



Wellbore Cleanup Magnets

Fit-for-purpose suite of high-capacity ferrous debris extraction tools



Wellbore Cleanup Magnets: Engineered approach for mechanical solutions that optimizes production and minimizes NPT

Nearly all downhole operations result in the generation of ferrous debris which could remain in the wellbore. Even tripping pipe can leave behind bits of metal that, if not removed from the wellbore, can eventually damage both completion tools and the formation. Failure to recover even the most minuscule ferrous particles can result in a costly intervention, effectively offsetting the benefits of designing the most reliable and cost effective completion.

Evolving from the pacesetter MAGNOSTAR[†] magnet, the suite of new generation magnet debris management tools from M-I SWACO, a Schlumberger company, include the MAGNOSWEEP II[†] compact-design, high-capacity magnet, MAGNOSHOE[†] magnetic specialized tool, and CT MAGNOSTAR magnet. These highly effective magnets are field proven to extract high volumes of ferrous debris in any application where circulation alone provides inadequate debris removal.

Specially engineered magnets give you a clean path to optimal production

FEATURES

- High-strength rare earth magnets
- Single-piece mandrel designs
- Casing-protective facing
- Robust designs for high-torque, high-temperature service
- Applicable for all casing/liner sizes and weights
- Magnet engineered specifically for coiled tubing operations
- High-volume extraction capacities

BENEFITS

- Optimizes wellbore cleanup
- Minimizes completion, formation damage
- Enhances cleanup when circulation alone is insufficient
- Captures, extracts large volumes of metal debris
- Simplifies debris removal on surface
- Eliminates remediation for ferrous debris-induced damage
- Reduces costs
- Helps maximize production

The M-I SWACO all-inclusive suite of wellbore cleanup magnets has raised the bar for ferrous debris recovery. Designed as integral components of the work string, our line of fit-for-purpose magnetic extraction tools are engineered to recover all sizes of ferrous debris deposits. Our magnets work in any wellbore geometry or application, including:

- Displacements
- Post-perforating
- Pre-fracturing
- Multizone completions
- Milling
- Burning
- Fishing
- Smart completions
- Coiled tubing

Many operations produce a large amount of metal debris which can be detrimental in many ways such as, formation or completion equipment damage, the possibility of compromising a well barrier or acting as a choke if left in the heel of a deviated wellbore. When a milling job is required to mill up a packer or in a side track situation when cutting a window an enormous amount of metal will be generated. Perforating and deburring a perforation interval will also create ferrous debris that must be managed through the use of debris management magnets. In unforeseen situations when a fishing operation is necessary, magnet tools can be an extremely effective extraction tool. Many times these operations are performed in completion fluids with very little solids carrying characteristics making it difficult if not impossible to circulate this type of heavy debris to surface. In many cases it is much more beneficial to capture this debris downhole rather than circulating it to surface due to the possibility of compromising a well barrier such as BOP's or the wellhead.



MAGNOSTAR magnet: The premier magnet for ferrous debris extraction



Features and benefits

- Single-piece mandrel with no internal connections
- Optional dedicated flow path to prevent flow path restrictions when packed full of debris
- Fixed stabilizer sleeve on box end to provide stand-off when pulling out of hole (POOH)
- Casing-compatible facing material to minimize casing wear
- Available in common casing/liner sizes and weights (13 3/8" to 7")
- Large capacity for retrieving up to 150 lbs (68 kg) of ferrous material
- High-strength, rare earth magnets rated to 400° F (204° C)
- No flow restriction below the tool permitting large debris-free access to magnets
- Recovered debris easily removed on surface

The ground breaking MAGNOSTAR magnet was designed specifically for large-volume cleanup applications in high-torque strings. The pacesetter tool provides superior magnetic surface area for ferrous debris extraction when circulation alone is insufficient for wellbore cleanup.

The MAGNOSTAR magnet works as an integral component of the work string during cleanup to remove ferrous debris. It can be run in conjunction with other wellbore cleanup tools as part of cased hole drilling, milling, and polishing assemblies. It can be rotated and reciprocated without fear of damage to the casing or the tool itself. The MAGNOSTAR magnet is applicable for use in any application with the potential for significant ferrous debris deposits in the wellbore.

