

GEOPRO



GRS360™

Reciprocating Reamer Shoe System

GRS3-2024-CAT-REVO
GEOPRO ISLE OF MAN LIMITED P.O. Box 227 Peveril Buildings, Peveril
Square, Douglas, Isle of Man, IM99 1RZ

INTRODUCTION

Stuck pipe incidents occur both while drilling or running tubulars such as casing, liners or completion strings. With deeper more challenging wells being drilled, the need for enabling technology to successfully deploy tubular strings in hole and to target depth is now more common than previous thought. Current solutions include static reamer shoes with enhanced cutting structures and profiles, and casing drilling bits, both requiring string rotation and fluid circulation; ratcheting / reciprocating systems and hydraulically activated technologies. In some instances, string rotation with circulation is possible and due to either cost or the specific effectiveness the operator needs, static reamer shoes such as the GeoMOLE™ are preferred. However, rotating either casing, liner or completion strings require careful planning and modelling taking into account the torsional limitation of downhole systems in order to prevent expensive replacement costs due to damage; to ensure the suitability of the string configuration to withstand the rotational forces to be exerted on it, downhole conditions and limitations of surface equipment. All this comes into play where rotating casing is required.



At the other end of that fulcrum are hydraulically actuated reamer shoe systems such as the GeoproHYDRA™, that do not require the string to be rotated but require circulation to activate the tool to ream. Depending on the selected technology, other factors such as pressure circulating rate and pressure limitations of downhole tools and surface equipment, downhole conditions, string configuration, etc. need to be taken into consideration during selection. The DRILFix™-MRS is an exception as it is a high torque, motorized system that can also be rotated from surface with the string. However, it also has the same limitations as all PDMs and this should be taken into account when planning a deployment.



Somewhere between static reamer shoes and hydraulically actuated systems lies a host of technologies that either ream or facilitate gliding of the nose across and over

ledges or obstructions. These types of tools either have a ratcheting mechanism, j-slot key mechanism or guide rails that enable a nose profile to simultaneously rotate a certain degree with each reciprocation. The GRS360™ falls within this category. The GRS360™ works by string reciprocation. As the name denotes, each reciprocation results in at least 360° revolution of the telescopic nose/reamer profile. The standard tool completes 2.5 revolutions in either the up stroke or down stroke or 900° revolution to the left in the upstroke and 900° right hand turn with the downstroke. This can be configured for up to 5 revolutions in either direction totaling 1800° in either the downstroke or upstroke when reciprocating.

WHAT IS THE GRS360™?

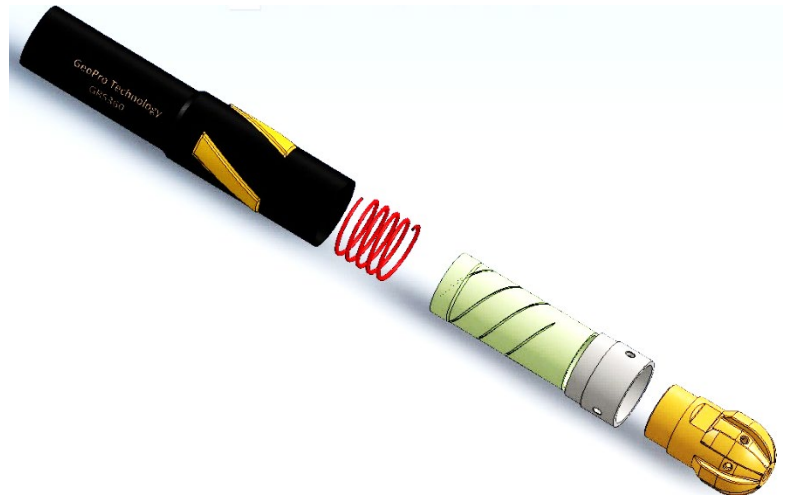
The GRS360™ is a mechanical reamer shoe designed for tubular operations and extremely pressure sensitive formations where fluid circulation during tubular deployment is not possible or not an option. Nevertheless, basic drilling practices such as breaking circulation periodically should not be neglected.

Geopro provides both a standard and a spring-loaded tool system depending on tool size and drill out diameter (where applicable). All non-drillable systems are configured with a spring embedded between inner and outer mandrels. The inner mandrel provides an axis for the spring to oscillate across while the outer mandrel prevents debris from getting in between the spring, ensures the spring operates within controllable boundary conditions and will stay effective for the duration of the application.

The spring provides a constant force once of up to 2.2T once an obstruction is encountered while running in hole, using a 0.625" diameter spring. Spring loaded systems are available for all non-drillable variants. They are standard for 7-inch collar-based tools and smaller.



