

A low-angle, upward-looking photograph of a drilling rig. The central focus is a large, vertical metal pipe or drill bit, surrounded by a complex network of steel beams, cables, and pulleys. The background is a clear, bright blue sky. The lighting is bright, creating strong highlights and shadows on the metal surfaces.

GeoproHYDRAT™ NGX2

High Efficiency ENERGIZED Drive with
FASTDRILL™ Optimized Internals

The Story of The GeoproHYDRA™

In 2016 motorized reamer shoe systems were few. The turbine-based systems were the first to be commercially available with a few non-drillable turbine and motor variants available through some Chinese manufacturers. In 2012 Geopro's quest to have a viable alternative to the turbine-based system led to the MRS (motorized reamer shoe) in 2015 and the GeoproHYDRA™ the following year in 2016. Since its launch in mid 2016 the GeoproHYDRA™ has evolved from a low torque-high speed system to a medium torque-ultra-high speed reamer shoe solution with industry leading versatility and robustness.

In 2024, in its current form, the GeoproHYDRA™ NGX is poised as the industry leading hydraulically activated tubular reamer shoe system. Its ability to easily adapt to downhole conditions by enabling operators to maximize surface parameters distinguishes it from any other system available to rig crew. It is one thing to spin fast and create just the right level of torque output and another to do this within the boundary conditions that exist naturally due to downhole conditions and surface equipment limitations. For example, we had a potential client that had acquired competitor technology as advised by their technology group only to find that it needed over 7 bpm to activate which was much higher than the ECD threshold of their formations. Meanwhile at 7 bpm (<300 gpm), the 9-5/8" GeoproHYDRA™ NGX is operationally effective delivering close to 2000 rpms.

The ENERGIZED series improves the operational efficiency of the tool by incorporated curved impeller blades such that at higher flowrates where the direct jets from the drive discs are better directed, these curved surfaces act like scoops and improve sustainable performance when needed. Furthermore, the direct jet profile is now more focused, providing a much better jet than in previous versions. Coupled with a new, PDC drillable bronze-copper alloy nose with tungsten carbide insert (TCI) cutters, the GeoproHYDRA™ NGX Ultimate is the ultimate reamer shoe system and retains its position as the industry leader for tubular deployment.



Description

The GeoproHYDRA™ NGX is an infinitely customizable, low flow activation and low-pressure tool capable of sustaining high axial loads due to its upper and lower ball bearing assembly and a stabilizing radial bearing just above the nose. Unlike systems based on the inverse moineau pump and turbine drilling motors, there is no stalling pressure peaks with the GeoproHYDRA™. The flow paths remain open even if the tool stops to function. This attribute makes the GeoproHYDRA™ ideal for pressure sensitive operations and string components when deploying casing, liner or completion strings.

The GeoproHYDRA™ NGX exists today as 4 versions divided into two variants: drillable and non-drillable. Drillable systems have all drillable internals and the nose whereas the non-drillable system is all steel.

Drillable Versions include the GeoproHYDRA™ NGX with aluminium internals and nose, the RAPID with a mixture of aluminium and composite/plastic materials internally and the nose and the Ultimate with all aluminium internals and a Bronze-copper alloy with TCIs at the nose. Non-drillable systems are all steel and also have an eccentric nose with TCI cutters.



The GeoproHYDRA™ NGX is very unique in that it is the first multi-chamber high speed system introduced to the market with each chamber uniquely driven by its own internal forces and decoupled from other chambers. It is enabling the user to customize the tool to a wide range of downhole conditions with surface limitations in mind. To us at Geopro it enables us to provide the industry with a high-performance fluid-driven reamer shoe system that can be activated and operated at industry leading low flow regimes. For example, table below shows the activation for different technologies, including some of the current copies of the GeoproHYDRA™:

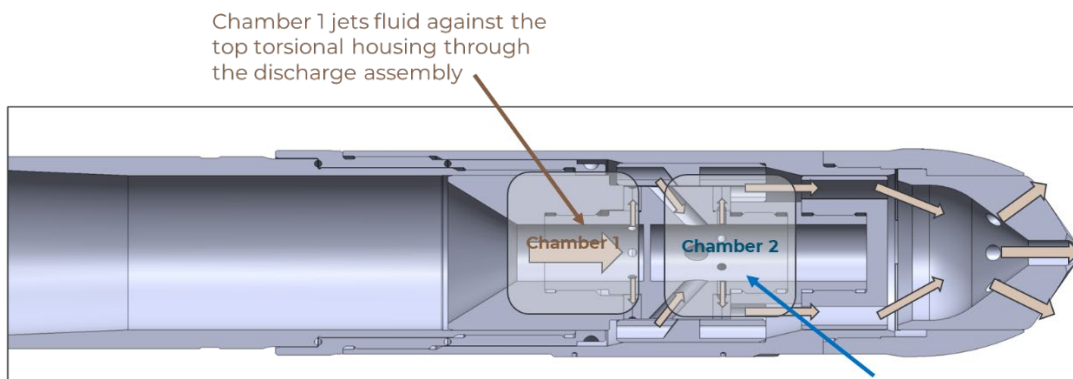
Tool Size	Turbine Technology	Copycat Technology	GeoproHYDRA™ NGX	
(inch)	Activation flow rate (gpm)			Operationally Effective (gpm)
4½	125	60	27	60
7	210	80	30	80
9⅝	294	165	50	125
10¾	N/A	220	65	155
13¾	N/A	500	125	250

The multi-chamber design essentially directs the fluid against the torsional housing (impeller assembly) in chamber 1 and then a large bore bypass “valve” allowing over 95% of the initial fluid through into a secondary chamber where the fluid is once again directed at a secondary torsional housing (impeller assembly). The result is about 33% of the original activation fluid requirement for dual chamber designs and about 27% for triple chamber designs. Additional chambers may be included based on the actual well conditions and objectives. Mathematically, the relationship between the fluid activation requirements and the number of chambers based using a single chamber as reference is as follows:

$$Q_{activation} = 0.4934x^{-0.548}$$

Where $Q_{activation}$ is in oilfield units of gpm (gallons per minute).

For example, the single chamber 13¾” GeoproHYDRA Gen1 tool activates at 500 gpm at surface, an NGX NRGZ triple chamber quad chamber system will activate at 135 and 116 gpm respectively and be operationally effective from 270 gpm.



MAIN FEATURES OF THE SCALABLE DRIVE

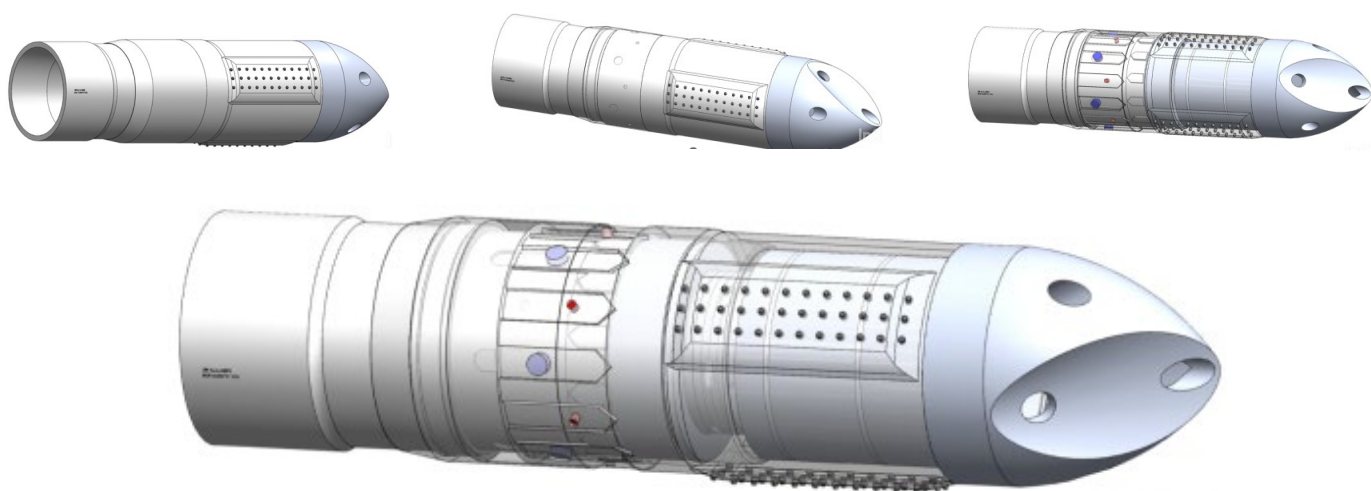
- ❑ Use of different port diameters to accommodate larger particle sizes
- ❑ Lower pressure signatures
- ❑ Customizable drive mechanism to meet wide range of “Downhole-to-Surface” conditions

Same fluid is then channeled via inlet valves into Chamber 2 where the fluid is then jetted against the lower torsional housing through the lower discharge assembly



Features and Benefits

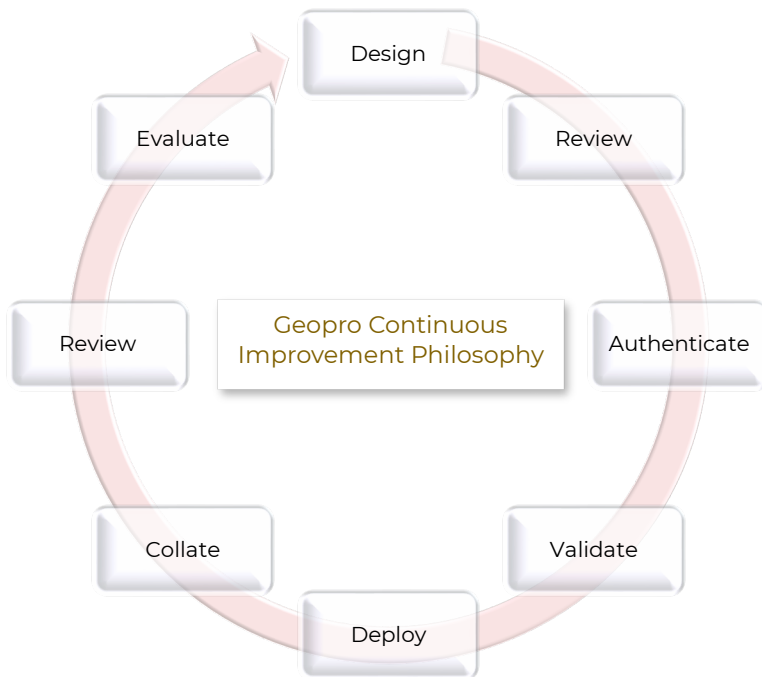
- Multi-chamber drive mechanism with variable / configurable drive ports.
- Multi-chamber design allows for performance optimization for larger OD tools to ensure low flow activation and operability, lower ECDs and overall lower operating pressures.
- Allows the use of sub-standard equipment such as low pressure rated liner hangers to be run in and through deeper horizons.
- Use of different port sizes to accommodate larger particle sizes such as loss circulation material or glider beads.
- Loss circulation material tolerance.
- Low pressure signatures. Typically, 1 – 1.5 psi/gpm depending on the tool size.
- Customizable drive mechanism to meet a wide range of “downhole conditions and surface parameters”.
- Low or zero (0) stall pressures since all flow paths are open to flow even when the tool stops rotating.
- Tool continues to operate even when cementing ensuring even distribution of cement around casing or tubular thus resulting in much better cement quality across the shoe and the entire casing annulus.
- The GeoproHYDRA™ NGX can be equipped with different nose designs depending on the objective of the customer.
- The GeoproHYDRA™ NGX NRGZ series have been optimized for quick drill out by removing up to 50% of the total drillable material in previous versions. Therefore, drill out times in all sizes is expected to fall between 25 – 90 minutes depending on the number of chambers within the tool. All components in the drillable system are PDC bit drillable.
- The “Shear-n-Slide” locking system (2SL™) is a Geopro innovation incorporating a series of shearable pins and interlocking slots to ensure the tool is locked when drilling out. This has been specifically designed for operations where the customer deliberately over displaces during cementing thereby ending up with no cement at the shoe or where this is known to occur frequently.



