

DAV MX™



Popular, simple and robust tool that solves common drilling problems quickly, with immediate cycling feedback. It is **versatile too**; simply run valve in hole and drop the dart required for the application (see suggestions over leaf) when needed.

Much more info at CircSub.com!

Spots LCM faster and saves lost mud; MX darts are quicker to set, with fast pump and land characteristics.

- Over twice as fast as traditional ball systems

Confirms BHA isolation from above; Activates, isolates, latches and confirms in a single shot, with a pressure drop seen at surface.

... and from below; Latching darts make it the only tool that stops secondary contamination through the bit after LCM spotting.

Largest bore in class; At least 25% more TFA than other tools thanks to the micro seats and the all-metal MX design.

Extended MX performance; Mechanically extruding darts provide many advantages over plastically extruding balls.

- Higher temperature stability
- Higher pressure stability
- Lower risk of blow-thru
- Faster pumping into place
- High angle deliver-ability
- More precise closing shear pressures
- Anti-contamination latches

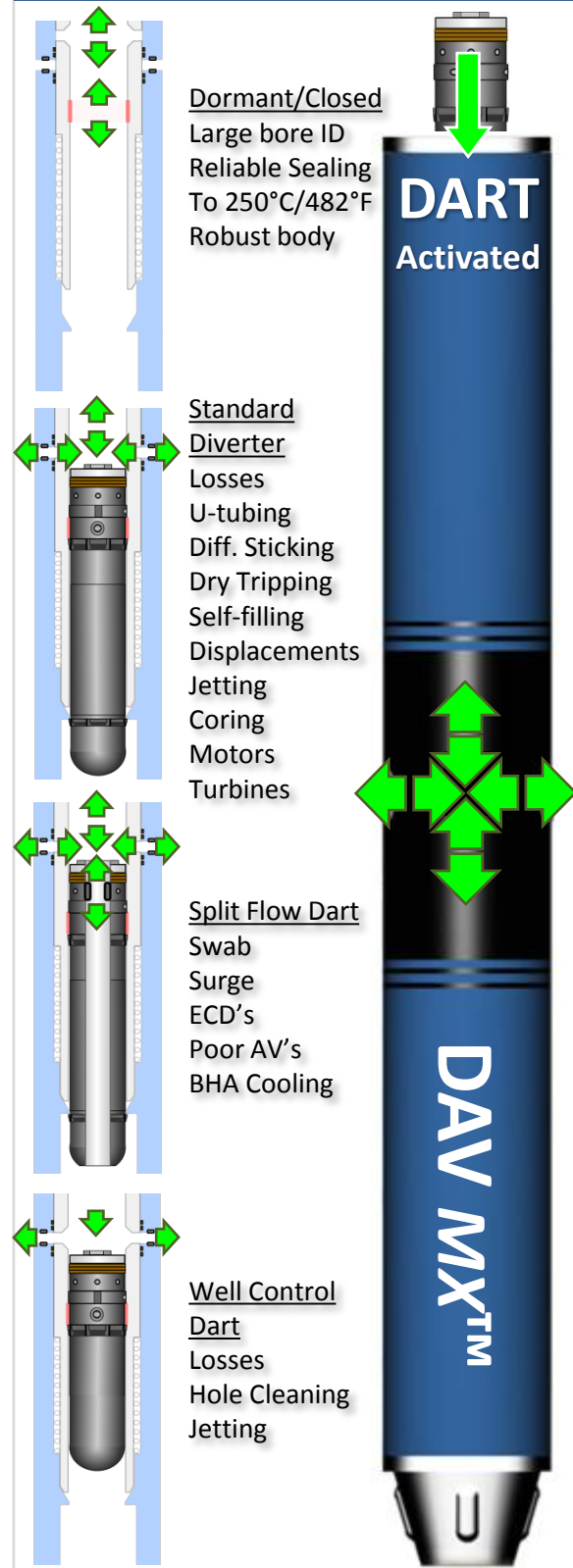
Patent pending for assured multi-cycling, Mechanical Xtrusion removes the need to rely on plastic extrusion and its blow-thru risks. Standard MX darts have a dual-shear safety factor to ensure reliable opening, protecting the shear pins from 90% of the bore pressure on landing. The closing dart applies 100% of the bore Pressure onto the releasing button for assured and fast de-activation of the valve.