Table 1 lists available GRS360™ tool sizes and specifications. GRS360™ systems come standard with an eccentric nose profile. For non-drillable variants this nose is made of steel and has Tungsten Carbide Insert (TCI) cutters embedded as standard. If drillable variants are ordered the steel nose is replaced with a Bronze-Copper alloy nose and TCIs. The stabilizer blades on the upper housing are normally only machined and can be laser clad or with HF4000 hard-facing. Other options for hard-facing or blade protection are available. This include TCI or PDC dome cutters, or crushed carbide. The latter is not recommended though it is the cheaper option. The stabilizer pads on the GRS360™ are straight bladed and aligned with the axis of the tool and string. This helps when tripping in/out of hole by reducing drag that would have been associated with a spiral blade profile. These pads provide stabilization of the tool in the centre of the borehole and stand-off from the borehole walls.



TECHNICAL SPECIFICATIONS

Table 1: Technical Specifications of the GRS360

Model #	Hole Ø (in)	Tubular Ø (in)	Max Body Ø (in)	Gage Ø (in)	Drift/Drill Through Ø (in)	Nose Ø (in)
GRS-0450-0600-ND ¹	6	4½	5¼	5⅝	N/A	5¾
GRS-0450-0613-ND ¹	6⅝	4½	5¼	5¾	N/A	5⅞
GRS-0550-0650-ND ¹	6½	5½	5⅞	6⅝	N/A	6¾
GRS-0550-0650-ND ¹	6½	5½	5⅞	8⅝	N/A	8¾
GRS-0663-0850-ND ¹	8½	6⅝	7⅞	8⅝	N/A	8¾
GRS-0700-0850-ND ¹	8½	7	7⅞	8⅝	N/A	8¾
GRS-0700-0850	8½	7	8.06	8⅝	6⅝	8¾
GRS-0700-0863	8⅝	7	8⅝	8¾	6¾	8⅞
GRS-0763-0850	8½	7⅝	8⅝	8¾	6½	8¾
GRS-0763-0950 ¹	9½	7⅝	8⅝	8¾	6½	9¾
GRS-0963-1163	11⅝	9⅝	10⅝	11⅝	8½	11⅞
GRS-0963-1225	12¼	9⅝	10⅝	11⅝	8½	11⅞
GRS-1338-1600	16	13⅝	14⅞	15⅝	12¼	15⅞
GRS-1338-1750 ¹	17½	13⅝	14⅞	16⅞	12¼	17¼
GRS-1863-2200 ¹	22	18⅝	20	20¼	17½	21½

¹ Spring drive with for constant force applied to the telescopic nose mandrel is available for these sizes and models. ND ~ means the tool type is made completely of steel or non-drillable material and therefore Non-drillable.

GRS-2000-2600 ¹	24 - 26	20	22	23 ¹ / ₈	18 ⁵ / ₈	23 ⁷ / ₈ - 25 ¹ / ₂
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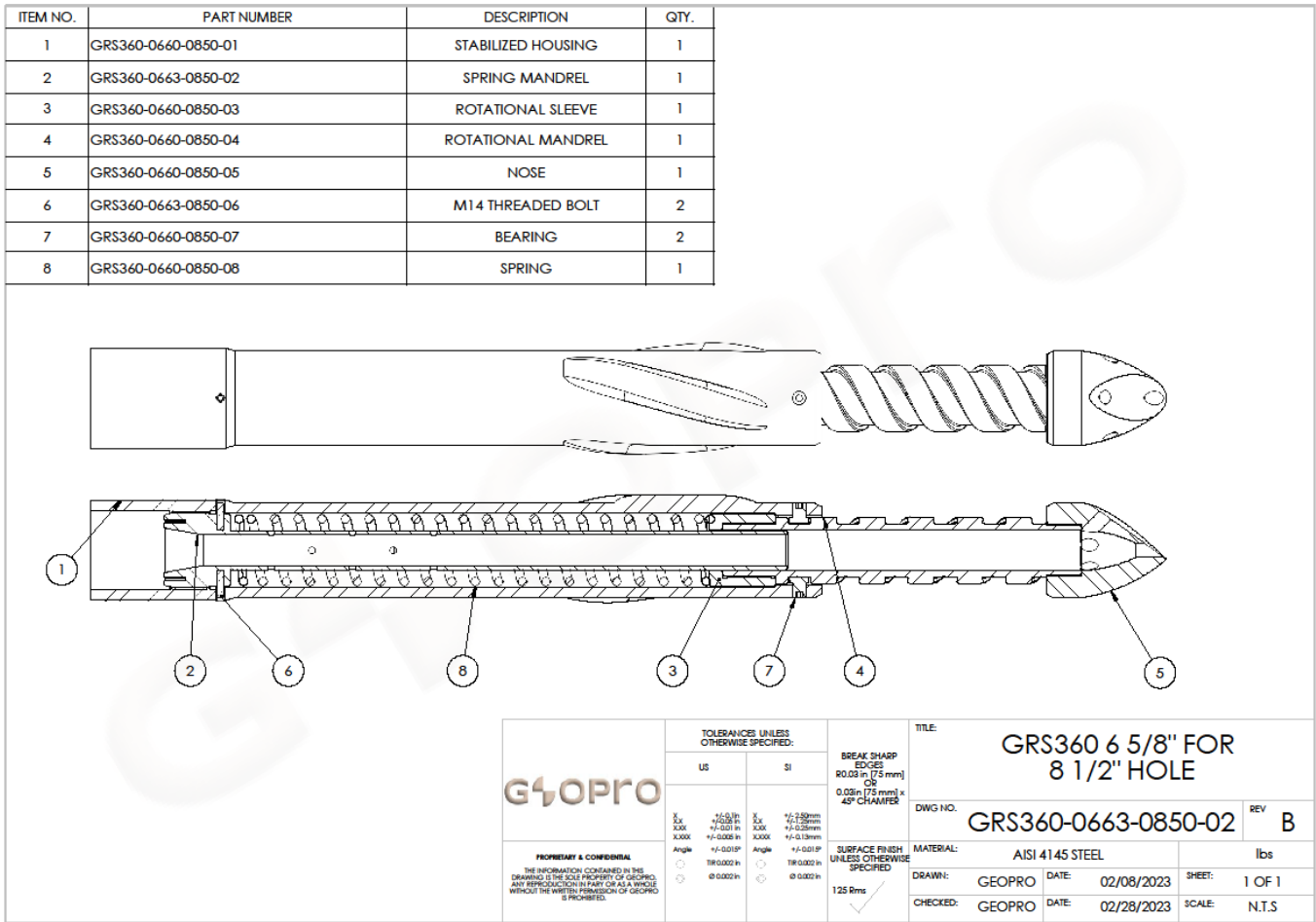


