



CUTTINGS BED MOBILIZER™ (CBM)

Debris Management Tool

The ULTIMATE in Hole Cleaning

Whether drilling on land or offshore, the advancement of technology and the ability to drill wells at a higher rate of penetration can create issues. One of several tools Arrival Energy Solutions has created is the patented Cuttings Bed Mobilizer. Designed and built to combat the problem of cuttings laying on the low side of the wellbore. CBM's are positioned throughout the entire horizontal section, ensuring that the entire lateral has minimal cuttings and no intermittent hole cleaning.

By adequate cuttings removal, operators can expect the following:

- More weight to the bit as tool joints aren't forced to push cuttings when sliding.
- Higher ROP and lower rotary torque.
- Increased tripping speeds and less or no overpull on trips.
- Reduced risk of suck pipe or packing off.

The Cuttings Bed Mobilizer's unique features that enable it to enhance hole cleaning.

- The CBM's overall length is relatively short and easy to handle on the rig floor.
- Embedded within the CBM is an impeller which picks cuttings up off the bottom of the hole and transports them to the high side where the high velocity circulation is occurring.
- Just in front of the impeller, a flow accelerator is embedded which provides turbulence and higher fluid velocities which assist the impeller in moving the cuttings off the low side of the hole.
- Four blades on the CBM ensure concentric motion at the flow accelerator and impeller and also assist in hole cleaning.
- The uphole blades on the CBM have both a left and right hand wrap which enhances hole cleaning when the drill string is being pulled of bottom or during a wiper trip.
- Clusterite is installed on the leading and trailing edges of all blades to enhance hole cleaning and also to reduce the effects of borehole spiraling.

At Arrival, we believe that unique technologies like the CBM can positively affect the overall time required to drill a well and make the drilling process significantly easier.

* Patent 8,336,645



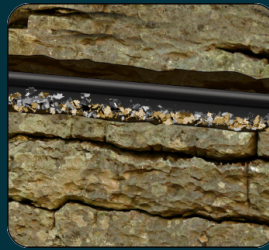
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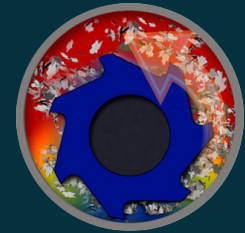
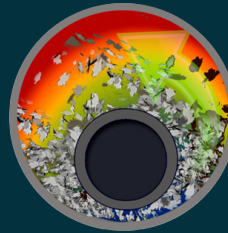
Debris Management Tool



Cuttings settle on the low side of the hole.



Cuttings and fluid move uniformly in annulus with CBM's in the drill string.

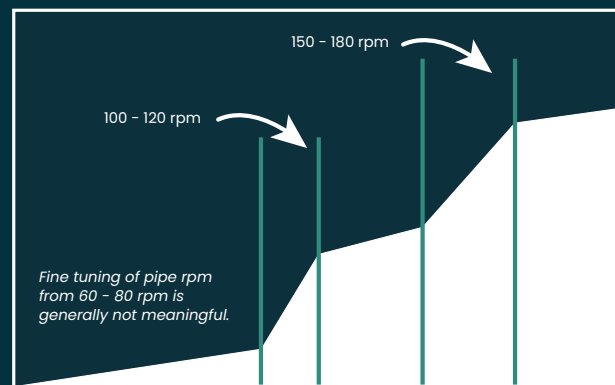


High speed pipe rotation will cause the fluid to spiral as it is forced up the hole. The cuttings bed can be agitated by a tool like the Cuttings Bed Mobilizer which lifts the cuttings off of the low side of the hole and moves it up into the flow path.

Cuttings Return Vary with Rotary Speed

Several operators have experimented with rotary speeds of up to 220 rpm, but little benefit has been seen over 180 rpm.

How fast can you rotate the pipe in your horizontal well? The Cuttings Bed Mobilizer can move the cuttings into the flow path at lower rpm.



Pipe RPM

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Drill Pipe Size	3-1/2"	4"	4"	4"	4-1/2"	4-1/2"	5-1/2"	
Standard Connection	3-1/2 API IF (NC 38)	4 API FH (NC 40)	DS40	XT39	MT40	4 API IF (NC 46)	4-1/2 API IF (NC 50)	5-1/2 API FH
Make-Up Torque	10,900 - 12,000 FT-LBS 1,478 - 1,627 daNm	21,000 - 22,400 FT-LBS 2,847 - 3,037 daNm	21,000 - 22,400 FT-LBS 2,847 - 3,037 daNm	19,500 FT-LBS 2,646 daNm	20,900 FT-LBS 2,836 daNm	23,600 - 26,000 FT-LBS 3,200 - 3,526 daNm	25,250 - 27,750 FT-LBS 3,424 - 3,763 daNm	30,200 - 33,200 FT-LBS 4,095 - 4,502 daNm
L1	116.0" (2,946 mm)	5,250" (133.4 mm)	5,250" (133.4 mm)	5,250" (133.4 mm)	5,250" (133.4 mm)	116.0" (2,946 mm)	116.0" (2,946 mm)	116.0" (2,946 mm)
A	5,000" (127.0 mm)	5,250" (133.4 mm)	5,250" (133.4 mm)	5,250" (133.4 mm)	5,250" (133.4 mm)	6,250" (158.8 mm)	6,625" (168.3 mm)	7,250" (184.2 mm)
Through Bore	2,250" (57.2 mm)	2,250" (57.2 mm)	2,250" (57.2 mm)	2,250" (57.2 mm)	2,250" (57.2 mm)	2,250" (57.2 mm)	3,000" (76.2 mm)	3,500" (88.9 mm)



* Make-up torque values listed are for reference only.

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