



Debris Management Drilling Tools

Protecting BHA components during well construction

Remove drilling debris from the wellbore before it creates expensive problems.

Debris commonly causes downhole tool failure, reduced tool integrity, and MWD reliability issues. Larger solids and debris can even compromise long-term production.

M-I SWACO offers a suite of custom-engineered drilling tools that function independently or as a complete assembly to eliminate debris-related risks.



MUDGARD

Workstring filter

Mitigates damage to BHA components

The MUDGARD* workstring filter can be used in tandem in any drilling application as a proactive measure to protect equipment susceptible to damage—such as MWD and LWD tools, RSSs, bits, and other critical BHA components—from large debris contained in the circulating system.

It also can be used in tandem with wireline-compatible tools, such as the WELL COMMANDER* ball-activated drilling circulating valve, to facilitate spotting of lost circulation material (LCM) while providing single-trip wireline access to recover chemical sources during stuck-pipe and other emergency incidents.

The MUDGARD filter is strategically incorporated in the drillstring to capture and retain all fluid-borne debris before such debris can invade and irreparably damage complex BHA components that use an impeller, modulator, or pulsar system. Optimized using computational fluid dynamics, this internal filter is highly resistant to erosion and creates only minimal pressure loss in the system. The MUDGARD filter is engineered with a contingency central bypass, which enables complete wireline access without requiring the recovery of additional drillstring components. The central bypass is also designed to reestablish fluid communication through the tool should a higher-than-expected volume of debris accumulate and subsequently block the high-capacity filter.

Applications

- BHA protection during drilling

Benefits

- Proactively protects BHA equipment susceptible to damage from fluid-borne debris, even at high flow rates
- Enables a pathway for single-trip wireline access in emergency situations
- Offers uncompromised LCM capture and chemical source retrieval
- Provides overpressure relief in excessive debris conditions
- Retains debris until filter is brought to surface
- Minimizes system pressure loss

Features

- Single-piece, high-strength collar with no internal connections
- Contingency central bypass
- Large debris capacity
- Erosion-resistant filter design
- Large flow-through area

MUDGARD Workstring Filter Mitigates BHA Failure in Seven-Well Field Trial

Challenge

During the well construction process, debris from the drilling operation can build up in the drilling fluid, damaging sensitive BHA components. To increase drilling efficiency, reduce the recurrence of BHA plugging, and improve tool performance, an operator needed to protect critical BHA equipment from circulation debris. The operator collaborated with M-I SWACO for a field trial of an innovative new workstring filter.

Solution

The MUDGARD workstring filter is engineered to resist erosion and minimize pressure losses in the system while capturing and retaining fluid system debris. In addition, the filter features a contingency central bypass—enabling complete wireline access without requiring extra runs to recover drillstring components. M-I SWACO deployed the 4¾-in MUDGARD workstring filter as part of the BHA for the 6⅝-in section of seven extended-reach wells.

Results

Throughout the seven-well field test, the MUDGARD workstring filter captured and retained more than 10 lbm [4,764 g] of fluid-borne debris before it invaded and irreparably damaged complex BHA components—significantly increasing the service interval of the equipment. Over the course of the trial, the operator drilled more than 56,893 ft [17,341 m] over 1,950 h without having to pull out of hole or replace any filter screens.

Because of the field trial's success, incorporating the MUDGARD workstring filter into the BHA has become a standard practice for the operator in extended-reach wells. The operator now plans to use the innovative filter in the next sections of its upcoming horizontal wells.



The MUDGARD filter after recovering a variety of potentially damaging debris.



Large debris captured by the MUDGARD filter.



MAGNOGARD

Openhole magnet

Captures and removes damaging ferrous debris from wellbore

The MAGNOGARD® openhole magnet is the industry's only tool of its kind designed specifically for openhole drilling applications. The magnet collects and retains ferrous debris created during drilling operations, such as casing wear, broken bit teeth, or other metallic junk, keeping it out of the annular flow path and maximizing fluid bypass. By reducing contact with ferrous debris left in the wellbore, the MAGNOGARD magnet extends the life of your drill bit and other BHA components as well as reduces interference with MWD equipment.

The MAGNOGARD magnet is suited for all drilling environments, particularly high-angle wells or hard and abrasive rock applications, which, in concert with aggressive drilling parameters, increase the likelihood of bit damage and debris being trapped downhole.