The 2SL locking mechanism is configured prior to deploying the string to the field with shear pins preset to shear at predetermined loads. This cannot be reconfigured at the well site, and it is therefore important that both Geopro sales teams and the customer representatives agree on the parameters prior to the tool being configured. Depending on the tool size, tool can be dressed in as many as 12 pins, which can be made up of different types of aluminum, copper, bronze, brass or composite shear pins to match the required shear force.

A Culture of Continuous Improvement

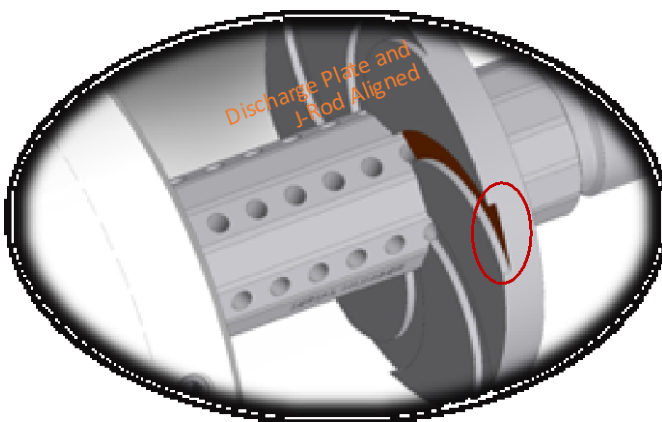
Each technology developed within Geopro and available to the market undergoes a thorough engineering review. Our principle has always been based on the old concept of “bottoms up”, which means, the design starts with the borehole and ends with the surface parameters. The story of the GeoproHYDRA™ defines and embodies this corporate culture. With over 500 iterations across the entire family of tools, Geopro has continuously pushed the envelope in a bid to provide the perfect hydraulically actuated reamer shoe that can still be effective with low flow parameters.



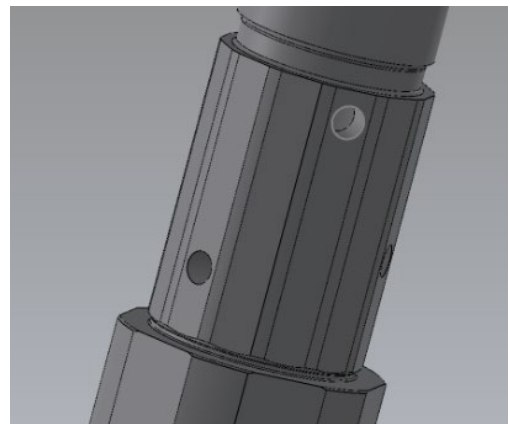
- Design: original design concept.
- Review: peer review and value challenge.
- Authenticate: authenticate design parameters with peer review findings and suggestions.
- Validation: carry out workshop test on design to validate performance claims or response.
- Deploy: commercialise and deploy to the field to customer operations.
- Collate: liaise with customer operations team to collect pertinent run data for further design validation or modifications.
- Review: Review operational data for accuracy.
- Evaluate: authenticate and validate data against workshop tests, design objectives and expectations and run performance.
- Feedback should push further modifications and design improvements.

For example, we moved away from several discharge ports (a) on the drive chamber to only 6 ports per chamber (b) in the Gen2X and changed the discharge path from a rectangle to a circular at the inlet and elliptical at the jetting point (d). The GEN2X drive was a single chamber tool but the NGX drive system (c) incorporates several GEN2X drive chambers and a more focused drive disc design (d).

The result in the simple change to 6 ports in a single chamber design are shown in the figure (e). Figure (e) compares the RPM as a function of circulation rate for GEN1 and GEN2X drive systems with the rest of the tool design remaining the same.



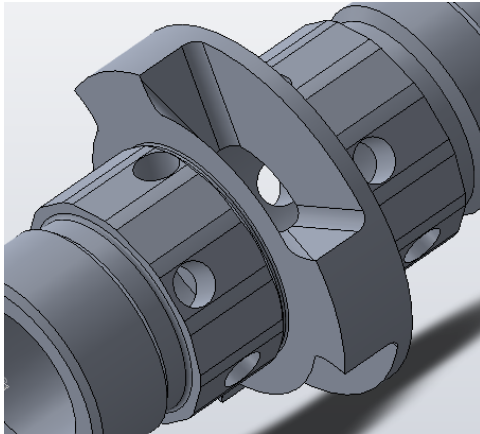
(a) GEN1 drive chamber and drive discs



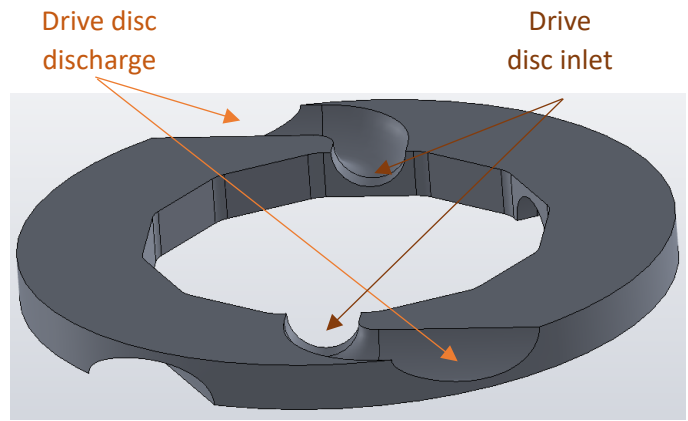
(b) GEN2X single drive chamber

From Figure (e) one can see that the single chamber GEN2X drive at 190 gpm had a similar performance as the GEN1 system at 440 gpm, proving the low-flow configuration concept. The NGX system further improves on this by reducing low flow effectiveness to < 80% of the activation flow rate for GEN1 systems and other comparative technology in the market.

The NGX drive system further enhances tubular running by enabling displacement of loss circulation material when needed. Documented evidence can be found in SPE Paper 207717 where the customer washed down over 5,000 feet of open hole to TD after curing losses at 7,035 feet. The size and number of ports in the NGX drive system can be modified to suit a wide range of conditions making it the perfect reamer shoe system and infinitely customizable. The minimum restriction is 15 mm (equivalent to size 19 nozzles on a bit), which means whatever can be pumped through a size 19 nozzle can be circulated through the drive chamber.

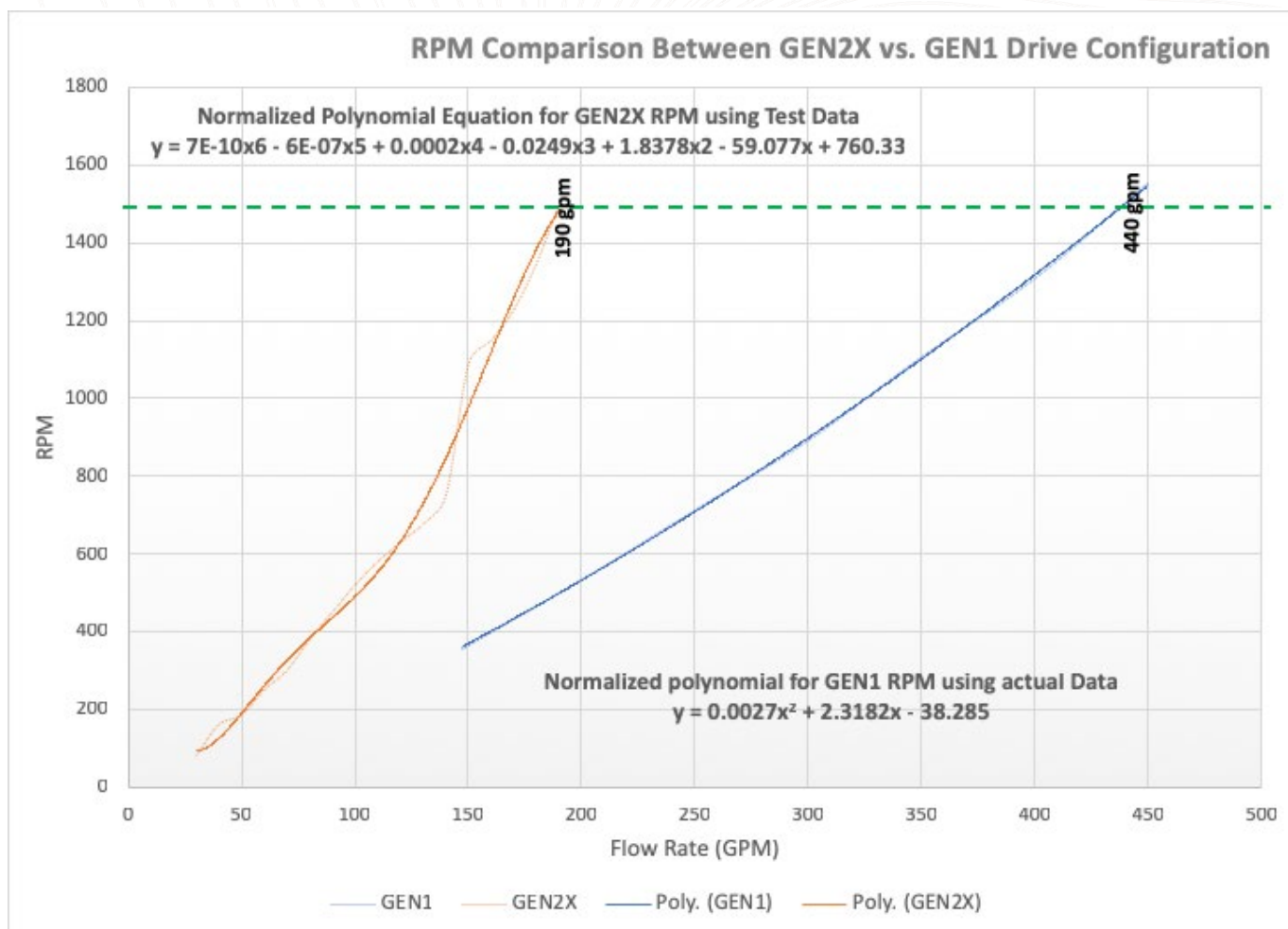


(c) NGX dual chamber drive



(d) Focused drive discs for the NGX Energized system

Unless otherwise stated, the minimum inlet ports formed by upper and lower drive discs assembled together will be 15mm which pans out to an ellipse with a 15 mm (minor) and 30 mm (major dimensions). This equates to a flow through area of 0.274 in² at the inlet and 1.096 in² at the discharge outlet.



(e). RPM comparison between GEN2X and GEN1 drive configurations for a 7-inch GeoproHYDRA™

Technical Specifications Of The GeoproHYDRA™ NGX NRGZ Systems

The GeoproHYDRA™ NGX has three bearing assemblies. Two of these assemblies are towards the top of the tool and responsible for on and off bottom functionalities. The two upper bearing assemblies are made up of a single track of ball bearings enclosed within an upper and lower race that is hardened to withstand high rotational speeds and axial loads. These bearings have been subjected to high axial loads in excess of 200 kips and have been run for several days with as much as 20 million revolutions and continued to perform well. The radial bearing protects the drive mechanism from unusual bending moments and torsional shocks.

All GeoproHYDRA™ NGX systems are manufactured from AISI 4140/4145 110KSI steel grades or higher, unless otherwise stated, while drillable components are made of Aluminum T6-6160 material and/or composites (for the RAPID system) and/or Bronze – Copper alloy nose for the Ultimate. Optional 13Cr or special alloy variants are available. From Q3, 2023, all GeoproHYDRA™ with additional requests such as burst discs, floats, proprietary threads, etc. shall have a top sub in addition to the tool. The top sub shall house all additional extras. This reduces the risk of post manufacturing mishaps and ensures the GeoproHYDRA™ is always in optimal operational readiness.

All GeoproHYDRA™ tools are function tested before shipping out to the field location. Mechanical properties of the tool are designed to be higher than that of the casing.