How it works

The MAGNOSTAR magnet is made up as a conventional tool. It has no limiting trip speed factor and can be rotated at common drilling speeds.

The blades on the housing provide a generous flow area for fluid bypass around the tool, while stabilizers simultaneously provide standoff and a secure area away from the casing wall to collect debris. On surface, the tool can be easily cleaned as per M-I SWACO safety procedures, with all debris captured, weighed, and, where appropriate, photographed for subsequent documentation requirements. Additionally, the connections of the MAGNOSTAR magnet can be fitted with mill rings to produce a heavy-duty tool for more aggressive applications.

MAGNOSTAR magnet proves itself in the field

Gulf of Mexico: BHA featuring MAGNOSTAR magnet cleans up milling debris

The Situation

The operator was planning a casing exit in the 14-in. section of its Gulf of Mexico well. The primary objective was minimizing the risk of damaging the BOP through exposure of metallic debris during the window milling as the milling operation was expected to generate a large volume of ferrous debris. The operator was concerned that running magnets in the milling string would raise the risk of packing off around the magnets.

The Solution

M-I SWACO recommended the operator run the MAGNOSTAR magnet which unlike conventional magnets that only capture debris on the outside diameter of the tool, retrieves debris within the “ribs” of the mandrel. In addition, even when full of debris, the MAGNOSTAR magnet still allows a generous flow area around the tool. Thus, an innovative BHA design was selected that included six MAGNOSTAR magnets spaced out above the milling operation, which would remain inside the 14-in. casing section once the window was cut and the rat hole drilled.

The Results

As a result of this novel BHA arrangement, no pressure spikes/packoff or other adverse effects were encountered while milling with the MAGNOSTAR magnets in the string. During the operation, the magnets successfully captured and recovered a cumulative 877 lb (398 kg) of metal, effectively limiting the exposure of the BOP elements to potentially damaging ferrous debris.