Installed just above the bit, the MAGNOGARD magnet is well positioned to promptly attract debris before it enters

the fluid stream. The magnet rotates and reciprocates in the open hole without damaging the tool or the formation. Once the powerful magnets make contact, the metallic fines are retained within high-capacity collection valleys. The collection grooves are similar to cased hole magnets designed to eliminate the risk of captured debris escaping and falling into the hole. All the collected fragments are restrained until the MAGNOGARD magnet is brought to surface, where it is inspected, cleaned of debris, and fully prepared for another run.

Because the MAGNOGARD magnet captures, retains, and removes ferrous debris from the flow path, the operator does not need to depend on the fluid stream to completely remove debris from the well; it can be separated with surface solids control equipment. The MAGNOGARD magnet captures casing chips and other metallic slivers entrained in the drilling fluid, which, over time, build up in continually reused oil-base mud (OBM) and create interference with directional survey tools or damage the internal components of the BHA equipment.

Applications

- Openhole operations, including drilling, casing exits, milling, prescreen wiper trips, and openhole fishing
- High-angle well drilling
- Wells using recycled drilling fluids
- High-temperature drilling

Benefits

- Extends bit life and reduces BHA damage
- Captures debris outside the primary flow path, minimizing ECDs
- Assures the open hole is free of steel prior to running lower completions
- Decreases survey interference by reducing magnetized metallic fines in the mud system
- Eliminates extras trips during milling or window cutting operations

Features

- Rated to 400 degF [204 degC]
- Single-piece, high-strength mandrel with no internal connections
- Streamlined OD design
- Large debris collection valleys
- Wear-resistant, smooth-ground tungsten carbide areas on body
- Circumferential magnet coverage

Operator Uses MAGNOGARD Magnet to Remove Debris and Enable Optimal BHA Performance, Onshore Texas

Challenge

Using data from previous wells, an operator in southwest Texas determined that downhole ferrous debris was having a detrimental effect on the RSS and MWD tools while drilling extended horizontal sections of the wellbore. The ferrous debris issue was unexpected because these were original boreholes in which no previous milling had been done. The planned section involved drilling an 8.5-in horizontal section from the curve landing point—10,951-ft MD (10,600-ft TVD)—to a TD of 20,787-ft MD (10,552-ft TVD) with inclinations ranging between 89° and 92° through a hard, abrasive formation.

Solution

M-I SWACO suggested incorporating the MAGNOGARD magnet as part of the drilling BHA. The magnet's streamlined OD enables rotation and reciprocation in the open hole with no risk of damaging the formation or the tool itself. The powerful magnets and generous debris collection valleys make it ideal for capturing and retaining ferrous debris from the flow path while minimizing the effects on ECD.

Results

The MAGNOGARD magnet was used while drilling the 8.5-in horizontal section to TD and successfully recovered 33 lbm [15 kg] of ferrous debris to surface. Removing this debris from the system enabled the RSS to perform optimally and eliminated previously experienced steering issues. Removing the ferrous debris from the system extended the downhole tool life and improved tool performance.



The MAGNOGARD magnet with completely full collection valleys after a drilling run in Texas.



The MAGNOGARD magnet features powerful, easy-to-clean magnets embedded into deep collection valleys.



WELL COMMANDER

Ball-activated drilling circulating valve

Helps prevent debris buildup and associated hazards

The multicycle, ball-activated WELL COMMANDER valve provides an alternate circulation path that effectively bypasses BHA restrictions. Ideal for use with all types of drilling fluids and clear brines, the valve is positioned above debris-susceptible BHA components, MWD and LWD tools, core barrels, mud motors, underreamers, and similar tools. Once in place, the advanced hazard mitigation tool can be opened to create an alternate path used to boost annular velocities, preventing hazards—such as the buildup of cuttings beds in drilling operations—and reducing circulating time during large-volume fluid conditioning and displacements.

Additionally, this advanced drilling valve enables spotting of LCM and wellbore strengthening pills exactly where needed without concern for exceeding the size and concentration limits of BHA tools prone to plugging.

The WELL COMMANDER valve delivers high flow rates that save time while spotting LCM treatments or kill-weight fluids; its large total flow area enables the valve to be used to spot very aggressive treatments. In addition, by bypassing restrictive BHA equipment, the valve enables operators to drain even small-diameter workstrings during a trip. The WELL COMMANDER valve avoids the risk of spilling drilling fluid at the rotary table by ensuring the weighted slug functions every time and at any angle, promoting a safer and cleaner work environment.