Features & Benefits Summary Table

Feature	Static Reamer Shoes	Mechanical Reciprocating Shoes	Turbines	PDMs	GeoproHYDRA™
Mode of operation	String rotation with circulation	String reciprocation with circulation	Fluid actuated	Fluid actuation with dedicated bit	Fluid actuated
Activation flow rate(s)	N/A	N/A	Dependent on size but typically same as lower to higher drilling flow rates	Dependent on size but typically same as lower to higher drilling flow rates	Dependent on size but typically between 20 – 100 gpm
Operating flow rate regime	Same as drilling or higher, depending on string configuration	Same as drilling or higher depending on string configuration	Typically, low – to – mid-range drilling rates	Typically, low – to – mid-range drilling rates	Typically starts at much lower to much higher than drilling flow rates for the hole section
Operating pressure rating	N/A	N/A	Typically, < 1000 psi otherwise the disc will rupture, and tool will fail	High but limited to the differential pressure of the power section	N/A – high
Torque Output	N/A	N/A	Low to medium	Medium to high	Low to medium
WOB rating	High/similar to casing string	High – typically close to the casing string	Low	Low – medium	High – over 160kips for small diameter tools +/- 7 inches
String Rotation	Required	N/A	N/A	Possible	Possible as an option but not recommended with the standard tool
Ratio of tool that rotates	N/A	About 35 – 40% of tool telescopes in/out	10%	< 10%	Whole tool rotates
Cement enhancement	Requires string rotation and reciprocation	Requires string rotation and reciprocation	Requires string rotation and reciprocation	Requires string rotation and reciprocation	Improves cement deposition and thus cement bond
LCM Tolerance	Tolerant	Tolerant	Not applicable	Limited scope	Can be configured to handle a wide range of LCM and slurry designs

West Siberia Case Histories

A major operator located in Western Siberia had asked for a 10 well trial of the GeoproHYDRA™ and GeoGLIDER® XTREME ultra-low friction centralizers. Historically, there was a 50% success rate to effectively run the 7-inch-long string once the section has been drilled which is further compounded when dedicated wiper trips are carried out. Apparently, wiper trips made it more difficult to run casing with most wells ending up either with casing having to be pulled and loss of the already drilled hole or worse still, with casing being stuck.

Table CH 1.1: Run Summary In Total Displacement (meterage) Traversed In Each Well And Run Time In Days

Well #	Date (mm/yy)	MD (metres)	Max Inc (°)	Max Flow rate (lps)	Max WOB (Tonnes)	Cumulative Distance Travelled, CDT (metres)	Circulating Time (hrs)	Total Run Time (Days)
1	01/18	3,718	77	28	30	9,400	14.1	2
2	03/18	4,017	77	35	35	28,300	135.6	7.1
3	04/18	3,602	77	41	30	26,300	108.4	5.5
4	05/18	3,608	84	40	28	6,000	9.4	Null
4 ST	06/18	3,590	85	31	28	10,400	31.9	2.4
5	07/18	3,940	79	34	26	17,265	70.2	4.2
6	08/18	4,142	71	31	47	21,900	79.1	6
7	09/18	3,713	72	34	43	30,800	106.4	5.3
8	11/18	3,899	72	44.7	60	62,500	195.2	10.5
9	03/19	3,933	77	24	10	24,500	69.4	4.65

Table CH 1.2: Run Summary Of Cumulative Revolutions Achieved By The GeoproHYDRA™.

Well #	Date (mm/yy)	MD (metres)	Max Inc (°)	Max Flow rate (lps)	Difficulty Index	Circulating Time (hrs)	Average RPM	Cumulative Revolutions
1	01/18	3718	77	28	2.5282	14.1	975	824,850
2	03/18	4017	77	35	7.0451	135.6	1450	11,797,200
3	04/18	3602	77	41	7.3015	108.4	1500	9,756,000
4	05/18	3608	84	40	1.6630	9.4	1500	846,000
4 ST	06/18	3590	85	31	2.8969	31.9	975	1,866,150
5	07/18	3940	79	34	4.3820	70.2	999	4,207,788
6	08/18	4142	71	31	5.2873	79.1	935	4,437,510
7	09/18	3713	72	34	8.2952	106.4	1001	6,390,384
8	11/18	3899	72	44.7	16.0298	195.2	1650	19,324,800
9	03/19	3933	77	24	6.2293	69.4	1250	5,205,000

The 7-inch GeoproHYDRA™ GEN1 and a single GEN2X were deployed for this test. All runs were successful in each attempt besides Well 4 which was completely screened out below the 9⁵/₈ inch casing shoe to the extent that a BHA could not get past the obstruction. This was subsequently sidetracked and re-drilled as Well 4ST. Each of these runs took a lot longer than 24 hours to complete the casing running operation. The initial assumption was that the issue was with 170m of coal seam that acted as cap rock to the reservoir which would have been encountered just prior to landing the 7-inch casing. In reality, the main issue was the extensive shale column just below the 9⁵/₈ inch casing shoe, extending down to the top of the coal seam. This section ranged from between 1,200 m to over 2,200 m along hole depth. The cost for recovery for a well where casing was not successfully deployed in the first attempt was estimated as being between \$1M and \$3.5M depending on the severity of the incident.

This test showcases the robustness of the GeoproHYDRA™ as the maximum circulating rate in each well ranged from 440 gpm (28 lps) to as high as 708 gpm (45 lps), WOBs as high as 132 kips (60 tones) with runs taking as long as 10.5 days, which, to the customer, was still cost effective. The GEN2X was run only in Well 9. As you can see it required the lowest circulating rate of the previous 8

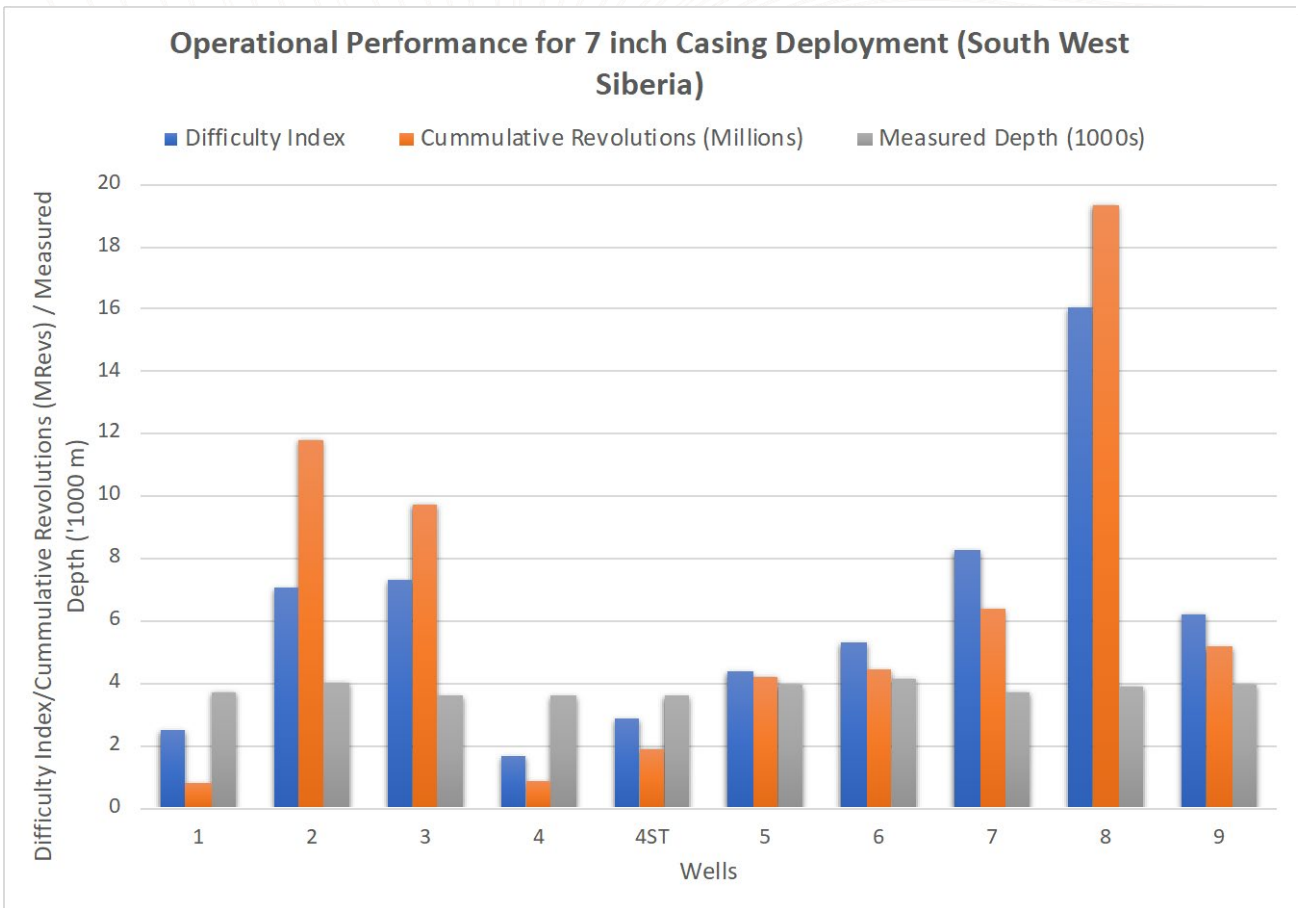


Figure CH 1.1: Operational Performance Of 7 Inch Casing Deployment In SW Siberia Using The GeoproHYDRA™

From Tables CH 1.1 and CH 1.2 the cumulative distance travelled (CDT) and the Difficulty Index (DI) are estimated as follows:

$$Cummulative\ Distance\ Travelled = Casing\ length + \sum_{i=0}^n \delta L_n$$

Where Ln is always positive and is both the travel distance in either direction (pickup or set down) during reciprocation other than additional depth gained when running in hole with the casing string.

$$Difficulty\ Index = \frac{borehole\ length\ (m)}{CDT\ (m)}$$

Unfortunately, the Difficulty Index only signifies how challenging the run is after the fact. However, it can enable operations teams set specific indices of what constitutes best, good, acceptable or poor performance for tubular deployment as a benchmark field-wide and between different technologies.

As the well numbers indicate, each preceding well was more challenging and remote from the others and the customer was willing to take higher risks. Figure CH 1.1 shows Well 9 which was completed with the GEN2X drive mechanism. One can see that though DI and cumulative revolutions were higher than Well 1, 4ST, 5 and 6, it was operated at the lowest flowrate of 377 gpm (24 lps) as the drilling crew were of the opinion it was a more powerful system.

The test resulted in a 100% success.



Mubadala Thailand Success Story – SPE PAPER 207717 (2021)

In Q1 of 2021 Mubadala Petroleum Thailand engaged Geopro engineering team to provide a 7-inch GeoproHYDRA™ that was LCM tolerant, could ream through obstructions in the borehole at low circulating rates since some of the reservoirs to be traversed were depleted and prone to severe to total losses and easily drillable. The maximum particle size in the loss circulation material was around 3mm. Based on this, the final product was a dual chamber GeoproHYDRA™ NGX with a minimum restriction of 15mm which was 5 times the maximum particle size. The tool was tested at surface to 175 gpm prior to running in hole. Figure CH 2.1 is the actual drilled trajectory. The objective was to run a 7-inch-long string from surface to a total depth of 12,354 feet with the 9½ inch casing shoe at 1,293 feet, leaving an open-hole section of 11,061 feet.