Up to

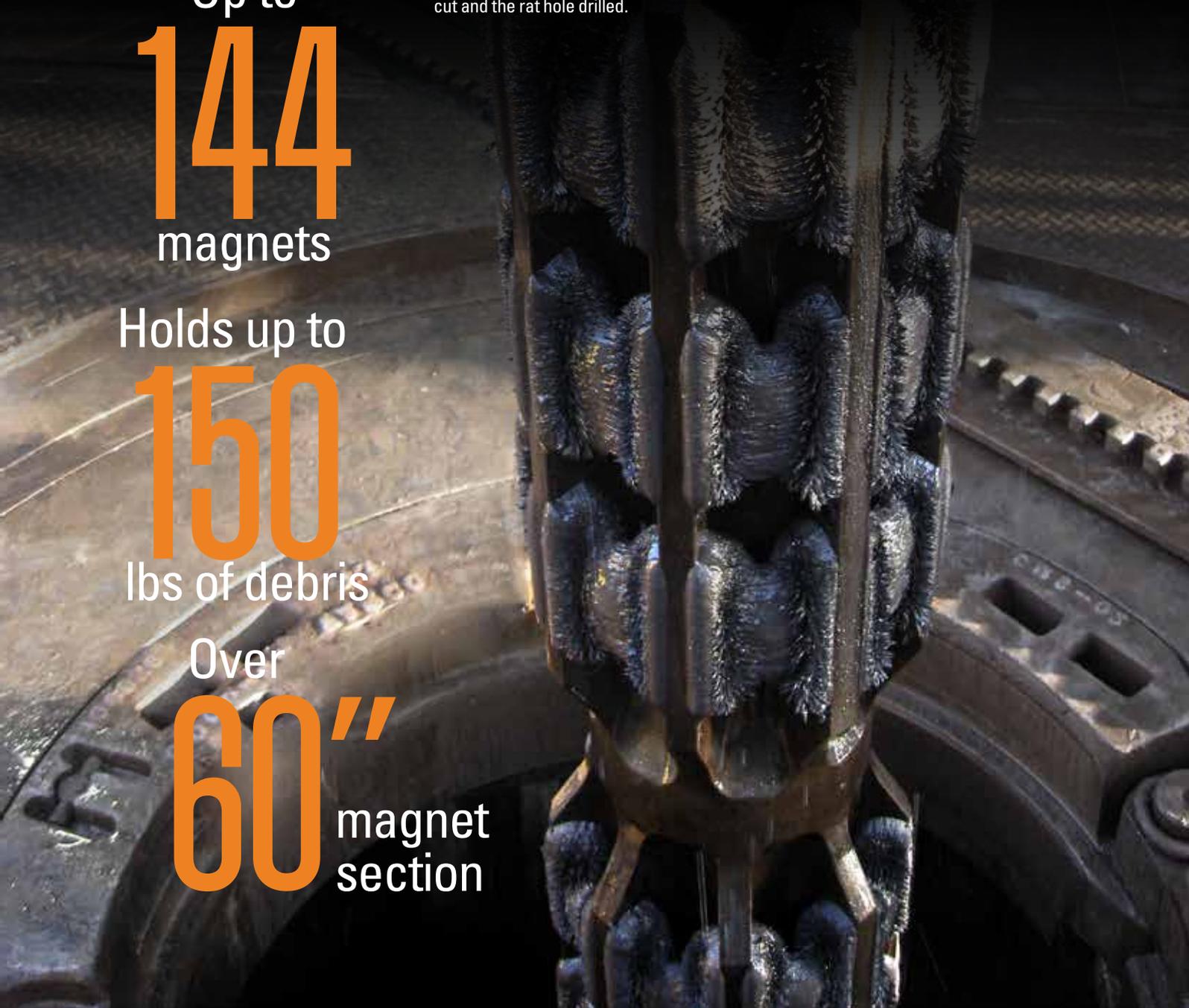
144
magnets

Holds up to

150
lbs of debris

Over

60"
magnet
section





Up to
48
magnets

Holds up to
50 lbs
of
debris

Over
22" magnet
section



MAGNOSWEEP II magnet: Compact high-capacity magnet for enhanced recovery

Features and benefits

- Compact design
- Single-piece mandrel
- High-strength rare earth magnets
- Fixed stabilizer sleeve to provide standoff when pulled out of the hole (POOH)
- Optional dedicated flow channel prevents flow path restrictions when packed full of debris
- Removable magnets for body inspection
- Recovered material is easily removed on location
- High-temperature rating on magnets up to 400°F (204°C)
- Debris channels allow for collection of larger volume of ferrous material

The compact MAGNOSWEEP II magnet tool is engineered to collect and extract large volumes of ferrous debris to ensure the integrity of the wellbore cleanup. The MAGNOSWEEP II magnet features a large magnetic surface area with distinct flow channels that combine higher magnet strength with greater volume. The tool can be run as an integral part of the work string during wellbore cleanup operations or as a component for cased hole drilling, milling, and polishing assemblies. The tool can be rotated and reciprocated without fear of damaging the casing or other tools.

How it works

The MAGNOSWEEP II magnet should be run in any operation that will potentially generate or encounter ferrous debris. The MAGNOSWEEP II magnet is made up as a conventional tool and, like the MAGNOSTAR magnet, it has no limiting trip speed factor, and can be rotated at common drilling speeds. The housing blades provide a generous flow area for fluid bypass, while the stabilizers provide stand-off for a secure debris collection area away from the casing wall. Once on surface, the tool should be cleaned per M-I SWACO safety procedures with the extracted debris captured, weighed, and photographed for any subsequent reporting required.

Field proven performance

Brunei: MAGNOSWEEP II recovers significant metal debris during plug drilling operation

The Situation

A major operator working offshore Brunei required a wellbore clean up operation during drill out of an EZSV plug as well as 51m of cement above it. As with most cased hole drilling operations of this nature metal debris would be generated creating the need for magnet tools in the BHA.

The Solution

M-I SWACO recommended utilizing the MAGNOSWEEP II magnet. The MAGNOSWEEP II magnet is designed to recover large volumes of ferrous debris to ensure the integrity of the wellbore clean up. The tool features a large magnetic surface area along with discrete flow channels to combine higher magnet strength with greater volume to make possible enhanced recovery with this compact magnet tool. The tool can be run as a component of most drilling/milling/polishing assemblies or as an integral part of the drill string during wellbore cleanup operations.