Applications

- Extended-reach, tortuous-well, and high-pressure drilling
- High-concentration LCM or kill-weight fluid spotting
- Cutting bed removal
- Underreaming or coring operations
- Annular velocity enhancement
- Fluid conditioning and displacement at high flow rates

Benefits

- Boosts annular velocity to enhance hole cleaning and facilitate drilling debris removal
- Enables control of debris reaching lower BHA components by shutting off flow completely
- Stimulates turbulent flow by combining the pipe rotation with increased annular velocities
- Reduces downhole pressure effects associated with increased rates
- Promotes workstring draining while tripping

Features

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

Case Study

WELL COMMANDER Drilling Valve Boosts Annular Velocity and Cleans Hole During Long Trips, Offshore Sakhalin Island

Challenge

While drilling a high-angle, extended-reach well, an operator in Sakhalin needed to boost annular velocities to assist in hole cleaning during drilling operations.

Solution

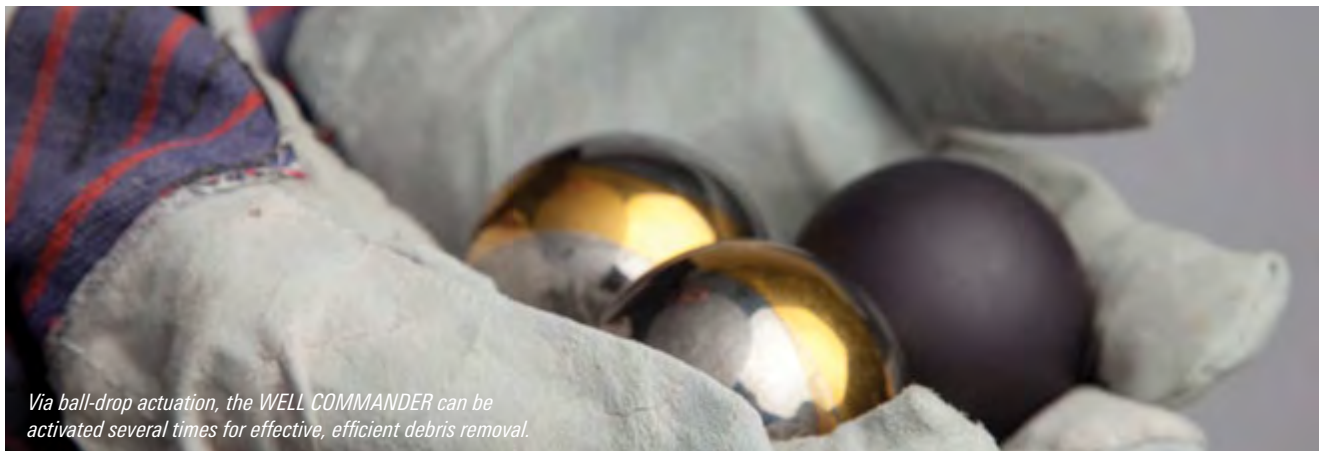
Because of the nature of the well, it was inherently difficult to remove cuttings from the wellbore. In order to create the velocities required to remove the cuttings at an 80° inclination in a 12¼-in well, the operator required a valve that would enable the fluid to bypass equipment downhole. Schlumberger and M-I SWACO decided that the WELL COMMANDER valve would be ideal for this application.

Results

The WELL COMMANDER valve was positioned at 80° inclination above the drilling BHA to mitigate drilling hazards and to boost annular velocities as required. Several high-viscosity, weighted sweep pills were pumped through the ports of the WELL COMMANDER valve at high rates to facilitate hole cleaning and cuttings removal. Once the operator began to use the valve, it found that the cuttings volume at surface increased by more than 150%. When the well reached TD, the operator swept the hole one more time but found that it was clean. As a result, the operator was comfortable casing the well. The annular velocities achieved while using these pills would not have been possible without the improved hydraulics provided by the WELL COMMANDER valve.



M-I SWACO field technicians inspect the WELL COMMANDER valve to insure proper preparation for a run.



Via ball-drop actuation, the WELL COMMANDER can be activated several times for effective, efficient debris removal.

Protect your production, assets, and equipment.

With M-I SWACO debris management tools, proactively take measures to ensure downhole equipment—and production potential— isn't compromised.

Prevent debris-related drilling hazards and associated NPT with cost-effective debris management drilling tools from M-I SWACO.

MUDGARD workstring filter

MAGNOGARD openhole magnet

WELL COMMANDER ball-activated drilling circulating valve

Find out more at miswaco.com/debris

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