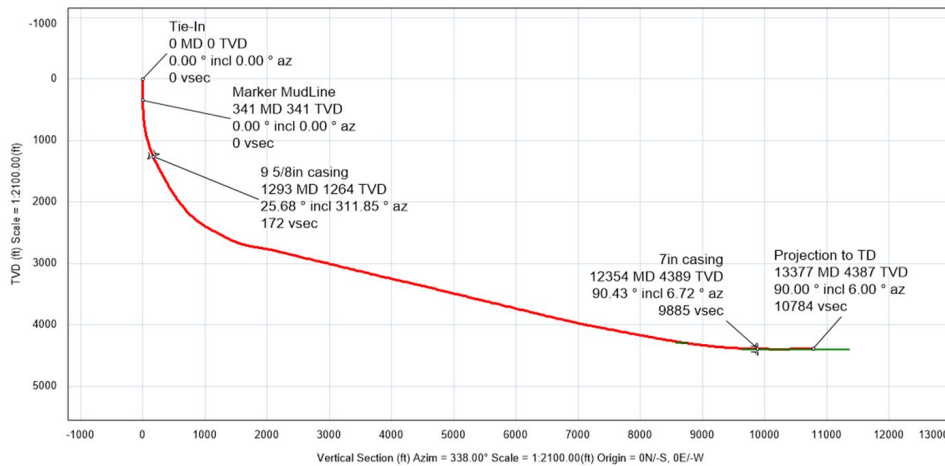


Figure CH 2.1.: Well X Trajectory

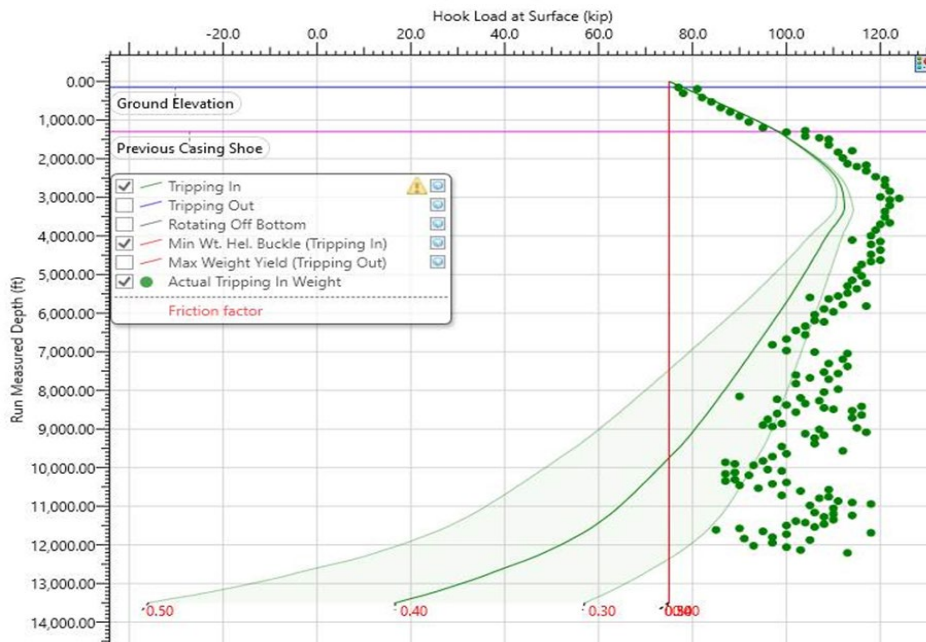


Figure CH 2.2: Well X Tripping Loads (Actual vs. Planned)

Operational Overview and Results

- Shoe track was made up of two joints of casing.
- Centek S2 centralizers were used.
- Hole size was 8½ inches and was drilled using a rotary steerable assembly.



- Shoe track was picked up and the GeoproHYDRA™ was function tested to 175 gpm.
- Broke circulation periodically between 500 and 1500 feet as dictated by the hole to clear all debris that may have built up upstream of the casing/centralizers.
- Encountered 20 bbls/hr losses at 7,035 feet AHD.
- Mixed and pumped 60 bbls of 30 ppb Tiger Bullet LCM into the active and circulated same through the string and the GeoproHYDRA™ to successfully cure losses. There was no need for a burst disc configuration.
- Washed down from 7,035 feet to section TD of 12,354 feet.
- While washing down observed a significant improvement (gain) in hook loads while circulating of between 15 – 20 kips, indicating that the GeoproHYDRA™ was creating sufficient agitation to significantly reduce overall string frictional losses. Same phenomena were observed in Well A in 2018. See Figure CH 2.3. Each time the GeoproHYDRA™ was activated there was an appreciable increase in hook load by up to 10 – 20 kips.
- 7-inch casing was successfully landed at target depth and cemented.
- Drill out time for the entire shoe track took 90 minutes.

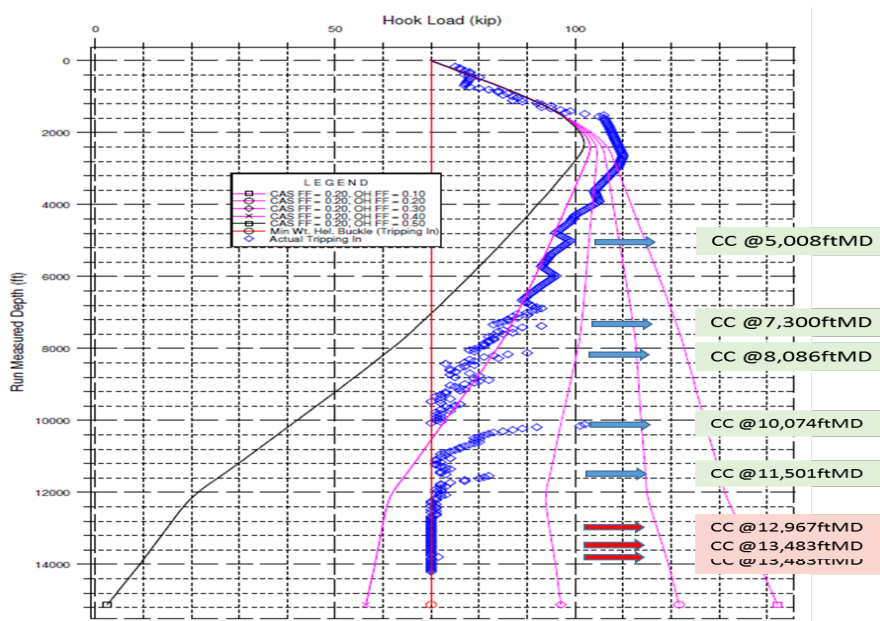


Figure CH 2.3.: Well A (drilled in 2018) Tripping Loads With The GeoproHYDRA™

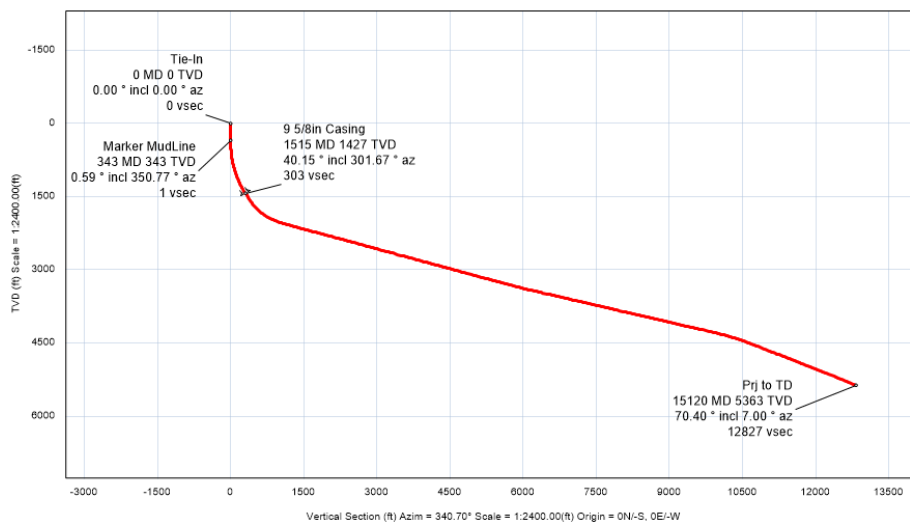
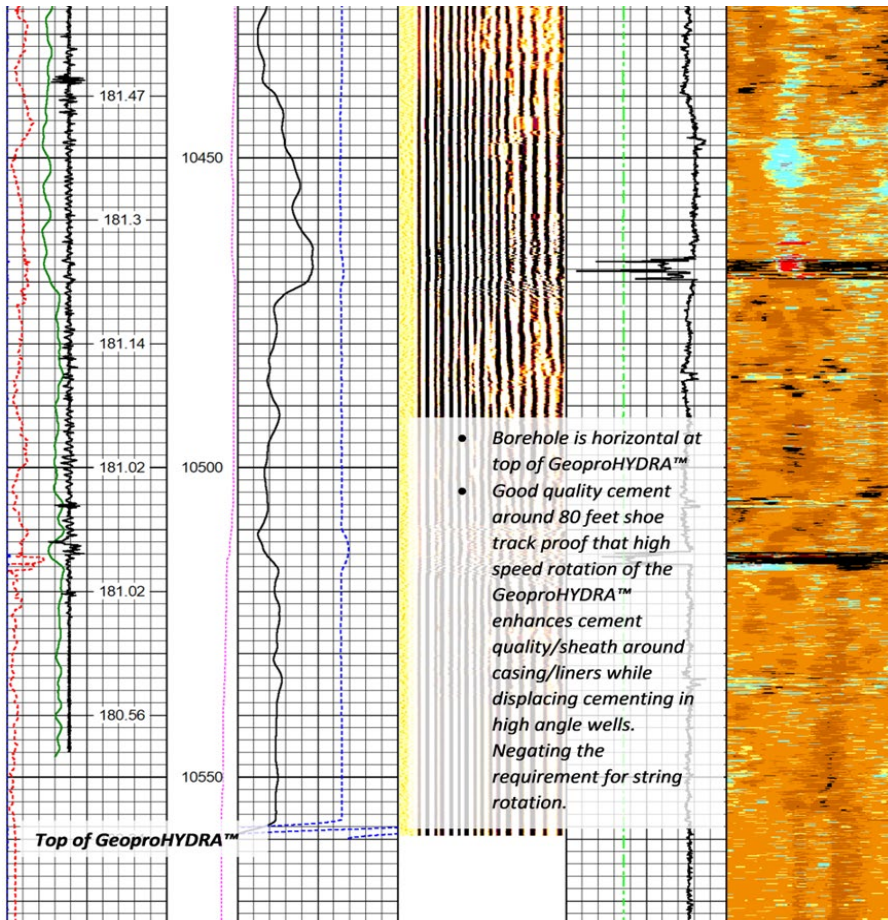


Figure CH 2.4.: Well A (2018) Trajectory



Nigeria Swamp (2020) Cement Quality

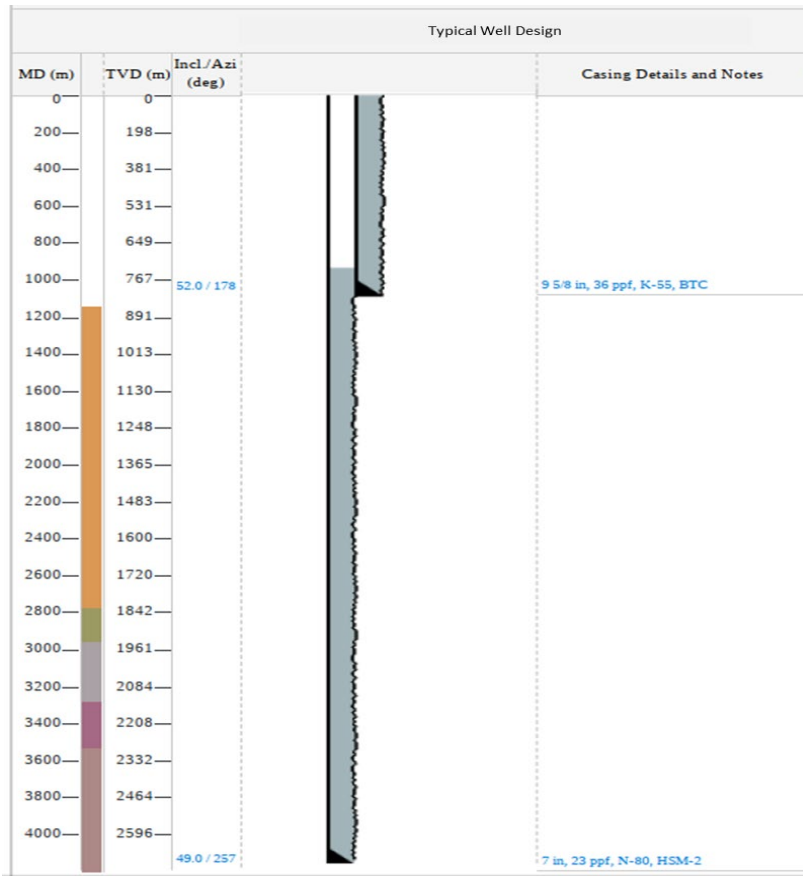


- This was an 8½ inch side-track from 9⅝ inch casing.
- The 8½ inch window was at ± 6,000 feet and at near vertical (< 5° inclination).
- The 8½ inch side-track was drilled to the horizontal landing point at ±10,560 feet.
- The 7-inch liner was run with a GeoproHYDRA™ and with revised operating envelope of 100 gpm / 800 psi SPP limits.
- Tool was made up to the shoe track and function tested to 100 gpm with < 50 psi surface pressure.
- Running-in-hole was uneventful though losses were encountered prior to landing the liner at depth resulting in revised operating envelope of 80 gpm / 800 psi.
- The liner was successful cemented, and the result showed the best cement job the customer has had in the field and with very good cement quality across the shoe track.

