

Description

The **SwivelMASTER®** is a drill-pipe or work string deployed tool that allows the upper string to be rotated with either tension or compression force being applied at the tool without rotation or torque being applied to the string or BHA below it. This ability to rotate the upper workstring provides a dramatic reduction in workstring friction above the **SwivelMASTER®**.

This significant increase in available force at the tool dramatically enhances deployment in or retrieval of complex equipment in ERD wells.

The tool can be locked with the application of predetermined differential pressure at anytime to allow full torque to be transmitted to the BHA below the tool. The **SwivelMASTER®** can be provided in either single shot or multi-function form that can be locked and unlocked multiple times as required.

Applications

Provides enhanced deployment and retrieval capabilities in ERD, highly deviated and horizontal well bores for applications such as:

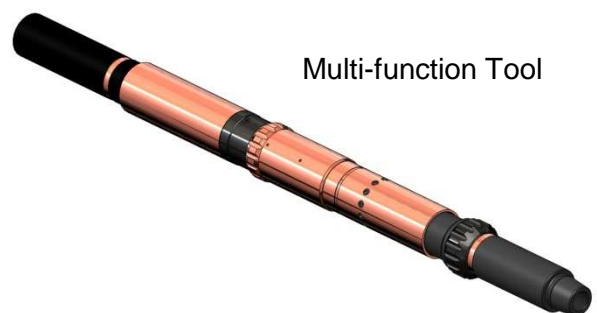
- Lower sand screen completions
- Horizontal liners (cemented or non-cemented)
- Slotted or pre-perforated liners
- Gravel pack installations
- TCP gun deployment
- Fishing
- Firing jars
- Deploying deep set packers
- Multi-lateral completions
- Casing exits

Benefits

- Extends the current well construction boundaries on ERD and highly deviated wells
- Increases length of open hole completion providing additional reservoir exposure / drainage
- Allows wells from fixed locations to access by-passed oil
- Improves operational efficiency
- Reduces cost and risk
- Eliminates the need for other friction reduction tools such as sub based friction reduction tools
- Provides force required for firing jars by eliminating drag
- Eliminates stick slip when deploying critical components such as whipstocks and multi-lateral completions
- Facilitates offshore well development from onshore or artificial island rig sites
- Reduction of drag in tension allows retrieval of equipment that would previously have been lost in hole

Features

- Clutch mechanism allowing the string above the tool to be rotated independently from the string below
- Heavy duty compression bearing
- Heavy duty tension bearing
- High torque capacity clutch
- Standard rotary connections
- Large ID
- Multi-function option
- Long life rotary seals
- Adjustable operating pressures
- Hydraulic function
- Back-up locking feature
- Short compact design



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Case Study: The SwivelMASTER[®] changes the ERD completions game

History of the deployment of the SwivelMASTER[®]

- First job run for Chevron in September 2006 and used exclusively by them until July 2007
- Four days rig time was reduced to 10 minutes to MU the connections and test the tool
- Major IOCs also began to see the benefits of running the SwivelMASTER[®] such as DONG, SHELL, APACHE, BP, VERMILLION, CNR and MAERSK in 2008 and 2009
- 2010 saw records for ERD wells being broken on a regular basis culminating in the most recent World Record ERD well early in 2011. 13,124 feet of sand screens and multiple swellable packers were deployed in a 40,504 feet MD well with a 5,853 feet TVD and an ERD Ratio of 7:1
- New designs are currently being developed for extreme service and for other extreme applications

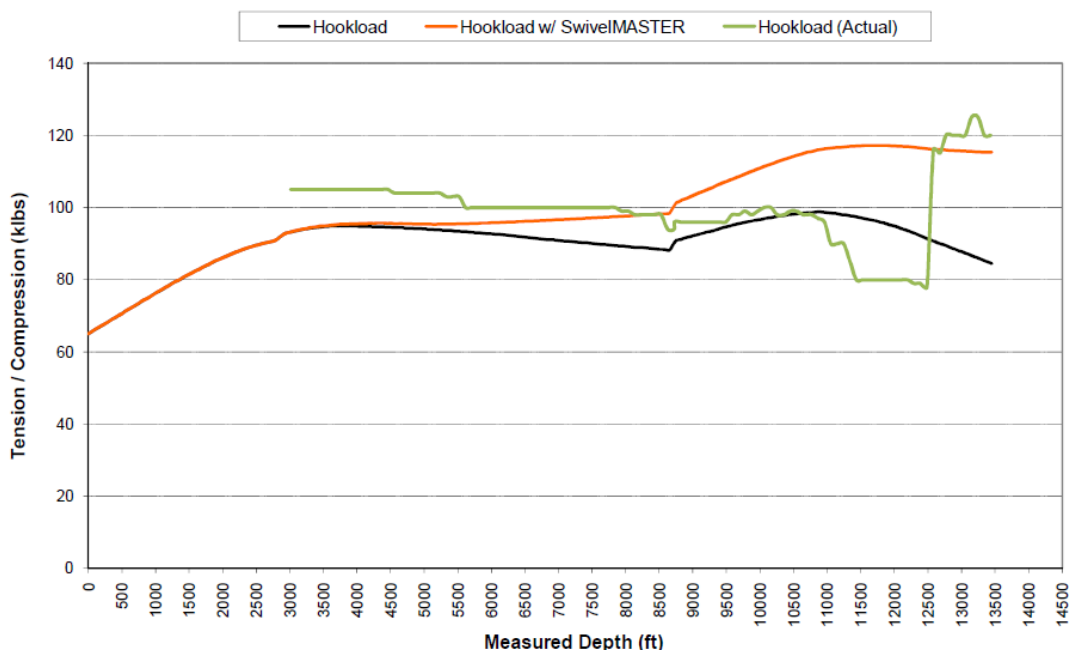


Single Shot Tool

Real Applications of the SwivelMASTER[®] and the resultant benefits

- The subject well was directionally drilled offshore Nigeria to a TD of 13,466ft MD. The completion objective was to run 4½" ResFlow sand screens along a 2,537ft horizontal open hole section to TD
- The 3½" SwivelMASTER[®] was installed in the string as an insurance policy but mainly to see the weight gain benefit it would provide. In addition the operator wanted to minimise the number of heavy tubulars required in the BHA and subsequent handling of them
- The 4½" screens assembly was run to a depth of 11,375ft where the available weight to run the completion in hole dropped to zero. Rotation was slowly introduced up to a maximum of 30rpm to reduce axial drag and increase available weight
- Rotation was continued for the final 9 stands that were run in hole and an average weight gain of 40,000lbs was experienced. The completion was subsequently run to TD without any further weight issues. [Please see graph below detailing weights running in hole](#)
- Although the SwivelMASTER[®] was initially installed in the string as an insurance policy, in the end it was essential in ensuring the screens were run successfully to TD
- Without the SwivelMASTER[®] a trip to surface would have occurred

