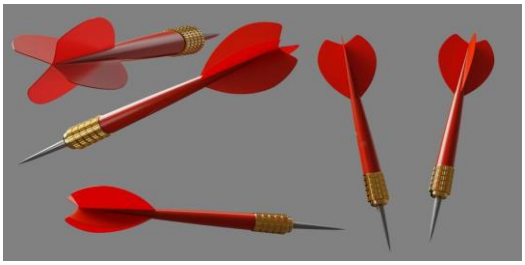
GENERAL ARTICLE

Ball Activation vs. Dart Activation. Which is the better method?

Introduction

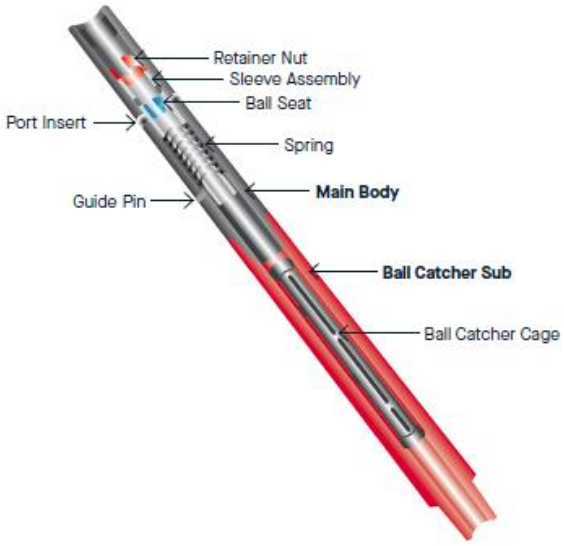
Many arguments have been raised over the years as to the superiority of ball activated circulating tools vs. dart activated counterparts or vice versa. There is no simple yes or no answer to this since many factors can influence the selection. This article is not intended to establish the superiority of one system over the other because, there is no absolute best single solution for all the conceivable problems that can be encountered. Sometimes, a ball activated system provides the solution whereas at other times, a dart activated system may provide a more desirable outcome.



The intention of this article is to bust some of the myths that do exist in our industry mainly due to the abundance of misinformation.

Argument

The majority of ball or dart activated circulating tools currently in use in our industry comprise of a “main valve body” and a “catcher sub” as external components. The internal components of these tools generally comprise of sliding sleeve / spring systems. The interaction of internal and external components is in such a way that once the sleeve is forced down and the spring is fully compressed, the internal and external ports line up, hence establishing communication between the inner part of the string and the annulus. Upon releasing of the force on the sleeve and by the force of the recoiling spring, the sleeve moves back upward, and the inner ports are sealed off from the outer ports, terminating communication between the inner part of the string and the annulus. Therefore, the key factor in the operation of the circulating tool is the successful arrival and proper seating of the activation device on the seat of the sleeve so as to cut off the fluid flow to the bit, forcing the sleeve to travel downward and divert the flow through ports. This is why the argument should be more in relation to what activation medium is more suitable for which situation rather than a blanket statement that dart or ball is a superior medium!



Justification

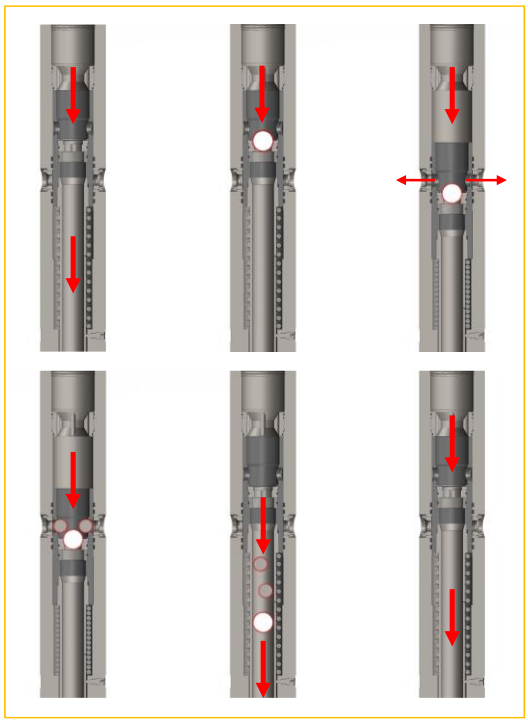
When considering the use of multiple activation bypass systems in vertical or near-vertical wells, the choice between a ball drop or dart drop system would depend on how fast the operator wishes to activate or deactivate the tool. If we consider solely, the gravitational force, then, as long as the dart or the ball has similar weights, it does not really matter which system is selected. As in most cases a dart has a higher SG than a ball (e.g., metallic dart vs. elastomer ball), the operator may select a dart activated system especially when heavy mud is used. However, it is important to note that under normal circulation the travelling speed might be defined by the flow rate that is being used to displace the ball as this would be faster than just gravitating down. The choosing of a dart over ball activation method may become even more critical if, in addition to the use of heavy mud, limited circulation is encountered.