Figure CH 3.1.: Cement Quality At Near Horizontal Inclinations

Thailand Onshore Case History – SPE Paper 209920 (2022)

A major national oil company in Thailand ordered 3 GeoproHYDRA™ NGX systems as contingency for a specific 4 wells campaign in 2021. The three tools were configured differently with two of them with 15 mm drive ports and the third, a slightly previous iteration of the GeoproHYDRA™ NGX dual chamber design, with 8 mm drive ports.



Objectives

- 7-inch GeoproHYDRA™ was needed to overcome casing stick-up occurrence in the particular field.
- Reduce risk associated with borehole instability vis-à-vis “stick-up” occurrence.
- Reduce days on well and catch-up with the AFE days.
- Stay within budget (AFE).
- The 8½ inch hole sections in all wells was typically > 3,000 m in length.
- All wells were built and hold with severe turns in the 8½ inch section. Sometimes with a slight drop towards the end of the sections.

Figure CH 4.1: Typical Well Design For The 4 Wells Drilled.

Table CH 4.1: GeoproHYDRA™ Operating Results

Circulation Depth (m)	Max Flow (lpm)	Pressure (psi)		
		Well 4	Well 2	Well 3
850	550		210	540
1100	700	330		
1500	450		320	580
2200	450	475	460	730
2850	450		610	950
3200	450	650		
3500	450		700	1150
3900	450	900		
4100	450	870	900	1300
	550	750	730	1100



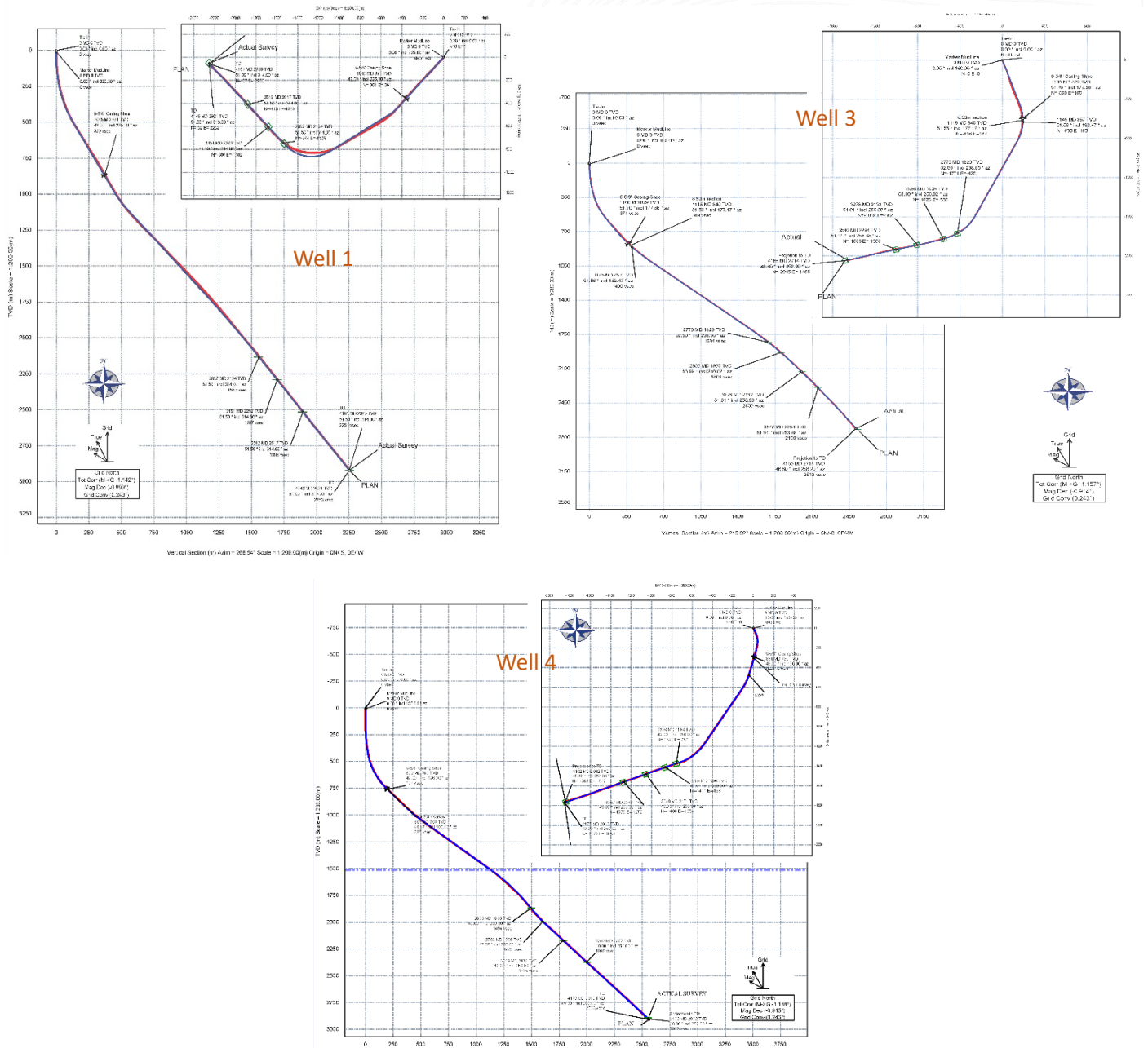


Figure CH 4.2.: Well Trajectory Well 1, Well 3 and Well 4.

The well trajectories shown in Figure CH 4.2. are similar in design and representative of the directional requirements for each of the 4 wells drilled in that campaign.

Summary of Results

The customer ran a conventional shoe in Well 1 and was unable to go beyond 3,102m where the 7-inch casing string got stuck leaving 1,044 m of rathole below the casing. The 7-inch casing was cemented in place and subsequently a 6-inch bit was used to drill out casing and as a cleanout run to ream to bottom and a 4½ inch liner was set across the rathole section. This cost the customer 11.7 days additional. The GeoproHYDRA™ reamer shoe system was not used.

In subsequent Well2, Well 3 and Well 4, the GeoproHYDRA™ NGX systems were deployed as part of the strategy and the 7-inch casing string was successfully run in all three wells at the first attempt.



Petronas Indonesia Case Histories - SPE Paper 217652 (2023)

Petronas Indonesia has acquired and deployed three 5½ inch GeoproHYDRA tools since June 2020. The first tool deployed in 2020 was our first 5½ inch single chamber GEN2X drive system with 7mm drive ports and subsequent systems have been dual chamber NGX drive systems with 15mm drive ports. All three tools were used to deploy pre-drilled liner completion strings in a Field located in the East Java Sea, North of Madura Island.

The field is situated within the East Java Basin covering about 50,000 KM2 from Central Java eastwards across East Java through the Madura straits.

The offshore platform has been located centrally within the field to ensure the main reservoirs can be drained from a single location resulting in most of the wells with ERD well profiles.

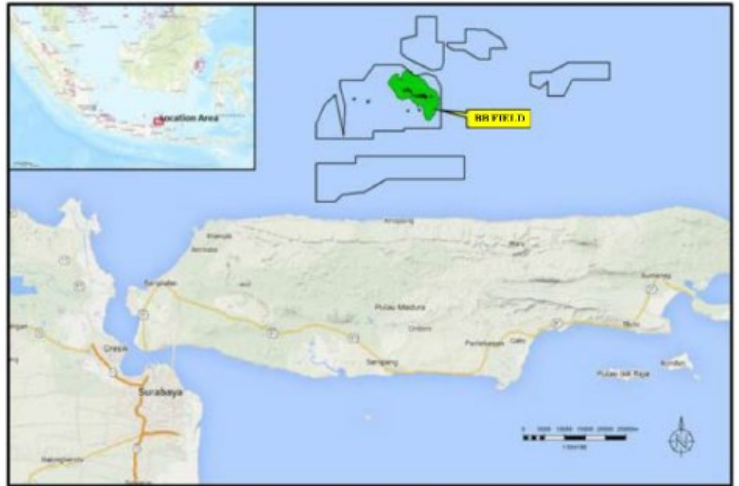


Figure CH 5.1: Location of Petronas Indonesia Field

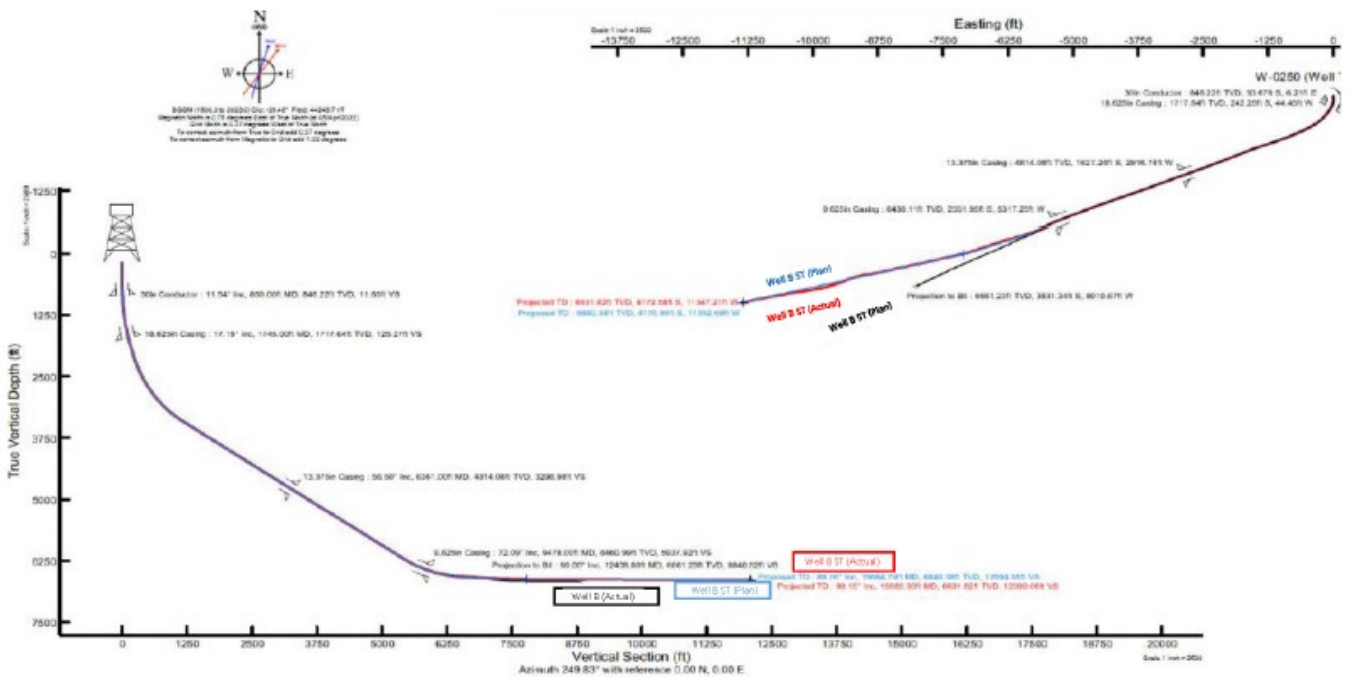


Figure CH 5.2: Final Well Trajectory for Well B (2022)

Torque simulation results are shown in Figures CH 5.3, which show that the maximum make-up torque for the string connections will be exceeded over 3,500 feet from well TD making string rotation a no-go option for string deployment. This is a field and reservoir with challenging geology prone to wellbore instability from below the surface casing and into the carbonate oil bearing reservoir.