SwivelMASTER vs Conventional T&D Model
Client, Field, Well Name



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Description

The EzeeGLIDER® is the ultimate in down-hole centralisation, offering field proven lower friction co-efficients leading to superior drag and rotational torque reduction. The tool is made from a high temperature high pressure injection moulded polymer. The EzeeGLIDER® is available in BOS21 standard grade polymer composite for most low friction requirements as well as BOS22 self lubricating polymer composite for low friction water based mud applications. The tools are available in Spiral (22-25°) or Passive (5°) angle bladed configurations. Both blade styles are water-melon shaped to pass through casing and multi-lateral windows, washouts and tight spots.

Applications

Dramatically reduces torque and drag and provides enhanced deployment and removal capabilities in ERD, highly deviated and horizontal well bores for applications such as:

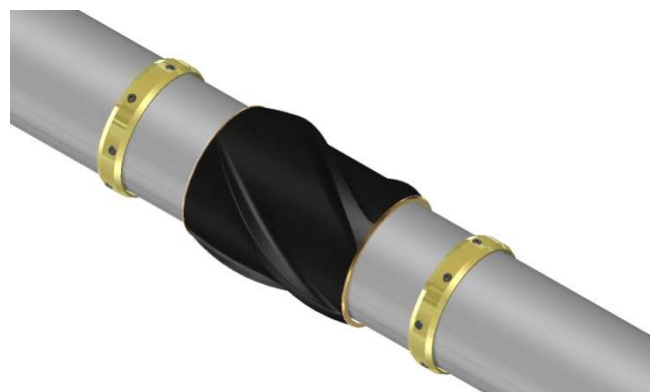
- Lower Sand Screen Completions
- Extended reach/horizontal wells
- Horizontal liners (cemented or non-cemented)
- Deploying deep set packers
- Rotating cemented liners
- Drilling with casing/liner
- Production riser/tubing insulation
- Multi-laterals/window exits
- Multi-Lateral Completions
- All Casing exits
- Protection of open hole packers/accessories
- Tough open hole conditions

Benefits

- Extends the current well construction boundaries on ERD and highly deviated wells
- Increases length of open hole completion providing addition reservoir exposure / drainage
- Provides a bearing when drilling with casings or with liners
- Allows wells from fixed locations to access by-passed oil
- Improves operational efficiency and puts forces where they are required instead of being lost in the form of drag
- Safety improvement with a reduction of manual handling issues
- Allows liners to be consistently rotated whilst cementing providing better zonal isolation
- Can eliminate the need for other friction reduction tools
- Proven to pass through casing exits and MLT windows without snagging causing casing or liners to stick
- Provides string rotation while running liners and casings to ensure they reach planned depth

Features

- Material has an ultra-low friction co-efficient
- High durability and wear resistance
- Thermal stability
- Thermal insulation
- Light weight low density material
- Melon shape blades
- Spiral 25 degree or passive 5 degree blades
- High compressive strength
- Chemically inert
- Short compact design



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Case Study

Well Challenge

- Extended reach well with 9,000'TVD and total measured length of 23,000'
- Exiting through a window at 71 degrees with an aggressive faced whipstock
- Planned 7,000' of 5½" completion with liner hanger packer
- Well screens and swellable packers
- Multiple (9) coal seams and undulating well profile in excess of 109 degrees and then 90 degree horizontal section to TD
- Initially about exiting the window and the high potential for re-entering should the liner completion assembly not be able to reach full setting depth.
- High frictional forces that could necessitate rotation of the wells screens and swellable packers in order to reach target setting depth.
- High side load forces through undulating coal seams and requirement for positive standoff across producing zone.

Solution

- After several days dealing with some major hole stability issues the client ran the 5½" liner completion with no issues exiting the window.
- They reported historically low friction factors for the field and no requirement to rotate the completion assembly at any point during the operation.
- Client will utilize EzeeGLIDER® 2000 Centralizers on future wells and is also interested in looking at incorporating a SingleRUN™ Motor on future completions as a contingency to the 4-5 days of hole conditioning required prior to running this completion.
- Of note, hole issues did require the client to shorten the length of the final liner completion string to deal only with the targeted zone of interest, whereas the initial plan of the longer assembly was to also have access to a lower zone as well.

Result/Benefit

- Using client provided well and survey data BOScalc™ predictive models were run using a range of historical field friction factors as well as those for BOS21 material type EzeeGLIDER® 2000 centralisers
- Models were also run to simulate standoff effects with up to 1" loss of centraliser OD. BOScalc™ came back reporting significant friction reduction with no compressive failure of workstring and acceptable standoff across producing zone.
- Head to head comparative testing across the aggressive whipstock face was done and the Caledus EzeeGLIDER® 2000 did not bind or jam as did other metal products.
- Based on BOScalc™ reports Caledus proposed client run (2) EzeeGLIDER® 2000 Spiral Centralisers per joint, (377) total, with single units on each of the first two joints to provide a flexible guide to initiate window exit. Spacing of EzeeGLIDER®s 2000 was designed to provide maximum flexibility for both running and retrieving the assembly should well stability issues necessitate.