Figure 1: Typical spiral string stabilizer design

CASE HISTORY

The GRS360 6-5/8" sets a new record in Europe with the successful deployment of the longest lateral in the field.

In a recent high angle, extended reach well, the 6-5/8" GRS360 was used to successfully land a 3,800+ m (> 12,467 feet) long completion string in an oil producer offshore. This is the longest production lateral to be attempted in the field. The customer opted for the GRS360™ in favour of the GeoproHYDRA™ due to limitations on the circulating rates possible with such a long completion string.

The well was a high angle horizontal (ERD) well with a TVD of 2,500m, a horizontal displacement of 6,400m and a total depth in excess of 7,500m.

This is an excellent example of applying simple, fit for purpose design to provide practical solutions to a customer.

The entire operation from picking up the GRS360 to landing the liner hanger took over 70 hours to complete.



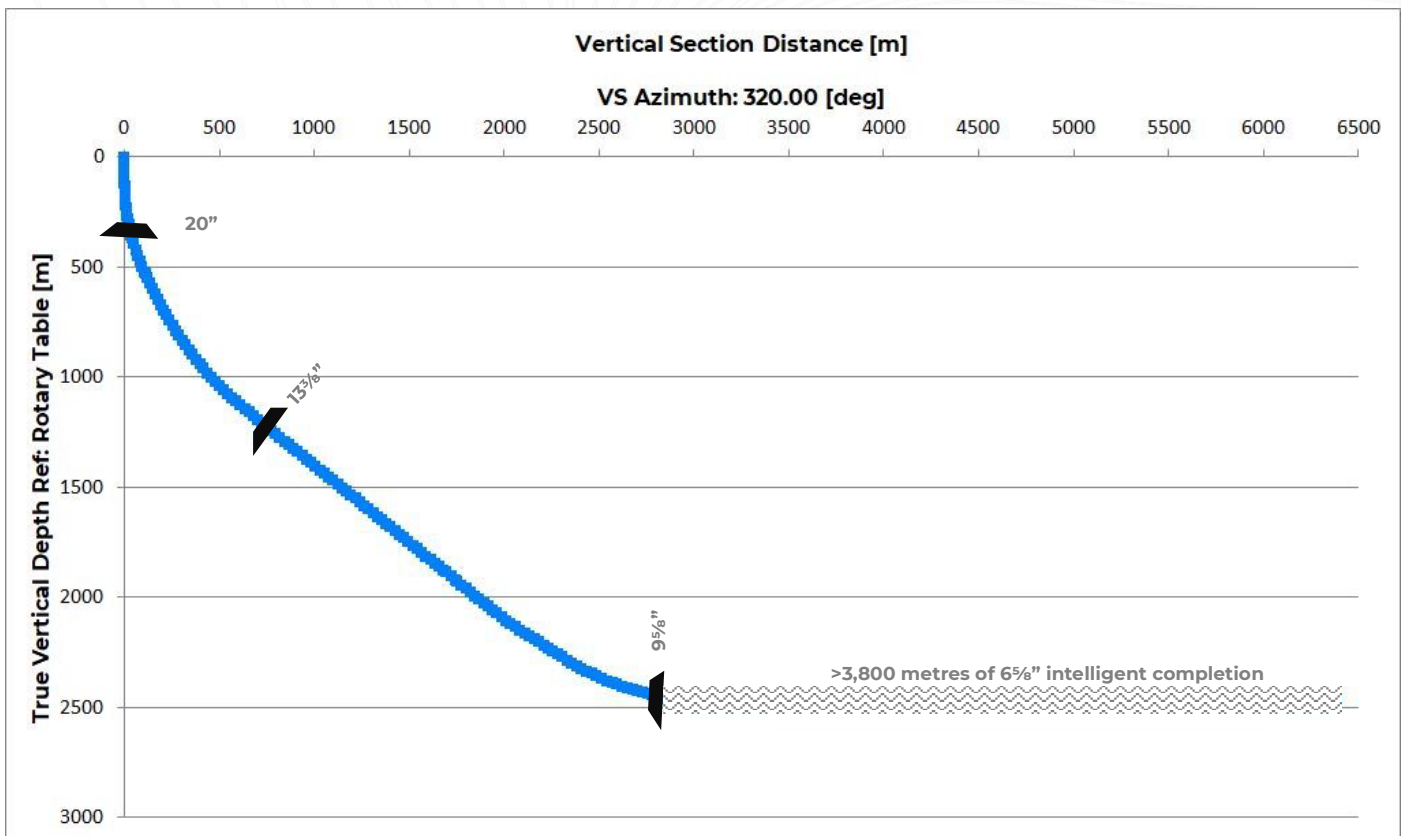


Figure 2: GRS360™ Used to successfully deploy over 3,800 m of 6 5/8 inch intelligent completion string in an offshore well (2023)

SUMMARY

The GRS360 is a mechanical ratcheting tool for completions, liners and casing. It works by reciprocating pipe and with each full cycle up and down the GRS360™ telescoping nose rotates 2.5 times (900 degrees) either way or 5 revolutions (1800 degrees) in total. This can be configured for higher revolutions at the request of the customer. However, there are advantages to the short profile since the standard tool is between 8 – 12 feet long fully extended depending on the tool size. Where 5 revolutions are required, the tool will extend between 2 – 5 feet depending on the tool size.