The Results

On the first trip the 10 3/4 inch MAGNOSWEEP II magnet recovered 25.5 lbs (11.6 kg) and the 7 5/8 inch tool recovered 14.3 lbs (6.5 kg) of metal debris. On the second trip the 10 3/4 inch tool recovered 18.3 lbs (8.3 kg) and the 7 5/8 inch tool recovered 8.5 lbs (3.8 kg) of metal debris. Total recovery was 66.6 lbs of mostly metal fines with a few larger metal chunks included.

MAGNOSHOE magnet: The industry's most powerful magnet for large debris extraction

Features and benefits

- Fully encased rare earth magnet
- Magnet components rated to 570°F (300°C)
- Forward facing circulation ports
- Simple three-piece construction
- Modular sleeve with circulating/draining ports
- Fully tested protective shroud for safe shipping and handling
- High-strength magnet array can carry and retain oddly shaped and heavy debris
- Allows circulation below magnet face to remove or disturb debris prior to engaging ferrous material
- Captured debris is not disturbed by fluid draining from ports on modular sleeve
- Modular sleeves can be selected to provide appropriate capture space for the varying size and shape of debris
- Easily cleaned on rig for subsequent runs
- Approved for air shipments with no special packaging required

The MAGNOSHOE magnet is engineered with the latest and most powerful magnet technology available, allowing it to withdraw large and abnormally-shaped ferrous debris that has fallen to the bottom of the wellbore and cannot be circulated back into the annular path of a conventional drill string magnet. Shop tests have shown the MAGNOSHOE magnet is capable of effectively lifting up to 1,500 lbs (680 kg) of ferrous debris.

The MAGNOSHOE magnet was designed to simplify completions and enhance displacements. It can be used in any situation where larger metallic debris has fallen to the low side of the wellbore or on top of another element higher up in the well. Since larger debris can be difficult to mill and circulate back into the fluid stream, it must be retrieved mechanically. The MAGNOSHOE magnet can be readily deployed on the end of the work string for drilling, displacements, dedicated cleanouts, or similar wellbore pre-completion preparation activities.

The MAGNOSHOE magnet arrives on location in a protective shroud that shields its powerful magnetic field. The MAGNOSHOE magnet has passed an independent compass deflection test in accordance with IATA Packing Instruction 953, making it fully compliant for shipping via passenger or cargo aircraft.

This protective shroud and the designation for safe shipping facilitate safe transport to the rig. It also protects personnel from injury while handling the tool on the rig floor.

How it works

The MAGNOSHOE magnet can be used in conjunction with other wellbore preparation tools, including the MAGNOSTAR magnet or the MAGNOSWEEP II magnet. As the tool is lowered, a unique fluid circulation ring incorporated in the modular sleeve helps disturb debris so the tool can locate directly on the top of the target. When the MAGNOSHOE magnet contacts the targeted debris, the magnetic forces hold it on the magnet until it is physically removed on the surface. While tripping out, the circulation ports facilitate draining the string so the fluid is directed away from the collected debris so it is not dislodged from the magnet on the way out of the hole.

The modular sleeve comes in a standard and elongated version to suit different size and shape targets. When the tool and its captured debris are brought out of the hole, the MAGNOSHOE magnet can be quickly removed from the string and set aside to prepare for the next operation. The tool can be cleaned offline to be ready for another run or stored in its protective shroud and transported to another location.





Holds up to
1500 lbs
of
debris

MAGNOSHOE magnet proves itself in the field

Norway: Cable Clamp Fishing with a 9 5/8" MAGNOSHOE magnet makes life easier

The Situation

During a completion on a well in offshore Norway it became apparent that a cable clamp had been lost downhole. Since milling this debris down to a manageable size and circulating it to surface was not an option, a fishing operation would be required before further completion operations could resume. Due to the odd shape of "the fish" and a 75° deviation in this section of the well this proved to be a difficult task to recover.

The Solution

M-I SWACO suggested running in with one 9 5/8" (8 1/4" OD) MAGNOSHOE magnet on the end of the string and two 5/8 9 5/8" MAGNOSTAR magnets to remove the cable clamp and any residual debris in as few runs into the well as possible. The MAGNOSHOE magnet is engineered with the most powerful magnet technology available, with the ability to carry and retain odd shaped metal debris. The tool has forward facing circulation ports to remove or disturb debris prior to engaging the ferrous material. The tool was the ideal choice for fishing this type of metal debris from the well.