Sample Specification: EzeeGLIDER® Spiral Blade for (22°-35°) for Casing / Liner Cementation

Model Number	BEGS106142	BEGS095120	BEGS070082	BEGS054082
Unit Size	10-3/4" x 14-1/4"	9-5/8" x 12"	7" x 8-1/4"	5-1/2" x 8-1/4"
OD (inches)	14.250	12.000	8.250	8.250
ID (inches)	10.980	9.750	7.100	5.600
Length (inches)	10.000	10.000	10.000	10.000
Weight (kg)	5.200	4.300	2.300	2.300
Flowby (inches ²)	45.980	32.030	11.890	25.680
Blades	5	5	5	4
No. on Std Pallet	40	45	90	90
Collar P/N	SCB106	SCB095	SCB070	SCB054
Collar Weight (kg)	2.000	1.700	1.000	0.900

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Description

The BridgeBUSTER[®] FastDRILL[™] is designed to be run on the bottom of the casing or liner to enable strings to be washed, rotated and reamed to planned Total Depth. This latest generation of the already successful BridgeBUSTER[®] has been refined and focus has been placed on further improvement of drillout times without compromising the reaming capabilities.

The tool does not include any valves so as to reduce the risk of debris damage to the valve system while reaming into the well. The company recommends that a normal float collar or double valve float collar is run some distance back from the BridgeBUSTER[®] to ensure they are not compromised in performance when reaming.

By not including valves in the tool and by reducing the amount of aluminium and other proprietary features in the nose design, time spent drilling is greatly reduced thus minimising the risk to the BHA and to the integrity of the casing shoe stability.

Applications

Provides enhanced deployment in problematic formations, coal beds, sloughing shale, ledged well bores, ERD, highly deviated and horizontal well bores for applications such as:

- Lower sand screen completions
- Liners (cemented or non-cemented)
- All casing strings
- Slotted or pre-perforated liners
- Gravel pack installations
- TTRD completions
- Multi-lateral completions
- Casing exits

Benefits

- Increases probability of casings and liners reaching planned TD
- Can be run in conjunction with a NaviGATOR[™] to provide end of casing rotation where the full string cannot be rotated
- Provides low cost improvement in operational efficiency
- Low cost insurance
- Fast drill out significantly reduces drilling inside casing time thus protecting BHA and casing
- Fast drill out time significantly reduces the risk of damage to the casing shoe integrity which could cause leak off or ledge issues at the shoe
- Improves bit performance

Features

- Fast drill out eccentric aluminium nose
- 360 degree cutting structure coverage
- Large flow area
- Short compact design
- Matched to client casing weights and threads
- Hollow tool
- Can be provided with shear out floatation plugs
- Right hand spiral stabilizer
- Casing bore protection



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Case Study

Well Challenge

Due to an unforeseen drilling hazard, a Major North Sea operator needed to change the liner he had planned to run to a smaller size. After setting this liner it was planned to carry out a high pressure frac job, however due to the change in liner size the shoe track equipment available was not compatible with this planned frac job. Challenge – The new string available was equipped with a standard open nose shoe, which would not contain the pressure required to frac the well.

Solution

Caledus[®] made use of our own dedicated machine shop throughout the night to manufacture a closed end BridgeBUSTER[®] FastDRILL[™] shoe, threaded with a high torque premium connection to match the customer requirement all within 24 hours and this was all during last few days before the Christmas break. The solution provided here was a sense of urgency and an ability to react to the situation in a positive and professional manner.

Result/Benefit

The closed ended shoe made it to the rig without causing any delays to drilling operations. The benefit to the client to get this rapid response at any time of year never mind the Christmas Holidays was that the operation continued without any rig delays, resulting in a massive cost saving.



Model Number			
	BB050082	BB070082	BB095120
Dimensional Data			
Casing Size	5.000"	7.000"	9.625"
Outer Diameter	8.250"	8.250"	12.000"
Length	38.600"	39.000"	43.900"
Connection	Variable	Variable	Variable
Casing Weight (min)	15.500 ppf	26.000 ppf	43.500 ppf
Casing Weight (max)	23.200 ppf	32.000 ppf	53.500 ppf
Drillout Size (max)	4.250"	6.000"	8.500"
Directional Ports	3	3	3
Drillable Nose	Yes	Yes	Yes
Nose Profile	Eccentric	Eccentric	Eccentric
Technical Data			
Tool Ratings			
Body Material	4145H Steel	4145H Steel	4145H Steel
Nose Material	Aluminium	Aluminium	Aluminium
Flow Area (Nose Ports)	2.860 ² "	4.470 ² "	9.130 ² "
Flow Bypass Area	8.450 ² "	8.088 ² "	10.792 ² "
Reaming Pad Quantity	6	6	6
Reaming Coverage (Reciprocation)	100%	100%	100%
Reaming Coverage (Rotation)	100%	100%	100%
Spiral Gauge Blade Quantity	6	6	6
Spiral Gauge Direction	Right	Right	Right
Spiral Gauge Coverage	100%	100%	100%
Backreaming Feature	Yes	Yes	Yes

Other sizes available
Suitable for strings from 2-3/8" to 20"

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Description

SingleRUN™ Motor systems are designed to be run on the bottom of the final casing or liner string to ream or drill to planned Total Depth by pumping only. The motor is of new manufacture when supplied (not used equipment) and is available in numerous sizes to suit the application.

The system's equipment includes a rupture disc sub with adjustable pressure rating to provide circulation should the motor plug. A float sub with DP floats to prevent back flow or sand ingress and crossovers to the client's tubulars and a suitable drill bit or reamer shoe.

Applications

Provides enhanced deployment in problematic formations, coal beds, sloughing shale, ledged well bores, ERD, highly deviated and horizontal well bores for applications such as:

- Lower open hole completions
- Slotted or pre-perforated liners
- Difficult open hole wellbore conditions
- Final string cemented casings or liners
- Sand control screens
- Cemented completions
- Getting complicated final strings to TD with many accessories
- Drilling new formation at TD with casing or liner
- Drilling up cement plugs set on prior drilling trip due to losses
- Negate the need for wiper trips after long periods of electric logging as mud and hole can be conditioned while running the liner
- Mud cap and/or under balanced drilling with liners
- Milling and fishing operations
- Well head abandonment
- Drilling shallow single string tubing's (salt domes and shallow gas)

Benefits

- Gets your casing or screens to TD when hole problems would stop normal deployment
- Can eliminate need for wiper trip prior to running casing or liner after long logging jobs
- Provides low cost improvement in operational efficiency
- Rotates end of string when full string rotation is not possible
- Drill/ream casing or liner back to TD by pumping alone
- Does not complicate job even with hydraulic liner hanger
- Provides a low cost method to drill without a rotary or top drive
- Provides low cost insurance.