A 5½ inch GeoproHYDRA™ NGX dual chamber system was deployed using an inner string to ensure flow could be provided into the tool and the completion string was successfully landed at depth with zero NPT. Several tight spots and restrictions were encountered during the run which were reamed through with 5 – 30 kips WOB and a maximum flow rate of 175 gpm. Well B currently holds the record as the longest horizontal lateral in Indonesia.



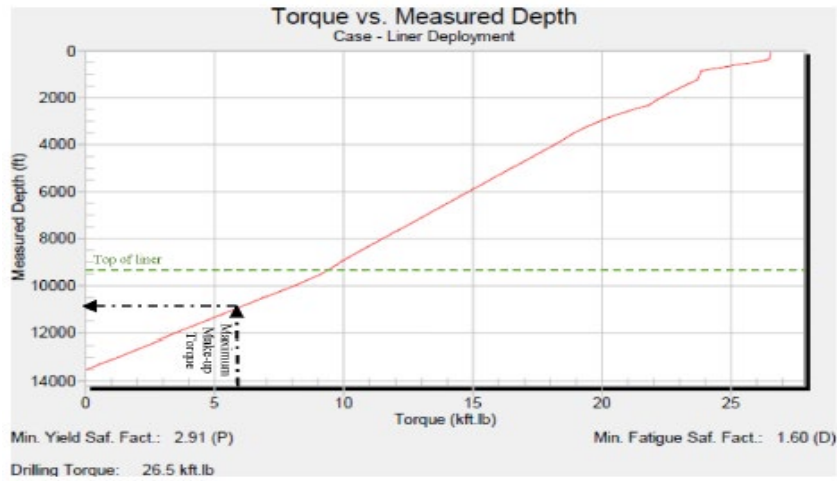


Figure CH 5.3: Reaming Torque Predictions for Well B 5½ inch Completion String (2022)

Well C was drilled and completed in February 2023. Drilling started early 3rd quarter, 2022 and due to severe borehole instability issues two rotary steerable BHAs were lost while drilling the 17½ inch hole section, leading to 2 side-tracks and a shorter 13¾ inch surface casing setting depth.

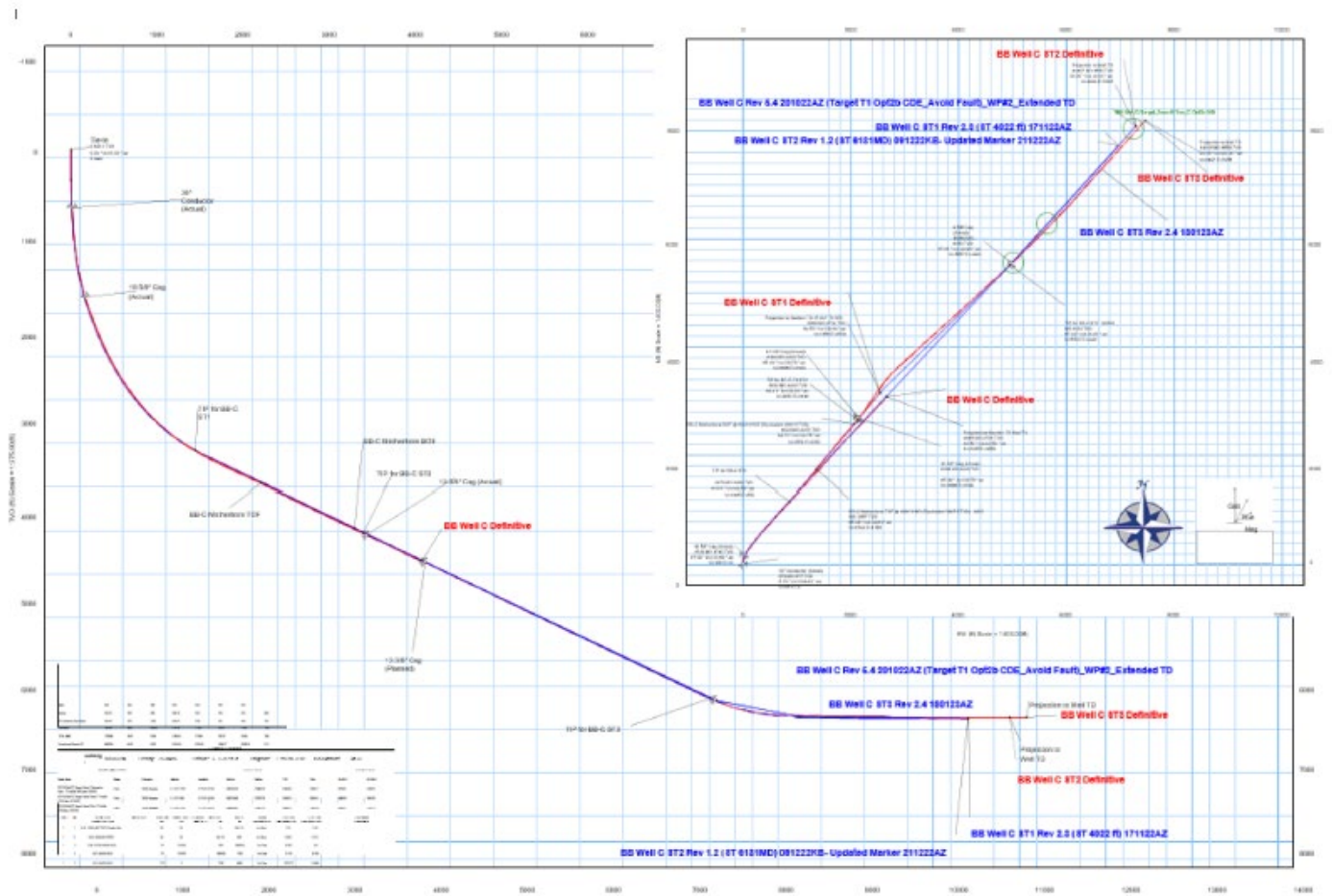


Figure CH 5.4: Final Well Trajectories for Well C (2023)



The 12¼ inch section was drilled to the top of the reservoir cap rock with no incidents. However, due to hole conditions a 3rd side-track was initiated in the reservoir section after an initial run with a standard guide shoe and the 5½ inch completion string proved unsuccessful. Side track 3 (ST3) was initiated at around 10,677 feet with 160 BPH loss rate observed at 10,761 feet. In the original drain hole loss rates of between 300 - 550 BPH was observed just below the 9⅝ inch casing shoe.

Side-track was successfully drilled to a depth of 14,305 feet. The 5½ inch completion string with the GeoproHYDRA™ NGX dual chamber tool was run in hole. Initial simulation of rotational torque should the string need to be rotated indicated that the maximum Make-up torque for the connections will be exceeded at around 11,000 feet, necessitating the need for the GeoproHYDRA™.

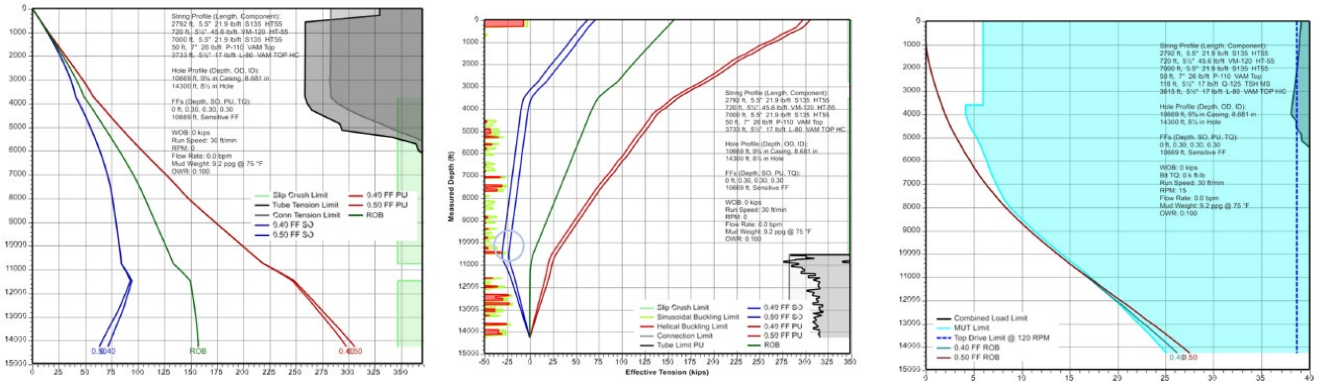


Figure CH 5.5: Torque and Drag Predictions for Well C 5½ inch Completion String (2023)

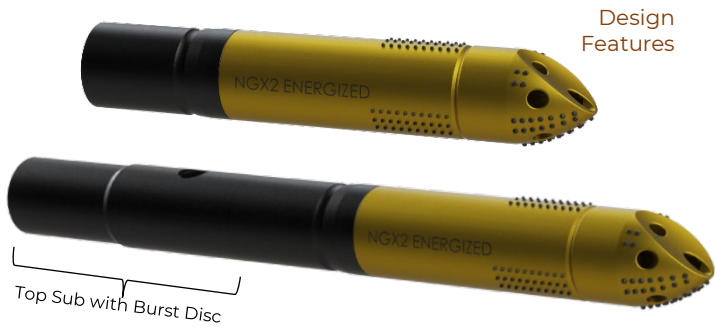
While running the 5½ inch completion string the rig crew followed a pre-agreed sequence of operation which included periodically breaking circulation at regular intervals in the open hole. At 10,900 feet the completion string was held up just below the side-track point. The rig was advised by Geopro support team to raise the flow rate to about 250 gpm and increase WOB from 10 kips to 15 - 25 kips as it was suspected that at 10 kips all of that surface weight was being lost as drag. The GeoproHYDRA™ responded to the new parameters which enabled the customer to land the completions string at depth, thus resulting in an instantaneous saving of \$780K which would have been the cost of a dedicated wiper trip and potentially \$3.8 Million, which would have been the cost of another side-track.



Specification sheets



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0450-0600-NGX-NRGZ-ND_18.9#_HTF-NR	GeoproHYDRA™	NRGZ™	4½	6



Design Features

- Ultra-high speed reaming capabilities.
- Aggressive eccentric nose and reamer body with Tungsten Carbide Inserts (TCI) cutters with 52 cutters on the nose alone.
- NGX™ XTREME self-cleaning bearing assembly.
- NRGZ™ – Energized, high efficiency drive mechanism.
- Dual reaming action: nose and stabilized body. Stabilized housing with 90 TCI cutters.
- Entire tool spins.
- Freely rotates by hand.
- Non-drillable (ND) design.
- Low operating pressure.
- No sudden or stall pressure(s).
- Low activation flow rates.
- Infinitely customisable to meet downhole conditions and well objectives.