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Multi-cycle & Multi-modal Circulating Sub



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DAVMX - Applications Guide

Curing losses: Delivering an LCM pill to seal weak pores causing losses is best performed bypassing the BHA, because of the damage that LCM can do to internals and the risk of plugging off the bit. Fast activation is important to minimise cost of mud lost and in the worst case prevent the mud pits running dry. Once the LCM has been 'spotted' the BHA needs to be lifted out of this 'sticky' pill to avoid a stuck pipe situation whilst the pill is setting. During lifting and lowering the heavier LCM will want to u-tube into the BHA through the bit, uniquely the DAV's latching dart will prevent this secondary contamination.

Further options are If losses are only dynamic, mud can be saved by gravity feeding the dart into the tool with the pumps off. Also with a high capacity catcher below, the DAV will provide multiple bypassing cycles in a single run.

Hole Cleaning: Often overlooked good hole cleaning is vital for safe exit from hole and easy run back in with liner or casing. Well angle, tapering and pump rates are all parameters which can mean flow velocities are inadequate to carry cuttings at all points. Bypassing the BHA can provide just the boost needed to improve cleaning which improves exponentially with flow. Additional agitation can be given by spinning the pipe, but only if some flow can be directed to cool the BHA (split flow dart) in order to prevent friction heat accumulating and damaging the jewellery.

Packed-off: In a pack-off situation circulation will be lost, a dart can be gravity fed to open the ports if the angle is below 60 degrees. If the pack-off is below the valve this will allow circulation to be resumed around the remainder of the system.

Differential Sticking: In this situation low pore pressure has allowed the higher bore pressure to stick the pipe fast against the formation. Pumping in a lighter fluid into the string and allowing a U-tube effect to push it back out lowers the annulus head and the bore pressure and frees the pipe. Using a lock open dart will allow this u-tubing in through the ports which would otherwise be impractical with a conventional drill string configuration.

Swab/Surge/Dry Tripping: A number or inconvenient side effects of running in and out of hole can be relieved by opening the DAV to equalise pipe pressure with the annulus. Risk of formation damage from swab/surge effects if u-tubes can be stopped with an open valve, which can later be shut to resume operations. Wet Tripping can be slow, messy and dangerous if the lifted pipe will not drain, however a lock open dart in the DAV will produce draining and ensure a quicker and safer dry trip.

Motors/Turbines: Running motors and turbines often delivers greater ROP but can also have negative effects on other parameters such as hole cleaning. The DAV reduces the downsides of running these tools by providing the ability to disconnect them from the circulation and thereby mitigate these problems when not drilling.

Other applications: Please contact us if your application is not listed and you want to know if the DAVMX is a potential solution for you.

DAVMX

Multiple Modes & Multiple Cycles

- 100% bypass or split flow
- Forward or reverse flow
- Latch open or NRV mode

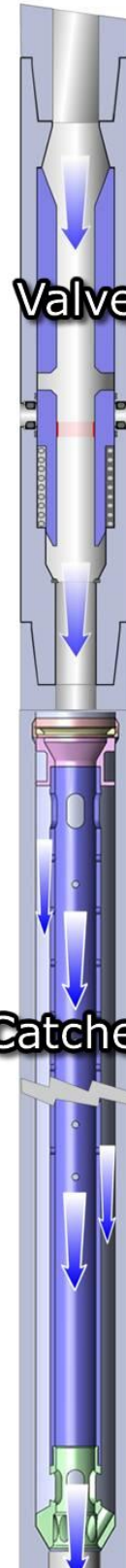
Body Strengths

The full-strength bodies feature high torque port geometries and are designed and manufactured to surpass the requirements for **API, NS1, NS2 & DS1.**

