20,000 =	\$640,000
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Also, the flexibility of the eMotion unit allows the Revolver to be opened and closed many times; this helps mitigate any unforeseen operation problems, potentially saving many more hours of rig time. Finally, the reduction in rig time reduces the potential of bad weather effecting the operation.

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