Dimensional Information

	Oilfield		Metric	
Casing/tubular size (suitability)	in	4½	mm	114.3
Tool diameter	in	5.35	mm	135.9
Maximum OD with cutters (nose)	in	5½	mm	142.88
Maximum blade OD with cutters (Body)	in	5¾	mm	146.05
Standard Length	in	< 32	cm	< 80.74
Total Number of Ports			6	
Centre Port diameter	in	1	#	25.4
Radial Ports diameter	in	1	mm	25.4
Total Flow Area (TFA)	in²	4.71	mm²	3,040
Number of chambers			2 - Dual chamber	
Total Weight	Lbs	114.18	kg	57.09

Top Sub

Length (minimum)	in	18	cm	45.72
Minimum / Maximum OD*	in	4.545 / 5.350	mm	115.44 / 135.89
Maximum ID	in	3.563	mm	90.50
Maximum Drift Diameter	in	3.515	mm	89.28

Operating Information

Operating Temperature	°C	> 500	°F	> 932
Operating Pressure	Psi/gpm	1.25	Mpa/lps	0.137
Burst Rating (SF = 1.1)	Psi	22,097	MPa	152
Burst Rating (SF = 1.125)	Psi	21,413	Mpa	148
Axial Yield (SF = 1.6)	Kips	488	MT	222
Maximum operating WOB	Kips	175	MT	79
Absolute maximum WOB	Kips	200	MT	91
Minimum activation flow	gpm	< 25	lps	< 1.9
Recommended operating flow rate	gpm	> 80	lps	> 5.05
Maximum operating flow rate	gpm	600	lps	37.85
Maximum DLS (operating)	°/100ft	45	°/30m	44.3

AISI 4140 /4145 (standard) /
As per customer requirement

Burst, Collapse and Axial Yield based on 125KSI steel

Rupture Disc (Model 206XXX – 12UN C-276) - OPTIONAL

Rupture Disc (bore)	in	1½	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	Per customer requirement
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Design dimensions and images are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* With burst discs installed



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0500-0600-NGX-NRGZ-ND_21.4#_HTF-NR	GeoproHYDRA™	NRGZ™	5"	6"



Design Features

- Ultra-high speed reaming capabilities
- Aggressive eccentric nose and reamer body with Tungsten Carbide Inserts (TCI) cutters with 52 cutters on the nose alone.
- NGX™ XTREME self-cleaning bearing assembly
- NRGZ™ – Energized, high efficiency drive mechanism
- Dual reaming action: nose and stabilized body. Stabilized body with 90 TCI cutters.
- Entire tool spins.
- Freely rotates by hand.
- Non-drillable (ND) design.
- Low operating pressure.
- No sudden or stall pressure(s).
- Low activation flow rates.
- Infinitely customisable to meet downhole conditions and well objectives.

Dimensional Information

	Oilfield		Metric
Casing/tubular size (suitability)	in	5	mm 127.00
Tool diameter	in	5.35	mm 135.9
Maximum OD with cutters (nose)	in	5½	mm 142.88
Maximum blade OD with cutters (Body)	in	5¾	mm 146.05
Standard Length	in	< 32	cm < 80.74
Total Number of Ports			6
Centre Port diameter	in	1	# 25.4
Radial Ports diameter	in	1	mm 25.4
Total Flow Area (TFA)	in ²	4.71	mm ² 3,040
Number of chambers			2 - Dual chamber
Total Weight	Lbs	114.18	kg 57.09

Top Sub

Length (minimum)	in	18	cm 45.72
Minimum / Maximum OD*	in	5.05 / 5.350	mm 128.27 / 135.89
Maximum ID	in	4.049	mm 102.84
Maximum Drift Diameter	in	4.001	mm 101.63

Operating Information

Operating Temperature	°C	> 500	°F	> 932
Operating Pressure	Psi/gpm	1.25	Mpa/lps	0.137
Burst Rating (SF = 1.1)	Psi	22,097	MPa	152
Burst Rating (SF = 1.125)	Psi	21,413	Mpa	148
Axial Yield (SF = 1.6)	Kips	488	MT	222
Maximum operating WOB	Kips	175	MT	79
Absolute maximum WOB	Kips	200	MT	91
Minimum activation flow	gpm	< 25	lps	< 1.9
Recommended operating flow rate	gpm	> 80	lps	> 5.05
Maximum operating flow rate	gpm	600	lps	37.85
Maximum DLS (operating)	°/100ft	45	°/30m	44.3
Material				AISI 4140 /4145 (standard) / As per customer requirement

Burst, Collapse and Axial Yield based on 125KSI steel

Rupture Disc (Model 206XXX – 12UN C-276) - OPTIONAL

Rupture Disc (bore)	in	1½	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	Per customer requirement
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Design dimensions and images are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* With burst discs installed



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0450-0850-NGX-NRGZ-ND_13.5#_VT	GeoproHYDRA™	NRGZ™	4½	8½



Design Features

- Ultra-high speed reaming capabilities.
- Aggressive eccentric nose and reamer body with Tungsten Carbide Inserts (TCI) cutters with 52 cutters on the nose alone.
- NGX™ XTREME self-cleaning bearing assembly.
- NRGZ™ – Energized, high efficiency drive mechanism.
- Dual reaming action: nose and stabilized body. Stabilized housing with 90 TCI cutters.
- Entire tool spins.
- Freely rotates by hand.
- Non-drillable (ND) design.
- Low operating pressure.
- No sudden or stall pressure(s).
- Low activation flow rates.
- Infinitely customisable to meet downhole conditions and well objectives.

Top Sub with Burst Disc

Dimensional Information	Oilfield		Metric	
Casing/tubular size (suitability)	in	4½	mm	114.3
Tool diameter	in	5.35	mm	135.9
Maximum OD with cutters (nose)	in	8	mm	203.20
Maximum blade OD with cutters (Body)	in	8¾	mm	209.55
Standard Length	in	< 32	cm	< 80.74
Total Number of Ports			6	
Centre Port diameter	in	1.5	#	38.1
Radial Ports diameter	in	1.5	mm	38.1
Total Flow Area (TFA)	in²	10.60	mm²	6,838
Number of chambers			2 - Dual chamber	
Total Weight	Lbs	139	kg	63.18

Top Sub				
Length (minimum)	in	18	cm	45.72
Minimum / Maximum OD*	in	5.05 / 5.350	mm	128.27 / 135.89
Maximum ID	in	3.563	mm	90.50
Maximum Drift Diameter	in	3.515	mm	89.28

Operating Information				
Operating Temperature	°C	> 500	°F	> 932
Operating Pressure	Psi/gpm	125	Mpa/lps	0.137
Burst Rating (SF = 11)	Psi	22,097	MPa	152
Burst Rating (SF = 1125)	Psi	21,413	Mpa	148
Axial Yield (SF = 1.6)	Kips	488	MT	222
Maximum operating WOB	Kips	175	MT	79
Absolute maximum WOB	Kips	200	MT	91
Minimum activation flow	gpm	< 35	lps	< 2.21
Recommended operating flow rate	gpm	> 100	lps	> 6.31
Maximum operating flow rate	gpm	600	lps	37.85
Maximum DLS (operating)	%/100ft	37	%/30m	36.42
Material	AISI 4140 / 4145 (standard) / As per customer requirement. Burst, Collapse and Axial Yield based on 125KSI steel			

Rupture Disc (Model 206XXX – 12UN C-276) - OPTIONAL				
Rupture Disc (bore)	in	1½	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	Per customer requirement
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Design dimensions and images are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* With burst discs installed



Product Number	Brand	Model	Casing Size	Hole Size
HYD-550-613 ND_XX#_FLUSHED	GeoproHYDRA™	NRGZ™	5½ in	6⅞ in



Design Features

- Ultra-high speed reaming capabilities
- Eccentric nose profile with Tungsten Carbide Insert (TCI) cutters
- NRGZ™ – Energized, high efficiency drive mechanism
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- Non-drillable (ND) design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives

Dimensional Information

	Oilfield	Metric
Casing/tubular size (suitability)	in 5½	mm 139.7
Tool diameter (min)	in 5½	mm 139.7
Maximum blade OD (nose)	in 5⅝	mm 142.88
Maximum blade OD (Body)	in 5⅞	mm 149.23
Standard Length	in <36	cm <91.44
Extended Length	in <54	cm <137.16
Total Number of Ports		7
Centre Port diameter	in 1	# 25.4
Radial Ports diameter	in 1	mm 25.4
Total Flow Area (TFA)	in ² 4.71	mm ² 3,040
Number of chambers		2 - Dual chamber

Operational Information

Operating Temperature	°C > 500	°F > 932
Axial Yield (minimum)	Kips 929	MT 421.52
Maximum operating WOB	Kips 125	MT 56.70
Absolute maximum WOB	Kips 160	MT 72.57
Minimum activation flow	gpm < 20	lps < 1.9
Recommended operating flow rate (minimum)	gpm > 60	lps > 3.79
Maximum operating flow rate	gpm 600	lps 37.85
Material	100 KSI AISI 4140 /4145 (standard) / As per customer requirement	

Additional Options

Rupture discs	Slick stabilised body	Drillable internals
Single or Dual float valves or NRVs	TCI cutter sizes	Drillable nose
Extended casing sub/adaptor	Machined directional flow path	Special clearance tool
Material type: 13Cr or SM13Cr		

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0550-0788 ND-20#_VT	GeoproHYDRA™	nGX	5½ in	7⅞ in



Design Features:

- Ultra-high speed reaming capabilities
- Eccentric nose profile
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- Non-drillable (ND) design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size	in 5½	mm 139.70
Tool diameter	in 6.10*	mm 153.67
Maximum blade OD (nose / stabilised housing)	in 7⅞	mm 187.33
Standard Length / Extended Length†	in 37 / 45	cm 91.44 / 114.3
Total Number of Ports/Nozzles		7
Centre Port diameter	in 1	# 25.4
Radial Ports diameter	in 1.0	mm 25.4
Total Flow Area (TFA) at Nose	in ² 15.847	mm ² 10,241
Number of chambers		2 - Dual chamber (nGX)

Operational Information				
Operating Temperature‡	°C	> 500	°F	> 932
Burst Rating (minimum)§	psi	20,291	MPa	139.9
Collapse Rating (minimum)**	psi	20,235	Mpa	139.5
Axial Yield (minimum)††	Kips	1,163	MT	527.71
Maximum operating WOB	Kips	175	MT	79.37
Absolute maximum WOB	Kips	225	MT	102
Minimum activation flow	gpm	< 25 (< 0.6 bpm)	lps	< 1.57
Minimum Recommended operating flow rate	gpm	> 80 (1.90 bpm)	lps	> 5.04
Maximum operating flow rate	gpm	800	lps	50.47
Material				AISI 4145 110 KSI steel

Additional features Single or Dual Float Valves
 nGX™ Dual Chamber Drive System:
 15 mm Ø drive disc ports (minimum restriction)
 Choice of (premium) connection – Typically blank or API

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

† Depends on float valves configuration, where a single or dual float may be requested by customer
 ‡ Much higher than 500 °C as tool is all steel
 § Values shown are for 110 KSI steel
 ** Values shown are for 110 KSI steel
 †† Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0550-0850 ND-20#_VT	GeoproHYDRA™	nGX	5 ½ in	8 ½ in



Design Features:

- Ultra-high speed reaming capabilities
- Eccentric nose profile
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- Non-drillable (ND) design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size	in 5½	mm 139.70
Tool diameter (min / max)	in 6.10*	mm 153.67
Maximum blade OD (nose / stabilised housing)	in 8¼	mm 209.55
Standard Length / Extended Length	in 37 / 45	cm 91.44 / 114.3
Total Number of Ports/Nozzles		7
Centre Port diameter	in 1	# 25.4
Radial Ports diameter	in 1.0	mm 25.4
Total Flow Area (TFA) at Nose	in ² 5.498	mm ² 3,547
Number of chambers	2 - Dual chamber (nGX)	

Operational Information				
Operating Temperature [†]	°C	> 500	°F	> 932
Burst Rating (minimum) [‡]	psi	20,291	MPa	139.9
Collapse Rating (minimum) [§]	psi	20,235	Mpa	139.5
Axial Yield (minimum)**	Kips	1,163	MT	527.71
Maximum operating WOB	Kips	175	MT	79.37
Absolute maximum WOB	Kips	225	MT	102
Minimum activation flow	gpm	< 25 (< 0.6 bpm)	lps	< 1.57
		Steady state at 1.1 bpm		
Recommended operating flow rate	gpm	> 80 (1.90 bpm)	lps	> 5.04
Maximum operating flow rate	gpm	800	lps	50.47
Material	AISI 4145 110 KSI steel			