The advantage of using a dart instead of a ball diminishes as the well angle deviates further away from vertical. The higher the well angle, the greater portion of the downward force is wasted in order to overcome the friction / drag between the activation medium and the inner wall of the string. So much so that, in the horizontal or high angle sections of a well, the movement of a dart, or for that matter a ball, would almost solely depend on circulation rather than gravity. As a matter of fact, in such circumstances, the gravitational pull and friction are the dart's worst enemies whereas, under similar conditions the friction between the ball and the inner wall of the string facilitates the rolling of the ball forward as long as there is circulation. **Therefore, in high angle or horizontal wells, a lot less circulation would be required to "roll" a ball forward compared to what would be needed to overcome the frictional resistance or drag between the dart and the inner wall of the string so as to "slide" it forward.**

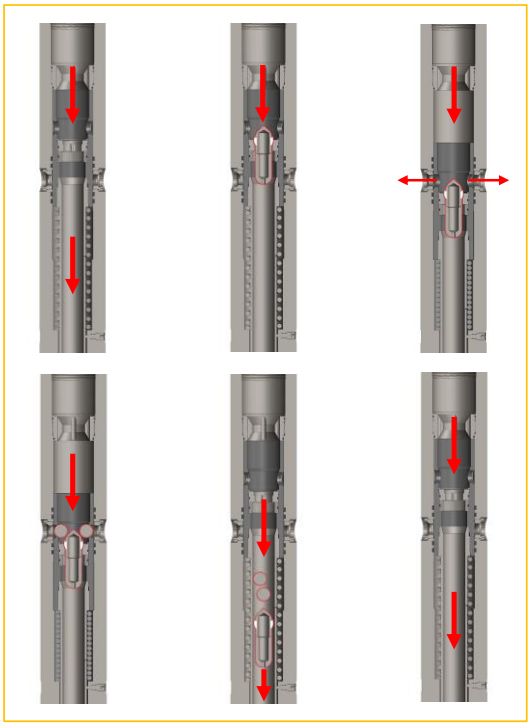
Conclusion

The DSI family of circulating tools are capable of offering **Ball activation, Dart activation and Universal Split Flow Dart (USFD*) activation features, all of which can be used in the very same tool that may already be downhole**. Hence, operators have full control on how they wish to address the **anticipated** or **encountered** well challenges whilst also maintaining full well control.

The operative word here is **"having full well control"** rather than using a device in the string whereby its default activation / de-activation mechanism requires the use of darts and, darts only. The irony is that no matter what is said about the



DSI PBL "Ball Drop" System – Activation / De-activation Sequence



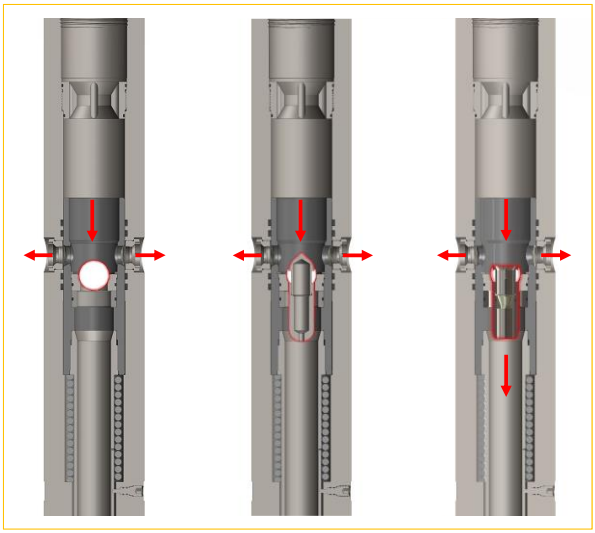
DSI PBL "Dart Drop" System – Activation / De-activation Sequence

superiority of darts over balls or vice versa, when the going gets tough, even the dart activated tool providers resort to the use of an "**emergency ball**" to activate their tool. The problem with this method is that, after activation with the emergency ball, which is a steel ball, the tool must be retrieved to surface because, once the "emergency ball" has been deployed, deactivation of the tool is not possible until the tool is retrieved, and the emergency ball is removed. This problem does not apply to PBL circulating tools since, regardless of which activation medium has been deployed, the tool can be deactivated and reactivated multiple times without the need to POOH.

Furthermore, in the event that a kick is encountered the PBL tool, regardless of whether activated by ball or dart, will return to ports-closed position as soon as pumps are shut whereas, with other dart or ball activated circulating tools, by default the tool is locked in open position once activated, hence if a kick is encountered, the tool is in open position and the integrity of the string and the ability to read SIDPP and SICP are compromised.

So, the more relevant factor to consider when choosing a circulating tool need <u>not</u> be whether to use the DSI PBL tool or some other "dart activated" circulating tool. Instead, the consideration ought to be with respect to the selection of the suitable activation medium to be used with the DSI PBL tool, most fitting to the anticipated drilling conditions and well parameters.

In order to cover all eventualities, the DSI PBL tool can be ordered with an Extended Catcher Sub and with full kits for Ball activation, Dart activation and USFD***** activation options, all of which can be utilised with <u>the exact same tool without the need for any alterations or modifications</u>.



DSI PBL "Ball, Dart and, USFD***** Drop" Systems

Such versatility in use is the reason why DSI is known in the market, most notably for its ability to offer complete circulating solutions to the energy industry.

***Universal Split Flow Dart (USFD)** is DSI PBL's next generation split flow dart system which enables the operators to drop the USFD and achieve all the benefits that the original DSI Split Flow Dart System provides, in addition to the ability to switch to 100% bypass through the ports, rendering the same tool suitable for pumping aggressive LCM pills without the need to deactivate the tool or having to trip out to change the tool.