Churchill User List

ADTI, AGR, Apache, ATP, BG, Britannia, BP, Centrica, Chevron, CNR, Conoco, Dana, DONG, Encana, ENI, Fairfield, E.ON Ruhrgas, Gaz De France, Hess, Hydro, KCA, Kerr McGee, Marathon, Maersk, Mobil, Nexen, Origin, Oxy, Paladin, Petrofac, PetroCanada, Phillips, RWE, Sakhalin Energy, Senergy, Shell, Silverstone, Statoil, Talisman, TAQA, Total, Tullow, Vietsovetro, Venture, Wintershall

Much more info at [CircSub.com!](http://CircSub.com)



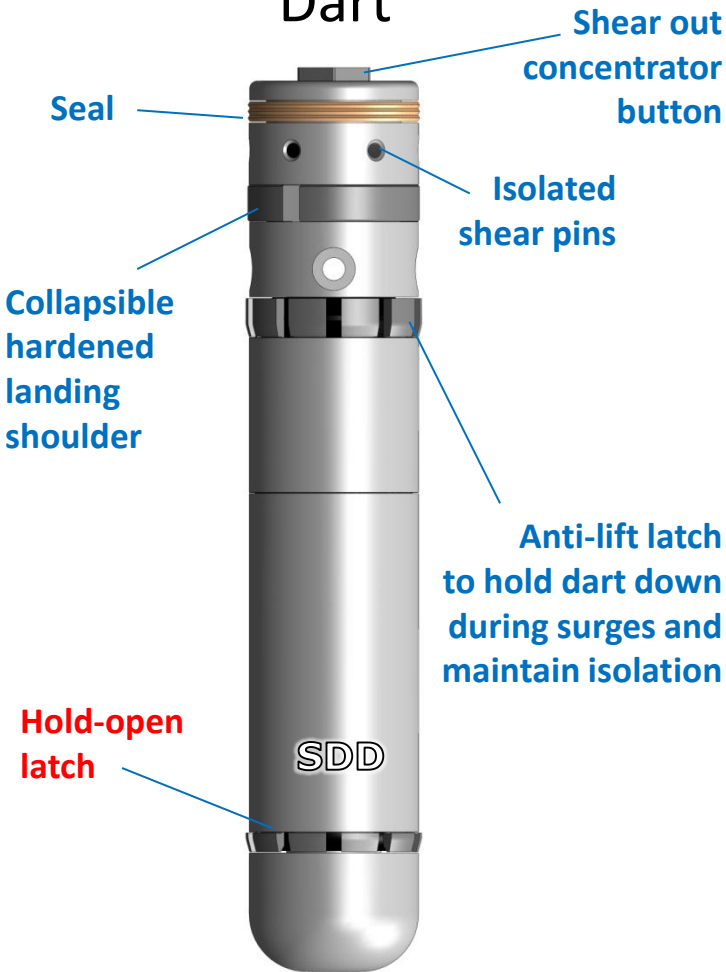
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Valve Data

Sizes	Connection Pin ID	Tool ID (Dart OD)	Ports TFA options	M/U Torque Max Pull
8" - 7 ft 8.13"	6 5/8 Reg. 3.0"	2.69" (Dart 2.75")	4 0.44-3.54 sq in	47-51K ft lbs 1,200 k-lbs
6½"-7 ft 6.88"	4½" IF NC50 2 13/16"	2.19" (Dart 2.25")	2 0.44-1.57 sq in	28-30K ft lbs 1,000 k-lbs
4¾"-7 ft 5.0"	3½" IF NC38 2.19"	1.94" (Dart 2.00")	2 0.44-1.57 sq in	10-11K ft lbs 500 k-lbs

Darts are collected below in a catcher sub inner core only 2/100th of an inch narrower than the valve above. A large inner annulus (over 9 sq in for 4½ IF) ensures no noticeable pressure drop when catcher is full.