The Results

In one run the MAGNOSHOE magnet successfully recovered the most difficult portions of the clamp material including a large amount of swarf allowing a subsequent run with a fishing tool to complete the operation. The MAGNOSHOE magnet was instrumental in clearing the way for completion operations to continue and reducing the amount of NPT.



Coil Tubing MAGNOSTAR: Specially engineered magnet for coiled tubing applications

Features and benefits

- Available in 2^{7/8}" and 2^{3/8}" sizes
- One-piece, full-strength mandrel
- Ridges and valleys design
- High-strength rare earth magnet
- Offset valleys designed to trap debris and cover 360° of the wellbore
- Design prevents debris from being washed or scraped off the tool
- Through bore allows high flow and ball drop
- Offset valleys designed for high capacity in a short length

The latest addition in the M-I SWACO suite of magnetic tools, the CT MAGNOSTAR tool was engineered specifically to remove large volumes of ferrous debris from the wellbore generated during coiled tubing operations. The unique CT MAGNOSTAR magnet typically is run on top of the coiled tubing motor during milling or clean out operations to attract plug slips, metal swarf, and other ferrous materials. The placement of the magnet prevents the debris from interfering with the milling operation, thus reducing the risk of motor stalling and the time required to complete the cleanout operation.

The CT MAGNOSTAR magnet can be used while cutting windows with coiled tubing, drilling out plugs, milling stuck fluid loss control devices, or in a simple clean out run. The through bore of the CT MAGNOSTAR magnet is large enough to allow balls to be dropped to disconnect a sub below for high-rate circulation.

The CT MAGNOSTAR magnet is highly recommended for use during milling operations to remove heavy metallic pieces, which cannot be circulated out, before they reach the BOP. In addition, the CT MAGNOSTAR magnet can be used in fishing operations for smaller pieces that can be deposited in the valleys of the tool.

How it works

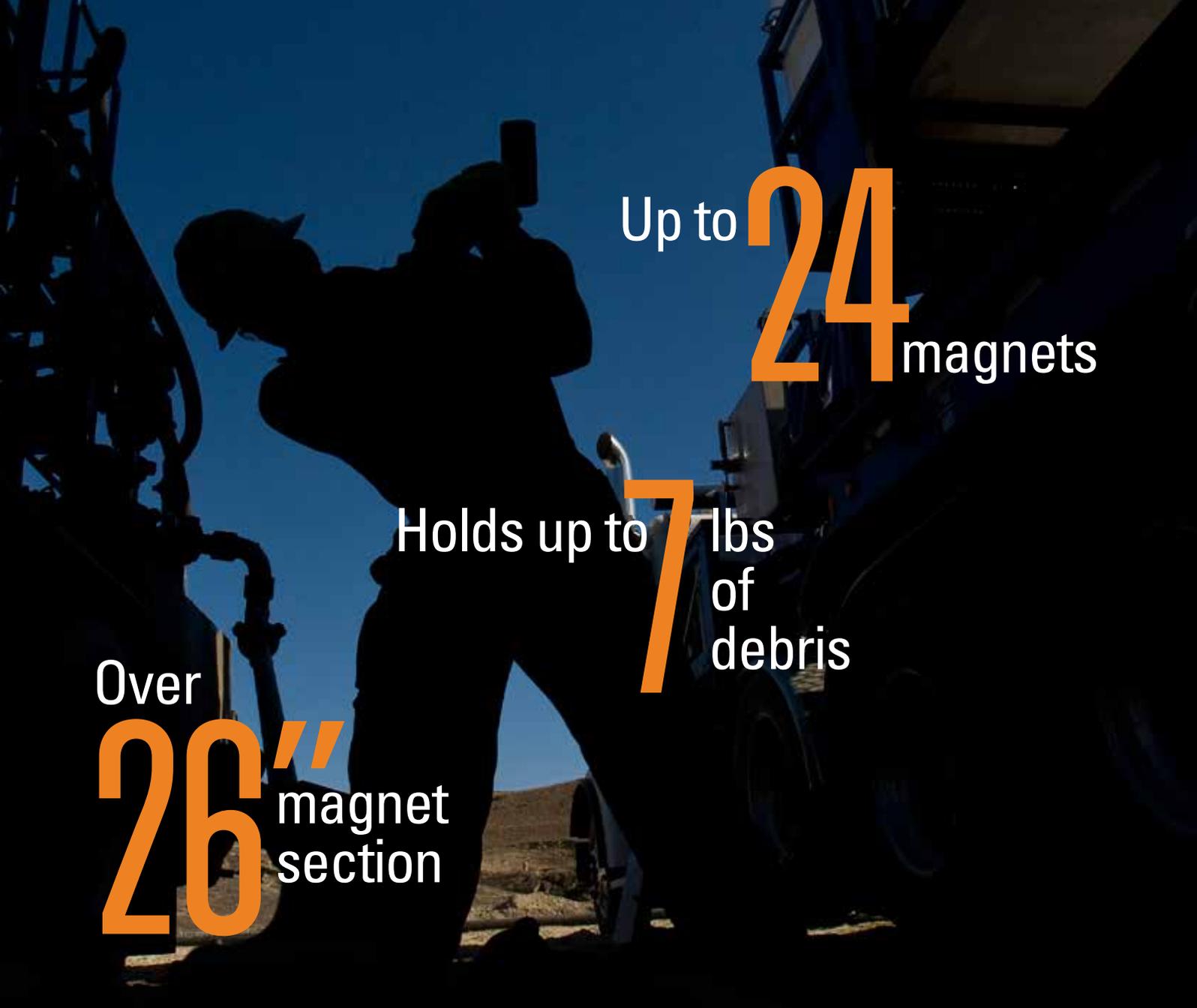
Ideally, the CT MAGNOSTAR magnet is added to the BHA on top of the motor where the high-strength rare earth magnet collects ferrous material. The design ensures the debris is not washed from the magnet area or scraped off as the BHA is removed from the well. In addition, higher temperatures do not interfere with the effectiveness of the rare earth magnet strength.