Features

- SingleRUN™ Motor systems are easy to pick up and use and do not complicate final string installation operations.
- The tool is a non-serviceable mud motor designed for 100 hours of in-well operating use.
- The motor has the same power output as a standard serviceable motor
- The motor has the same OD and connections as a standard serviceable motor
- Motor is available in a wide range of sizes, stages and rotor stator configurations



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Case Study

Well Challenge

- A major operator working offshore Tunisia had experienced extreme losses into a fractured formation while drilling the 8½" hole section trying to get to TD
- Several different approaches had been made to TD this well resulting in similar ends, stuck pipe, fishing, then sidetracking
- The hole had been drilled, but getting the completion to TD was a major concern due to the extreme differential pressures seen at the loss zone
- In order to isolate the loss zone, a plug was run inside the 9⅝" casing, set at 8130ft MD with 500ft of low compressive strength cement placed on top
- A solution was needed to be able to drill through the cement & plug, get past the loss zone and get the completion to TD

Solution

- It was decided to try the Caledus® SingleRUN™ Motor (SRM) to try and overcome the problem
- The motor was run with an 8½" rock bit on bottom, crossed over to the 4½" x 5½" x 7" lower completion, which was run with ICD tools and packers for zonal isolation, making it imperative to get to TD in order to have the correct isolation barriers in place
- Once the cement had set, the whole 1300m liner plus drilling/reaming assembly was run in hole on drill pipe with an inner string to carry flow to the SRM which was then used to drill out the 500ft of cement and the bridge plug
- The rig pumped at 5.5bpm with 1220psi to get the motor through the cement, then, on tagging the plug, the pressure applied was lowered to 5.5bpm and 680psi to drill through the plug. Drilling through the 500ft cement, the cast iron bridge plug then reaming on to TD took approximately 35 hours
- Caledus® personnel onboard worked closely with the rig crew to ensure they had all the technical support required in order to work within the tool limits and the pressure limitations of the liner system

Result/Benefit

- The Caledus® SingleRUN™ Motor, performed as required, getting the completion to bottom first time
- The operator was very happy with the performance of the tool and intends to use the same tools again to overcome similar problems in future, citing the tool as cheap insurance to get to bottom



Case Study

Well Challenge

- A major operator working offshore Central North Sea had experienced extreme difficulties whilst running their 7-5/8" liner to TD.
- The subject well was directionally drilled using an RSS assembly in combination with an under-reamer set to open the hole up from 8½" to 9⅞" diameter.
- The well path exited the 9⅞" host casing off a whipstock and built from the window on to a high inclination hold angle before landing horizontally at TD in the reservoir.
- The 7⅝" liner became tight when running out of a loose sand unit. The hole was circulated clean and liner running continued. The then shoe stood up in the region of some limestone stringers seen while drilling the section and it proved impossible to progress beyond these to the planned setting depth. Rotation was not possible due to the connection torque limits.
- The liner was pulled to make a wiper trip to try to dress the limestone ledges back. After cleaning up the well, the liner was re-run and once again became tight at the base of the sands. When attempting to circulate the hole clean, the string packed off and the liner became irretrievably stuck.

Result/Benefit

- The Caledus® SingleRUN™ Motor, performed as required, getting the liner to bottom first time.
- The Offshore Drilling Supervisors believe that it would not have been possible to run the liner to TD without the tool. Though the run in hole was not without problems, it was possible to wash and work the string past the ledges due to the rotation gained from the inclusion of the motor in the string.

Solution

- After cut and recovery operations, a second window was milled in the host casing and the interval was re-drilled with a modified well path. The 7⅝" liner was again run, this time with a Caledus® SingleRUN™ Motor complete with a dull PDC bit crossed back to the liner shoe track. The liner was successfully washed to depth and cemented in place.
- After successfully cementing the liner in place, a whipstock was set in the liner to sidetrack around the motor and drill the 3,000 ft horizontal reservoir interval to well TD.



Sample Technical Specification: 4-3/4", 4:5 Lobe, 6 Stage

General Data				
Model Number	SR475-45-6			
Motor Specifications				
Description	Imperial		Metric	
Tool OD	4-3/4	inches	120	mm
Weight	1,400	lbs	633	kg
Length	337	inches	8.560	mm
Temperature Rating*	120	degrees C	250	degrees F
Flow Rate	130 – 260	gpm	8 – 16	L/s
Torque (max)	3,800	ft-lbs	5,150	N-m
Power (max)	95	hp	71	kw
Differential Pressure (full load)	900	psi	6.20	mpa
Differential Pressure (max across bit)	2,000	psi	13.8	mpa
Weight on Bit (max)	25,000	lbs	11,300	kg
Top Connection (box)	3-1/2	inch reg	3-1/2	inch IF
Bit to Bend	46	inches	1,175	mm
Lobe Configuration	4/5			
Number of Stages	6.0			
Bit Speed (full load)	112 – 225	rpm		
Bit Connection (box)	3-1/2	inch reg		

Description

The Disposable CleanUP™ Tool (Clamp-On) is designed to clamp onto equipment that is run into and normally left in the well such as lower completions, upper completions, sand screens, whipstocks and many other critical components where it is imperative that debris is clean and kept away from the equipment. The assembly is equipped with a free rotating stabilisation sleeve fitted with magnets to collect ferrous material as well as a free rotating sleeve fitted with steel bristles for cleaning the internal diameter of the host casing.

Whilst separate pre-completion wellbore clean-up and displacement tools may still be used in advance of running the upper or lower completion, the ability to clean the setting area of the packer immediately prior to setting is deemed advantageous.

The Disposable CleanUP™ Tool (Clamp-On) will clean and prepare the host casing through reciprocation immediately prior to setting a production packer, liner hanger, or integral liner hanger packer on the completion assembly. It will also push debris ahead of critical components such as formation isolation valves and inflow control devices other functioning downhole equipment. The assembly or multiple assemblies can be positioned and spaced out on the completion pipe as required to clean whilst running in the hole. The tool may also be clamped onto the appropriate size of drill pipe and used on a separate cleaning trip if required. Brush type tools and magnet subs have proven reliable methods of cleaning and preparing casings prior to setting packers for many years.