Standard Diverter Dart



Standard Diverter Dart Overview - The SDD is the Dart of choice for most drilling applications. When pumped into place, the SDD holds the ports open and blocks off the through-bore to the BHA below. When the pumps are off, the ports of the valve remain open.

Most commonly used for:

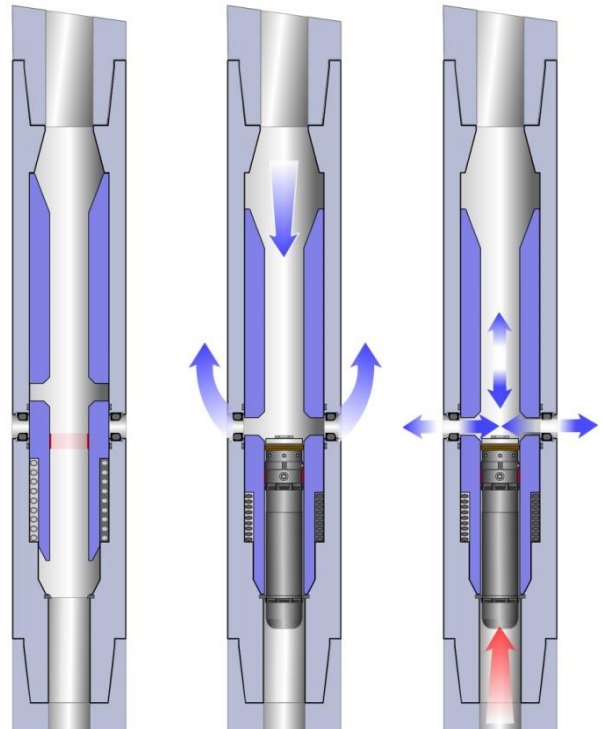
- Curing Losses
- Hole Cleaning

With the versatility of offering multiple applications, the SDD is also a time saver for tripping dry to surface and or jetting BOP's

Dormant position

100% Bypass

Drain and fill but no BHA return

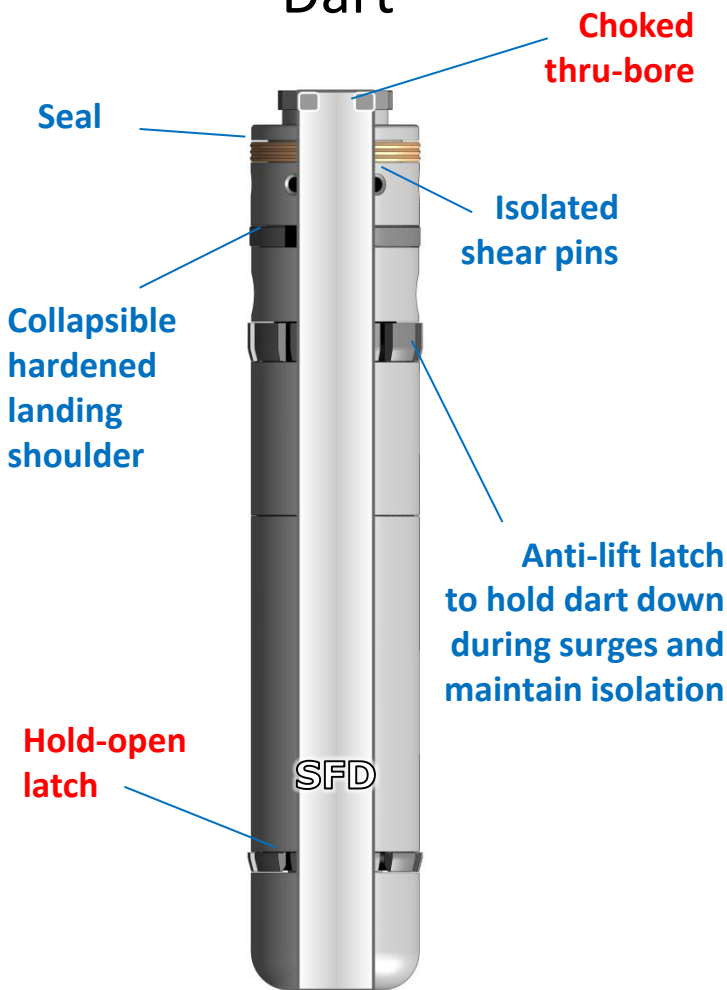


Flow control	Pumps on	Pumps off
Flow to annulus	Yes	Yes
Flow from annulus	No	Yes
Flow to bit	No	No
Flow from bit	No	No