Once installed atop the motor, the CT MAGNOSTAR magnet can be run in the wellbore with no changes to the milling operation. Back on surface, the metallic debris is removed from the tool using a non-magnetic tool. The debris is then classified and weighed.

It is recommended to run as many CT MAGNOSTAR magnets as required to capture the debris expected to be generated during the milling operation and to avoid any metallic material from impeding the milling operation.

Put our wellbore cleanup magnets to work for you

To find out more about our suite of wellbore cleanup magnets and how it is performing for our other customers, contact your local M-I SWACO representative.



Up to **24** magnets

Holds up to **7** lbs
of
debris

Over
26" magnet
section

CT MAGNOSTAR success

Arkansas: CT MAGNOSTAR quickly recovers all plug slips in milling job

The Situation

The operator had to drill 10 composite plugs with metal slips during a coiled tubing application on its 10,500- ft (3,200 m) well with 90° deviation. The primary concern was that the slips would not be circulated out with the fluid and viscous sweeps being used. Leaving slips in the highly deviated hole likely would cause debris to collect in the heel of the well and potentially choke the wellbore and reduce productivity. As the well eventually would probably require an ESP, any debris left in the hole could damage the stages of the pump within two to three years after being put on production.

The Solution

The operator elected to use a 2 7/8-in. CT MAGNOSTAR magnet on the BHA to recover the metallic slips of the 10 plugs to be drilled. The magnet was positioned on top of the CT MAGNOSTAR magnet motor assembly to recover the debris while the milling operation was being carried out.

The Results

The CT MAGNOSTAR magnet recovered 2 lb (.091kg) of very fine metal shavings and pieces of the plug slips, some of which were longer than 1-in. Pieces of this length would have been difficult, if not impossible, to circulate out of the hole, using only the water and viscous pills used in this well. Moreover, positioning the CT MAGNOSTAR magnet close to the motor kept the hard slips away from the milling face, thus speeding up the operation while reducing stalls. The average milling time was improved to 29.7 min.



This information is supplied solely for informational purposes and M-I SWACO makes no guarantees or warranties, either expressed or implied, with respect to the accuracy and use of this data. All product warranties and guarantees shall be governed by the Standard Terms of Sale. Nothing in this document is legal advice or is a substitute for competent legal advice.

Mi SWACO
A Schlumberger Company