Applications

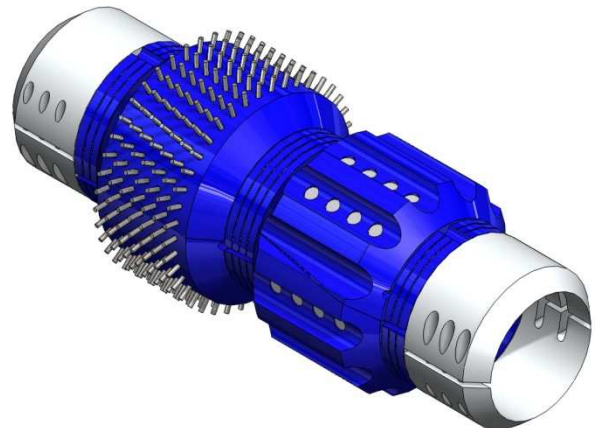
- Lower sand screen completions
- Formation isolation valve/completion isolation valve
- Advanced completions with surface controlled inflow control devices
- Slotted or pre-perforated liners
- Gravel pack installations
- Multi-lateral completions
- Whipstocks with packers for casing exits
- Liner tie back packers
- Multi zone horizontal completions

Features

- 360 degree brush coverage
- Free rotating tool
- Field proven Industry standard carbon steel bristles
- High strength rare earth magnets
- Polymer body
- Clamp on tool
- Field proven securing clamps
- Short compact design
- Easy to install
- Requires no premium connection
- Material independent of completion metallurgy

Benefits

- Low cost insurance in case your well is not as clean as expected
- Reduces risk of elastomeric packer leaks when setting
- Reduces debris on top of formation isolation valves and glass disc subs
- Provides low cost improvement in operational efficiency
- Utilises gravity to move debris down hole which is easier than removing debris
- Does not require a premium connection as it is clamped to the completion or tool
- Keeps ferrous debris away from critical components
- Free rotation does not induce torque in completion components
- 360 degree debris cleaning
- Has no effect on length of BHA or completion tally



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Case Study

Well Challenge

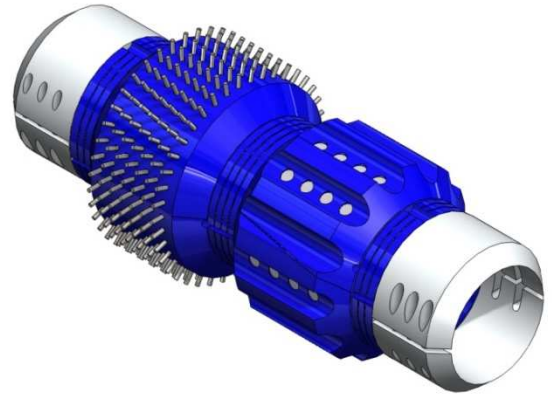
- Eliminate the need for a dedicated wellbore clean-up trip in the well but still reduce the potential risks from steel swarf and other debris causing packer setting and sealing issues
- Having no dedicated clean up trip could leave potentially harmful steel debris in well.
- Sharp burrs and steel swarf could cause elastomer problems, can we trap this somehow?
- Clean-up trips are becoming very expensive, can we save on this?
- Can I run my completion and adequately clean at the same time?
- Can I source a device which can be cost effective for this requirement?

Result/ Benefit

- Caledus has deployed this single trip technology for a leading operator in Perth Australia
- This simple, yet highly effective technology has seen a successful completion conclude with no time consuming dedicated clean-up trip or packer setting and sealing problems. Further use of this technology (Disposable CleanUP Tool) is planned by the same client

Solution

- Listening to the concerns and requirements of the client, Caledus set to work designing and delivering a new wellbore clean-up technology, "Disposable CleanUP Tool"
- This new tool was designed to allow a cleaning run to take place at the same time as the completion was being installed
- The tool is equipped with spring steel bristle wires for cleaning the inner diameter of the casing and strong magnets for collecting and trapping ferrous debris
- This particular design was able to be clamped onto the casing being installed rather than being an integral part of the casing with connections



Technical Specification: 5-1/2" Drill Pipe inside 10-3/4" Casing

General Data

Dimensional Data			Technical Data	
Description	Value	Units	Tool Ratings	
Model Number	DCT054106-C-01			
Drill Pipe Size	5.500	inches	Clamp Material	Aluminium Bronze
Casing Size	10.750	inches	Protector Material	Nylon
Casing Weight (min)	40.500	ppf	Magnet Quantity	80
Casing Weight (max)	73.200	ppf	Brush Coverage	100%
Overall Length	26.400	inches		
Protector Length	7.000	inches		
Brush OD (max)	10.377	inches		
Magnet Housing OD (max)	9.128	inches		
Clamp OD (max)	7.000	inches		
Clamp Slipping Force	11,000	lbs		

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Description

The Disposable CleanUP[™] TOOL (In-Line) is designed to attach via premium connections onto equipment that is run into and normally left in the well such as lower completions, upper completions, sand screens, whipstocks and many other critical components where it is imperative that debris is clean and kept away from the equipment. The assembly is fitted with magnets to collect ferrous material as well steel bristles for cleaning the internal diameter of the host casing.

Whilst separate pre-completion wellbore clean-up and displacement tools may still be used in advance of running the upper or lower completion, the ability to clean the setting area of the packer immediately prior to setting is deemed advantageous.

The Disposable CleanUP[™] TOOL will clean and prepare the host casing through reciprocation immediately prior to setting the completion assembly. It will also push debris ahead of critical components such as formation isolation valves and inflow control devices and other functioning downhole equipment. The assembly or multiple assemblies can be positioned and spaced out on the completion pipe as required to clean whilst running in the hole. Brush type tools and magnet subs have proven reliable methods of cleaning and preparing casings prior to setting packers for many years.

Applications

Provides enhanced deployment of critical completion components by cleaning the area where they are to be set or by pushing and trapping ferrous debris into a safe non critical area.