Function	Opening
Length	12"
OD's for 8 1/4", 7" & 5" tools	2.75", 2.25" & 2.00"
Opening shear resistance	20,000 psi
Closing shear yield	2,000 psi

Rec'd Opening Speed	250gpm / 6bpm
Maximum Opening Speed	350gpm / 8bpm
Max. Freefall Angle (@ zero gpm)	55°
Bypass TFA Ratio	100%
No. of Cycles /100" catcher	5

Split Flow Dart



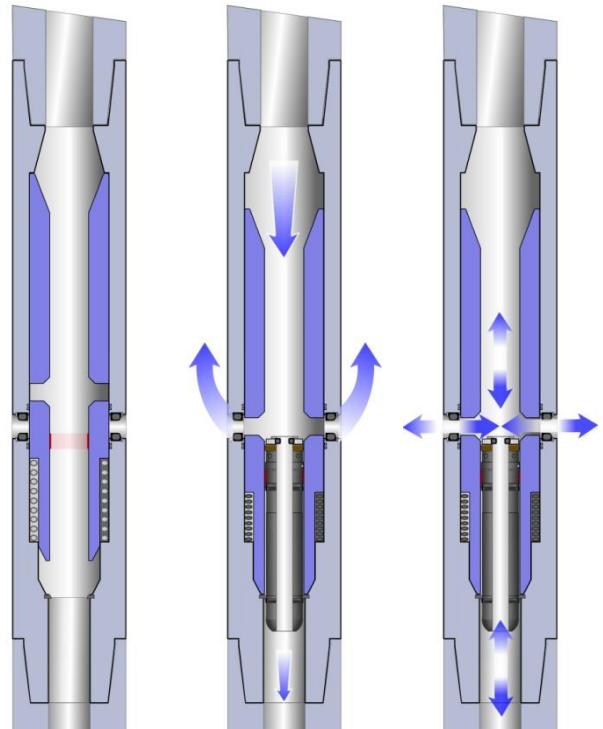
Split Flow Dart Overview - Like the Standard diverter, the Split Flow Dart holds the valve open with pumps off. Unlike the SDD the SFD has a choked bore which allows pressure and flow to pass to and from the drill bit.

For some applications full pressure relief is preferable, particularly when moving in and out of hole. In addition the knowledge that there is flow to bit can give better hole cleaning performance. The ability to keep the BHA cool whilst agitating flow by spinning the pipe, maximises hole-cleaning whilst and safe-guards expensive jewellery.

Dormant position

Split Flow Bypass

Drain and fill full pressure relief



Flow control	Pumps on	Pumps off
Flow to annulus	Yes	Yes
Flow from annulus	No	Yes
Flow to bit	Yes	Yes
Flow from bit	No	Yes

Function	Opening
Length	12"
OD's for 8¼", 7" & 5" tools	2.75", 2.25" & 2.00"
Opening shear resistance	6,600 psi
Closing shear yield	2,000 psi

Rec'd Opening Speed	250gpm / 6bpm
Maximum Opening Speed	350gpm / 8bpm
Max. Freefall Angle (@ zero gpm)	55°
Bypass TFA Ratio	~66%
No. of Cycles /100" catcher	5

Well Control Dart



Short-nosed without piston hold-open latch

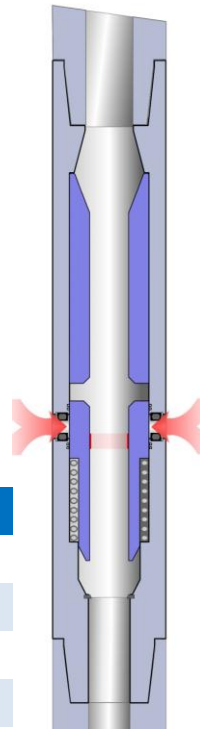
Well Control Dart Overview - The Well Control Dart is a unique feature of the DAV MX™ system.