Another advantage of the GRS360™ is the ability to quickly detect hole fill or sticky points at the nose as the string begins to take weight. This dictates when to start reciprocation.

GRS360™ for larger OD casing, 7 inch and larger, are all drillable. These are configured with a nose similar in design to the all-steel eccentric nose with TCI cutters, but made of drillable copper-bronze alloy. Further customization such as incorporating float valves, burst discs and specific material types and coatings, are also available on request.



CONTACT INFORMATION

Find below regional contact information to discuss your requirements or you can send an email to grs360@geopro.com.



Head Office		<p>Geopro (IOM) Limited P.O. Box 227 Peveril Building Peveril Square Douglas, IM99 1RZ Isle of Man</p> <p>+44 161 513 0044 (☎) gliom@geopro.com (✉)</p>
Eastern Hemisphere	Regional Head Office	<p>Geopro Oilfield Technologies Pte Ltd 718A Gaylang Road Singapore 389630</p> <p>+65 6349 2283 (☎) gotpl@geopro.com (✉)</p>
	Malaysia	<p>Geopro Oilfield Technologies Sdn Bhd 33 Floor, Ilham Tower 8 Jalan Binjai KLCC, Kuala Lumpur</p> <p>+60 2 1175 221 (☎) gotsb@geopro.com (✉)</p>
Sub-Sahara Africa	South Africa	<p>Geopro Limited (Incorporated in Isle of Man) Suite 6, 5 Fricker Road Illovo, Sandton 2196 Republic of South Africa</p> <p>+27 11 086 1059 (☎) glrsa@geopro.com (✉)</p>
Western Hemisphere	United Kingdom	<p>Geopro Oilfield Technologies (UK) Limited 13 West Hill London, SW18 1RB United Kingdom</p> <p>+44 1224 074386 (☎) gotukl@geopro.com (✉)</p>
	USA	<p>Geopro Oilfield Technologies Incorporated 3200 Wilcrest Drive, Ste 490 Houston, TX 77042 USA</p> <p>+1 281 720 8925 (☎) goti@geopro.com (✉)</p>

www.geopro.com