- Lower sand screen completions
- Advanced completions with surface controlled inflow control devices
- Slotted or pre-perforated liners
- Gravel pack installations
- Multi-lateral completions
- Whipstocks with packers for casing exits
- Liner tie back packers
- Multi-zone horizontal completions
- Formation isolation valve/completion isolation valve

Features

- In-line tool with premium connections matching metallurgy
- Field proven Industry standard carbon steel bristles
- High strength rare earth magnets
- 360 degree brush coverage
- Short compact design
- Easy to install

Benefits

- Low cost insurance when your well is not as clean as expected
- Reduces risk of elastomeric packer leaks when setting
- Reduces debris on top of Formation isolation valves and glass disc subs
- Provides low cost improvement in operational efficiency
- Utilises gravity to move debris down hole which is easier than removing debris
- Keeps ferrous debris away from critical components
- 360 degree debris cleaning



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Sample Technical Specifications

General Data				
Model Number	DCT070106 - I - 01		DCT044070-I	
Dimensional Data				
Description	Value	Units	Value	Units
Liner Size	7.000	inches	4.500	inches
Casing Size	10.750	inches	7.000	inches
Casing Weight	4.500 - 73.200	ppf	20 - 35	lbs/ft
Overall Length	54.200	inches	36.020	inches
Brush OD(max)	10.375	inches	6.890	inches
Magnet Housing OD (max)	9.244	inches	5.870	inches
ID	As per lining ID		As per lining ID	
Technical Data				
Tool Ratings				
Brush Coverage	360.000	degrees	360.000	degrees
Length of Bristle Trim	1.310	inches	1.300	inches
Magnet Quantity	40		40	
Magnet Grade	N38SH		N38SH	
Magnet Strength	Br 12,100 – 12,500 Gauss BH max 36 – 39 MGOe		Br 12,100 – 12,500 Gauss BH max 36 – 39 MGOe	
Maximum Operating Temperature	150°C (magnet limitation)		150°C (magnet limitation)	
*Burst Pressure	As per API casing		9,681	psi
*Collapse Pressure	As per API casing		7,589	psi

*Based on lowest yield material (L80) with blanking dimensions of weakest thread connection (Tenaris 3SB). Check manufacturer's data for connection burst and collapse pressures.

Description

The DriveSHOE™ range is a series of large diameter closed-end shoes used during subsea conductor driving operations. It is equipped with an aluminium parabolic nose or a flat aluminium plate. The tool prevents soft surface formation from entering the conductor while it is being driven. This form of conductor driving is advantageous for a number of reasons. There are two main types of DriveSHOE™, the DrillTHRU™ and the DriveTHRU™.

The DrillTHRU™ design is a parabolic Aluminium nose threaded and locked to the end of a prepared conductor joint or dedicated pup, and is drilled out once in position. Drillable internal guide landing rings, to accept single shot survey tools, can be provided as part of the DrillTHRU™ shoe assembly.

The DriveTHRU™ design is a flat bottomed Aluminium plate shear pinned to the end of a prepared conductor joint or dedicated pup and is knocked off and displaced aside by a subsequent conductor string, equipped with a DrillTHRU™ shoe once in position.

A DriveTHRU™ shoe followed by a DrillTHRU™ shoe means that two different sizes of conductor can be driven into place, before any drilling needs to take place.

Applications

- Deep driving of conductors
- Providing ability to survey whilst driving
- Allows for conductor to be driven through previous conductor

Features

- Aluminium parabolic noses on DrillTHRU™ version
- Flat aluminium plates on DriveTHRU™ version
- Available in most conductor sizes and wall thicknesses

Benefits

- Reduces driving friction
- Allows for deeper driving
- Can drive an additional conductor through previous conductor
- Helps mitigate against conductor collisions
- Allows drive path to be surveyed while driving
- Eliminates cuttings and other sea bed pollution



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Sample Technical Specification: 30" Conductor (1-1/2" Wall)

General Data

Model Number DS300-020

Dimensional Data

Description	Value	Units
Conductor Size	30.000	inches
Connection	Weld Prep	
Wall Thickness	1.500	inches
Drillout Size (max)	25.000	inches
Survey Plate	Optional	
Drillable Nose	Yes	
Nose Profile	Concentric	
Nose Type	DrillTHRU [™]	

Technical Data

Tool Specifications

Body Material	X56	
Nose Material	Aluminium	
Compressive Load – Upwards (Max)	900	klbs
Tensile Load – Downwards (Max)	1150	klbs
Safety Factor	3	



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Description

The SlickSHOE™ FastDRILL™ is an eccentric Aluminium nosed casing guide shoe offering no increase in OD compared to the coupling OD of the casing connection. The Aluminium eccentric guide nose is the same as on the BridgeBUSTER® FastDRILL™ reaming shoe and designed with the same internal features for ease of drill-out with all commonly used bits/mills. This latest generation of the already successful SlickSHOE™ has been refined and focus has been placed on further improvement of drillout times without compromising the tool capabilities.

The tool does not include any valves so as to reduce the risk of debris damage to the valve system while running into the well. The company recommends that a normal float collar or double valve float collar is run some distance back from the tool to ensure they are not compromised in performance when working the casing or liner to planned depth.

The SlickSHOE™ FastDRILL™ has been developed to help guide casing down when ledges or washouts may exist and when a cement nosed guide or float shoe is not considered robust enough. The tool can be used in circumstances when casing rotation or reaming cannot be achieved, but when some orientation of the shoe might be possible through reciprocation.