Other systems may close with the pumps off, but only the WCD latches down and seals so that there is no flow path into the drill string from either the bit or the annulus.

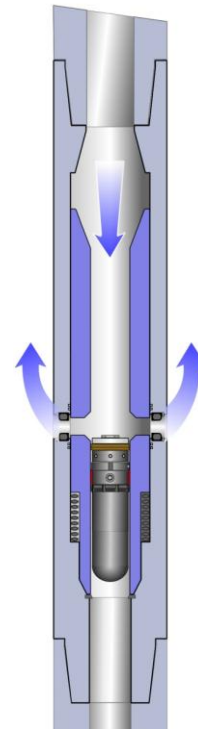
To get full well control, sealing is necessary from the outside-in and uniquely, for a simple valve, the DAV MX™ delivers.

Similar in many ways to the SDD with its 100% bypass, the WCD is the ideal dart for bypass in safety critical situations.

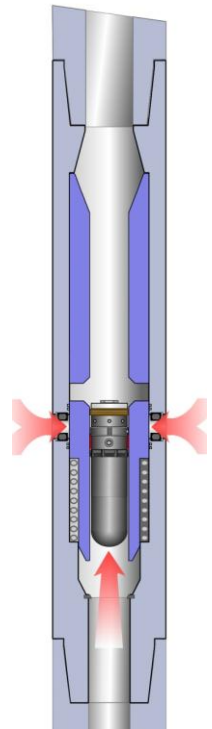
**Dormant position
No ingress**



Well Controlled Bypass



No return or ingress with pumps off



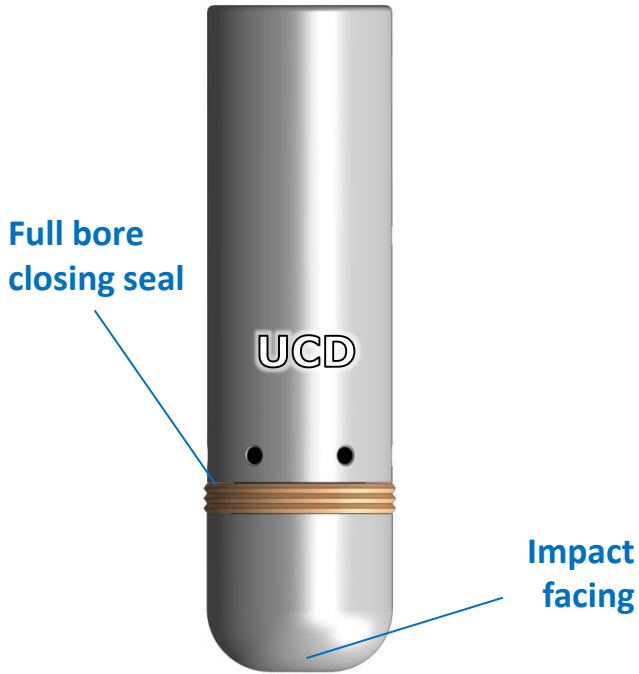
Flow control	Pumps on	Pumps off
Flow to annulus	Yes	Yes
Flow from annulus	No	No
Flow to bit	No	No
Flow from bit	No	No