Applications

Provides enhanced deployment in problematic formations, coal beds, sloughing shale, ledged well bores, ERD, highly deviated and horizontal well bores for applications such as:

- Lower sand screen completions
- Liners (cemented or non-cemented)
- All casing strings
- Slotted or pre-perforated liners
- Gravel pack installations
- TTRD completions
- Multi-lateral completions
- Casing exits

Features

- Fast drillout eccentric aluminium nose
- Large flow area
- Short compact design
- Matched to client casing weights and threads
- Hollow tool
- Can be provided with shear out floatation plugs
- Can be provided with bullnose

Benefits

- Increases probability of casings and liners reaching planned TD
- Fast drill out time significantly reduces the risk of damage to the casing shoe cement integrity which could cause leak off or ledge issues at the shoe
- Fast drill out significantly reduces drilling inside casing time thus protecting BHA and casing
- Improves bit performance
- Provides low cost improvement in operational efficiency
- Lower cost insurance
- Can be run in conjunction with a NaviGATOR™ to provide end of casing rotation where the full string cannot be rotated



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Technical Specification: 20" Casing x 21" OD (Weld Prep)

General Data		
Model Number	SS200210	
Dimensional Data		
Description	Value	Units
Casing Size	20.000	inches
Body Outer Diameter †	21.000	inches
Length Without Connection	40.000	inches
Approximate Total Length (Connection Specific)	51.000	inches
Connection	Weld Prep	
Casing Weight (min)	129.330	ppf
Casing Weight (max)	131.000	ppf
Drillout Size (max)	18.500	inches
Float Valves	None, Single or Double	
Directional Ports	3	
Drillable Nose	Yes	
Nose Profile	Eccentric	
Technical Data		
Tool Ratings		
Body Material	Line Pipe Grade X56	
Nose Material	Aluminium	
Flow Area (Nose Ports)	9.130	sq ins
Flow Area (Float Valve)	3.98	sq ins
Flow Bypass Area	* 106.02	sq ins



† If the OD of the welded connection is larger than 21.0" the max OD will be the connection OD.

* Based on tool in 24" open hole

Description

The NaviGATOR™ is a casing based tool that ratchets and turns round the end of a casing or liner string by simply reciprocating the pipe. Each time the end of the string is picked up and set down again the end of the NaviGATOR™ rotates around a number of degrees to the right, between 60 and 90 degrees depending on tool size.

A casing reamer shoe (Caledus® BridgeBUSTER®) or guide shoe (Caledus® SlickSHOE™) with an eccentric profiled nose, or similar third party device, can be placed below the tool so that the relative rotational motion from reciprocation can be used to orientate the nose over or past obstructions.

The NaviGATOR™ is a particularly useful tool if the casing or liner cannot be rotated whilst running in the hole. The tool can be used on cemented or un-cemented casing strings, completions, liners and sand control screens.

Applications

Provides enhanced deployment in problematic formations, coal beds, sloughing shale, ledged well bores, ERD, highly deviated and horizontal well bores for applications such as:

- Lower sand screen completions
- Liners (cemented or non-cemented)
- All casing strings
- Slotted or pre-perforated liners
- Gravel pack installations
- TTRD completions
- Multi-lateral completions
- Casing exits

Features

- Available in most standard casing/liner versus open-hole combinations
- Drill-out ID matches casing being run, no parts to drill inside tool
- Flow-by areas have been maximised for circulation and cementation
- Strength to suit casing specifications
- Supplied with customer specified casing connections
- Simple to install and use, no operator required

Benefits

- Increases probability of casings, liners and other open hole deployed systems reaching planned TD
- Can be run in conjunction with a BridgeBUSTER® FastDRILL™ or SlickSHOE™ FastDRILL™ to provide rotation of these tools where the full string cannot be rotated
- Provides low cost improvement in operational efficiency
- Low cost Insurance
- Fast drill out as tool has no components to drill out therefore reduces drilling inside casing time thus protecting BHA
- Fast drill out time significantly reduces the risk of damage to the casing shoe cement integrity which could cause leak off or ledge issues at the shoe



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Technical Specification: 9-5/8" Tool

General Data			
Model Number	NV095-00		
Dimensional Data			
Description	Value	Units	
Outer Diameter (nominal)	10.750	inches	
Outer Diameter (max)	10.768	inches	
Inner Diameter (nominal)	8.563	inches	
Inner Diameter (drift)	8.500	inches	
Upper/Lower Connection size	9.625	inches	
Upper/Lower Connection Weight	40 - 47	lbs/ft	
Upper/Lower Connection Thread	As per customer requirements		
Overall Length	79.200	inches	
Compressed Length	74.200	inches	
Tool Weight (approx)	600.000	lbs	
Technical Data			
Tool Ratings			
Material Minimum Yield	110,000	psi	
Tensile Strength	500	klbs	
Compressive Strength	500	klbs	
Torsional Limit	30,000	ft-lbs	
Internal Pressure (burst)	5,000	psi	
External Pressure (collapse)	5,000	psi	
Down-hole Temperature (max)	200	°F	

Technical Specification: 5-1/2" Tool

General Data			
Model Number	NV054-00		
Dimensional Data			
Description	Value	Units	
Outer Diameter (nominal)	6.325	inches	
Outer Diameter (max)	6.330	inches	
Inner Diameter (nominal)	4.811	Inches	
Inner Diameter (drift)	4.767	Inches	
Upper/Lower Connection size	5.500	inches	
Upper/Lower Connection Weight	17-26	lbs/ft	
Upper/Lower Connection Thread	As per customer requirements		
Overall Length	50.000	inches	
Compressed Length	46.400	inches	
Tool Weight (approx)	220.000	lbs	
Technical Data			
Tool Ratings			
Material Minimum Yield	110,000	psi	
Tensile Strength	250	klbs	
Compressive Strength	250	klbs	
Torsional Limit	8,000	ft-lbs	
Internal Pressure (burst)	8,000	psi	
External Pressure (collapse)	8,000	psi	
Down-hole Temperature (max)	275	°F	

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Description

The RotoTEC® is a drill-pipe deployed tool designed to eliminate casing wear and reduce torque and drag in the drill string. Unwanted casing wear and torque and drag can occur when the drill pipe tool joints come into contact with the casing under side-load during any pipe movement creating a frictional load between the surfaces.

The RotoTEC® comprises a free rotating outer body called the Protector Sleeve and an internal Pipe Sleeve. These parts are constructed from a composite material, which is highly durable, chemically inert and made from a self-lubricating polymer with a low coefficient of friction. The superior bearing qualities, allow surfaces to take higher loads, speeds and temperatures. The sleeves are fixed by robust upper and lower retaining clamps. The Pipe Sleeve, which is unique to RotoTEC®, prevents rotating parts contacting the drill pipe, negating any wear that may be caused when abrasive particles are present in the drilling fluid and pass under the sleeve.

Applications

RotoTEC® can eliminate casing wear and reduce torque and drag significantly by providing low friction free rotating positive stand-off surfaces in the following applications:

- Drilling operations
- Completions operations
- Multi-lateral activity

Features

- High strength composite
- High resistance to clamp slippage
- High side-load rating per tool
- High revolutions life per tool
- Generous fluting
- Drill pipe protection bearing
- Wear indicators
- Short compact design
- Lightweight construction

Benefits

- Reduces torque and drag
- Eliminates casing wear
- Protects drill pipe
- Enhanced limited rig capability/reduce stress on surface equipment
- Does not increase stand height in Derrick regardless of quantity
- Does not increase number of connections in drill string
- Maximised flow area
- Minimal ECD impact
- Less stiffening effect than rigid sub based tools
- Does not affect drill string ratings as external to pipe
- Reduce drill-string drag during lower completion installations i.e. sand screens/liner running
- Drilling riser protection



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Case Study

Well Challenge

- BG Tunisia had to drill and complete a 4850m MD well on the Bireno East Field offshore Tunisia
- Initial Caledus modelling of the “S” shape profile showed that torque in excess of 40,000ft.lbs would be required to drill the 8 ½” hole and over 52000ft.lbs would be required to drill the 6” hole section
- In addition to this there were concerns over possible casing wear to overcome due to the relatively high side loads (in excess of 4800lbs in the 8 ½” hole and 5600lbs in the 6” hole respectively)

Result/ Benefit

- Torque was reduced by – 30% on the 8 ½” hole section and 25% on the 6” hole
- RotoTEC® tools subjected to over ½ million revolutions
- Only 3 tools were removed from the string throughout the well operations , due to normal wear and tear
- No tools or parts thereof were damaged to beyond use

TD Solution

- Caledus modelled the drill string applying RotoTEC Friction Reducer® tools at 2 tools per joint in order to withstand and spread the high side loads
- The low friction self lubricating free rotating sleeves keeps the drill pipe from contacting the well bore, thereby taking away the potential for casing wear and reducing the friction factor seen with steel on steel when drill pipe is rotating on casing, to the low factors provided by the RotoTEC® tools
- 347 tools were applied to the 5 ½” drill string in total and the string was tripped 5 times in total carrying out both drilling the 8 ½” and 6” hole and 7” x 4 ½” liner running operations



Case Study

Well Challenge

- Shallow extended reach heavy oil wells in Alberta, Canada. Typical wells ran between 600 to 800m TVD and 3100 to 3500m MD. As a result of the short vertical when drilling with 5" DP beyond 2500m torque and drag increased to the point that drilling has to be stopped short of the targeted measured depth.
- Wells (6) were drilled from a pad with either a single or dual lateral well bore. The rig would first drill and case all (6) vertical sections and then begin to drill the laterals to TD and run slotted liner completions.
- In the case of dual laterals the first well would be drilled and completed with the slotted liner and then a window cut and the second lateral drilled and slotted liner run.

Result/ Benefit

- As RotoTEC® units on the HWDP were added there was a 30 – 35% reduction in torque noted and the lateral legs wells were drilled to planned measured depth in 1-2 days whereas in the past it would take up to 4-5 days with no guarantee that they would reach TD. The benefits to the client were twofold in that the wells were drilled several days sooner and to full depth.
- In one field the client used 8⁵/₈" casing and in another 9⁵/₈", no ECD issues were encountered in either casing string, but as a contingency Caledus® provided the client with a modified protector design that provided an additional 20% TFA inside the 8⁵/₈" wells should ECD become an issue.
- To date the client has used Caledus® RotoTEC® in (45) wells and continues to do so whenever torque values are seen to increase.

TD Solution

- Caledus® RotoTEC® Friction Reducer® non-rotating drill pipe protectors were proposed to be run on 5" HW Drill Pipe when torque levels started to increase. Caledus® field engineer and the company reps worked out an on-site placement program based on past experience and review of logs and survey data.
- The operator typically would initiate drilling the lateral section with standard 5" drill pipe and when approaching torque limits start adding their HWDP with (2) RotoTEC®s per joint. This configuration would address sideload forces and facilitate drilling both rotationally and by sliding pipe. The RotoTEC®s were only run inside casing so typical requirements only ran 70-100 units per well.
- The operator would skid the rig on the pad and had the luxury of being able to keep the RotoTEC® assemblies on the HWDP which also contributed in shortening the time required to drill each lateral section.



Technical Specification: 5-1/2" Drill Pipe (Aluminium Clamps)

General Data

Model Number RT054-AL01

Dimensional Data

Description	Value			Units
Drill Pipe	5.500			inches
	Protector	Pipesleeve	Clamps	
Outer Diameter	8.000	6.175	7.000	inches
Inner Diameter	6.300	5.500	5.500	inches
Length	7.000	10.550	4.100	Inches
Type	Hinged	Split	Hinged	
Material	Thermoplastic	Thermoplastic	Aluminium	

Technical Data

Tool Ratings

Rotation Speed (max)	160	rpm
Rotations *	2,000,000	revs
Operating Temperature (max)	330	°F
Side Load (max)	3,000	lbs
Torque Reduction (typical) *	35 %	
Drag Reduction (typical) *	27 %	
Fitting Time	2	mins
Axial Force to Slip	11,000	lbs
Axial Force to Split	80,000	lbs

Technical Specification: 3-1/2" Drill Pipe (Aluminium Clamps)

General Data

Model Number RT034-AL01

Dimensional Data

Description	Value			Units
Drill Pipe	3.500			inches
	Protector	Pipesleeve	Clamps	
Outer Diameter	5.500	3.917	4.750	inches
Inner Diameter	4.010	3.500	3.500	inches
Length	7.000	10.550	4.100	Inches
Type	Hinged	Split	Hinged	
Material	Thermoplastic	Thermoplastic	Aluminium	

Technical Data

Tool Ratings

Rotation Speed (max)	160	rpm
Rotations *	2,000,000	revs
Operating Temperature (max)	330	°F
Side Load (max)	3,000	lbs
Torque Reduction (typical) *	35 %	
Drag Reduction (typical) *	27 %	
Fitting Time	2	mins
Axial Force to Slip	7,000	lbs
Axial Force to Split	48,000	lbs

*Application dependent

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