WCD Specifications

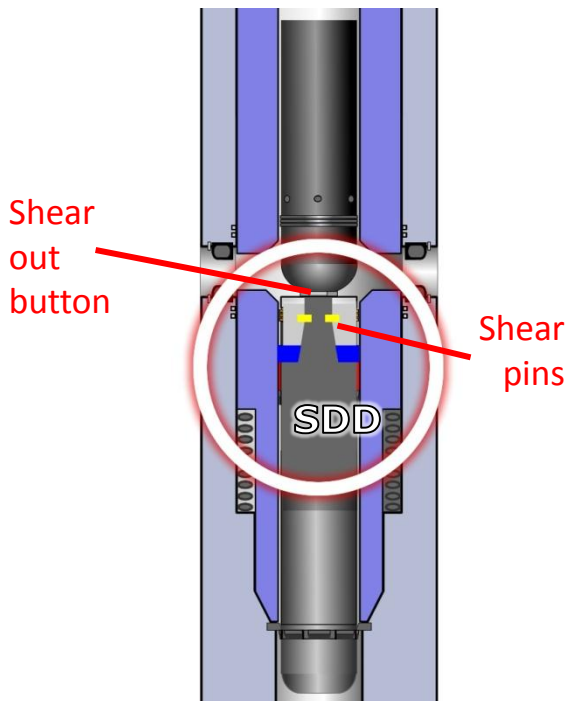
Function	Opening
Length	8"
OD's for 8 1/4", 7" & 5" tools	2.75", 2.25" & 2.00"
Opening shear resistance	20,000 psi
Closing shear yield	2,000 psi

Rec'd Opening Speed	250gpm / 6bpm
Maximum Opening Speed	350gpm / 8bpm
Max. Freefall Angle (@ zero gpm)	55°
Bypass TFA Ratio	100%
No. of Cycles /100" catcher	6

Universal Closing Dart



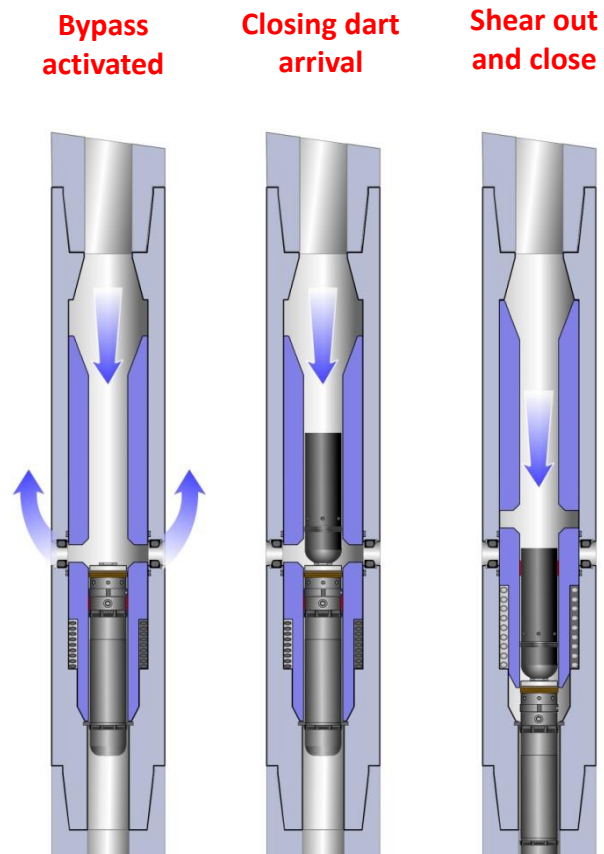
The closing dart hits the concentrator button to shear out the opening dart quickly and easily



Universal Closing Dart Overview - The UCD is used to close the valve, whichever Smart Dart™ is activated.

Once landed, the UCD will pressure up on the Opening Dart to shear it out and close the tool. When shear-out is done at high flow rates, closing is instantaneous and little pressure increase is seen at surface apart from the expected increase resulting from resumed thru-bit circulation.

Both Darts will pass through to the Catcher to where they are securely stored.



Function	Closing
Length	8"
OD's for 8¼", 7" & 5" tools	2.71", 2.21" & 1.96"
Rec'd closing speed	250 gpm / 6 bpm
Maximum closing speed	350 gpm / 8 bpm

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