Additional features
Single or Dual Poppet Valve nGX™ Dual Chamber Drive System: 15 mm Ø drive disc ports (minimum restriction)

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

[†]Much higher than 500 °C as tool is all steel

[‡]Values shown are for 110 KSI steel

[§]Values shown are for 110 KSI steel

^{**}Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0662-0850 ND	GeoproHYDRA™	nGX	6 5/8 in	8 1/2 in



Design Features:

- Ultra-high speed reaming capabilities
- Eccentric nose profile
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- Non-drillable (ND) design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives

Dimensional Information

	Oilfield		Metric	
Casing/Tubular size	in	6.625	mm	168
Tool diameter (min / max)	in	7.21*	mm	183
Maximum blade OD (nose / stabilised housing)	in	8.25	mm	210
Standard Length / Extended Length	in	37 / 46	cm	91.44 / 116.84
Total Number of Ports/Nozzles			7	
Centre Port diameter	in	2	#	50.8
Radial Ports diameter	in	1.250	mm	31.75
Total Flow Area (TFA) at Nose	in ²	10.50	mm ²	6777
Number of chambers			2 - Dual chamber	

Operational Information

Operating Temperature [†]	°C	> 500	°F	> 932
Burst Rating (minimum) [‡]	psi	19,541	MPa	134.73
Collapse Rating (minimum) [§]	psi	19,216	Mpa	132.49
Axial Yield (minimum)**	Kips	1,757	MT	797.06
Maximum operating WOB	Kips	175	MT	79.37
Absolute maximum WOB	Kips	225	MT	102
Minimum activation flow	gpm	< 30	lps	< 1.9
Recommended operating flow rate	gpm	> 100	lps	> 6.31
Maximum operating flow rate	gpm	1000	lps	63.08
Material			AISI 4140 /4145 (standard) / As per customer requirement	

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

[†] Much higher than 500 °C as tool is all steel

[‡] Depends on steel grade requirements. Values shown are for 110 KSI steel

[§] Depends on steel grade requirements. Values shown are for 110 KSI steel

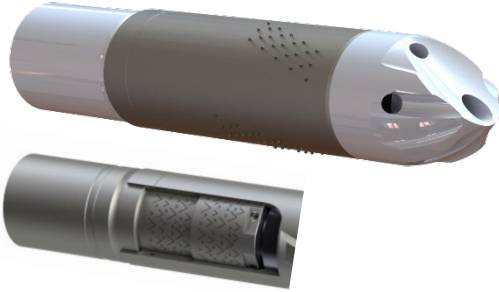
** Depends on steel grade requirements. Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0700-0850-NGX-NRGZ 29#-VT_110KSI	GeoproHYDRA™	nGX	7 in	8 ½ in

Design Features:

- Ultra-high speed reaming system
- Eccentric nose profile
- Dual reaming action: nose and stabilised body
- Advanced FasTDrill™ optimized internal drillable aluminium components and nose
- Axially directed port fluid grooves for enhanced bottom hole cleaning and cement deposition
- NRGZ™ – Energized torsional housing with 97% hydraulic efficiency
- nGX™ XTREME anti-jamming bearing assembly
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Customisable to meet downhole conditions and well objectives
- Infinitely customisable to meet downhole conditions and well objectives



Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 7	mm 177.8
Tool diameter (min / max)	in 7 5/8 / 8.0	mm 193.67 / 203.20
Maximum blade OD (nose / stabilised housing)	in ≤ 8.0 / ≤ 8 1/4	mm ≤ 203.20 / ≤ 209.55
Standard Length / Extended Length	in 32 / 55	cm 81 / 140
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 1.25	mm 31.75
Radial Ports diameter†	in 1.25	mm 31.75
Total Flow Area (TFA) (minimum)	in² 8.59	mm² 5,542
Number of chambers		2 - Dual chamber
Drill out bit diameter (maximum)‡	in 6 1/8	mm 156
Tool Weight (typical)	Lbs 209	Kgs 95

Operational Information

Operating Temperature§	°C > 450	°F > 752
Operating Pressure Drop (Typically)**	Psi/gpm <1.0	MPa <0.1093
Burst pressure (SF = 1.1)	Psi 15,434	Mpa 106.41
Collapse pressure (SF = 1.125)	psi 15,726	Mpa
Axial Yield (SF = 1.6)††	Kips 1,009	MT 459
Maximum operating WOB	Kips 175	MT 79.38
Absolute maximum WOB	Kips 225	MT 102.05
Minimum activation flow	gpm < 30	lps < 1.89
Recommended operating flow rate (minimum)	gpm > 150	lps > 9.46
Maximum operating flow rate	gpm 800	lps 50.47
Maximum DLS (operating)	°/100ft 30°	°/30m 29.53°
Rotational speed at 150 gpm		>1000 RPM
Rotational speed at 350 gpm		>3000 RPM
Material shown	AISI 4140 110KSI steel (standard) / As per customer requirement. Up to 180 KSI strength is available Aluminium 6061-T6 drillable components	

Optional Configurations

Rupture discs‡‡	Dependent on customer requirement
Float / no-return valves	Single or double drillable floats available as an option
Type of connection	Configurable to blanking dimensions of customer casing connections

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements
 † Standard port size shown. Can be modified to suit customer/well requirements if needed
 ‡ Depends on casing weight and/or special drift requirements
 § Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature
 ** Pressure drop across the tool when tool activates
 †† Depends on steel grade. Values shown are for 110 KSI steel
 ‡‡ Rupture discs are available and can be added just below the threaded connection should it be required. This will be according to customer specification



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0700-0850-NGX-NRGZ-ULTIMATE_29#-XX_110KSI	GeoproHYDRA™	nGX™2 ULTIMATE	7 in	8½ in



NGX™XTREME ANTI-JAMMING BEARING

Design Features:

- Ultra-high speed reaming system.
- Bladed Bronze-Copper Alloy eccentric nose profile with TCI cutters
- Dual reaming action: nose and stabilized body.
- Advanced **FasTDri™** optimized internal drillable components.
- Axially directed “grooved” fluid ports for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **nGX™XTREME** anti-jamming bearing assembly
- Entire tool spins.
- Freely rotates by hand.
- Tungsten carbide inserts (TCI) cutting structure on reamer body and nose.
- Low operating pressure.
- No sudden or additional stall pressure(s).
- Low activation flow rates.
- Customisable to balance expected downhole conditions with surface parameters.

Dimensional Information

	Oilfield	Metric
Casing/Tubular size (suitability)	in 7	mm 177.8
Tool diameter (min / max)	in 7½ / 8.06	mm 270.00
Maximum blade OD (nose / stabilised housing)	in ≤ 8 / ≤ 8¼	mm ≤ 203.20 / ≤ 209.55
Standard Length	in 37	cm 93.54
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 1.25	mm 31.75
Radial Ports diameter†	in 1.25	mm 31.75
Total Flow Area (TFA) at Nose (minimum)	in² 8.59	mm² 5,542
Number of chambers		2 - Dual chamber
Drill out bit diameter	in 6½	mm 156
Tool Weight (typical)	Lbs 231	Kgs 105

TOP Sub

Length (minimum)	in 18	cm 45.72
Maximum OD‡	in 7.94	mm 201.67
Minimum ID	in 6.29	mm 159.76
Drift Diameter	in 6.171	mm 156.74

Rupture Disc (Model 206XXX – 12UN C-276) - OPTIONAL

Rupture Disc (bore)	in 1½	mm 38.1
Rupture Disc (# per tool)	minimum 2	maximum 4
Pressure Rating (from – to)	Psi 1500 - 3000	MPa 10.342 – 20.684

Operating Information§

Operating Temperature**	°C > 450	°F > 752
Operating Differential Pressure (Typically)	Psi/gpm < 1.0	MPa/lps < 0.1093
Burst pressure (SF = 1.1)	Psi 15,434	Mpa 106.41
Collapse pressure (SF = 1.125)	Psi 15,726	Mpa 108.42
Axial Yield (SF = 1.6)	Kips 1,009	MT 459
Maximum operating WOB	Kips 175	MT 79.38
Absolute maximum WOB	Kips 225	MT 102.05
Minimum activation flow	gpm < 30	lps < 1.89
Recommended operating flow rate	gpm > 150	lps > 9.46
Maximum operating flow rate	gpm 800	lps 50.47
Maximum DLS (operating)	°/100 ft 30°	°/30m 29.53°
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement, Tungsten Carbide Inserts, Aluminium 6061-T6 drillable components, Bronze-Copper Alloy	

Further / Optional Configurations

Rupture discs	Requirement to be defined by customer.
Float / non-return valves	Can be installed onsite if required. Single or double drillable floats available are optional

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suit customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.

† Standard port size shown. Can be modified to suit customer/well requirements if needed.

‡ With burst discs installed

§ Based on 4140/4145 110Ksi Steel

** Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature. Melting Point of Bronze-Copper alloy is ± 950° C (1,742° F).



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0763-0850	GeoproHYDRA™	nGX	7 5/8 in	8 ½ in



Design Features:

- Ultra-high speed reaming capabilities
- Eccentric nose profile
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 7.625	mm 177.8
Tool diameter (min / max)	in 8.14 / 8.25	mm 193.67
Maximum blade OD (nose / stabilised housing)	in 8.250 / 8.375	mm 209.55
Standard Length / Extended Length	in 37 / 55	cm 104.1
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 1.25	# 31.75
Radial Ports diameter†	in 1.25	mm 31.75
Total Flow Area (TFA) at Nose (minimum)	in ² 8.59	mm ² 5,542
Number of chambers		2 - Dual chamber
Drill out/Drift diameter‡	in ± 6.25	mm 158.75

Operational Information				
Operating Temperature§	°C	> 450	°F	> 752
Burst Rating (minimum)**	psi	12,645	MPa	87.18
Collapse Rating (minimum)††	psi	12,816	MPa	88.36
Axial Yield (minimum)‡‡	Kips	1,172	MT	531.61
Maximum operating WOB	Kips	175	MT	79.38
Absolute maximum WOB	Kips	225	MT	102.05
Minimum activation flow	gpm	< 50	lps	< 3.15
Recommended operating flow rate	gpm	> 150	lps	> 9.46
Maximum operating flow rate	gpm	800	lps	50.47
Material	AISI 4140 /4145 steel (standard) / As per customer requirement Aluminium 6061-T6 and Aluminium 7175 drillable components			

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements
 † Standard port size shown. Can be modified to suit customer/well requirements if needed
 ‡ Depends on casing weight and/or special drift requirements
 § Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature
 ** Depends on steel grade. Values shown are for 80 KSI steel
 †† Depends on steel grade. Values shown are for 80 KSI steel
 ‡‡ Depends on steel grade. Values shown are for 80 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0863-0950-NGX-NRGZ _110KSI	GeoproHYDRA™	nGX™2	8 5/8 in	9 1/2 in



Design Features:

- Ultra-high speed reaming system.
- Bladed eccentric nose profile.
- Dual reaming action: nose and stabilised body.
- Advanced **FastDrill™** optimized internal drillable aluminium components and nose.
- Axially directed grooved fluid ports for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **nGX™XTREME** anti-jamming bearing assembly
- Entire tool spins.
- Freely rotates by hand.
- Tungsten carbide inserts (TCI) cutting structure.
- Low operating pressure.
- Low activation flow rates.
- Customisable to meet downhole conditions and well objectives.

Dimensional Information	Oilfield		Metric	
Casing/Tubular size (suitability)	in	8 5/8	mm	219.08
Tool diameter (min / max)	in	8 5/8	mm	219.08
Maximum blade OD (nose / stabilised housing)	in	9 3/8 / 9 3/4	mm	231.78 / 234.95
Standard Length	in	37	cm	93.98
Total Number of Ports/Nozzles			7	
Centre Port diameter (minimum)†	in	2	mm	50.8
Radial Ports diameter†	in	1.75	mm	38.1
Total Flow Area (TFA) at Nose (minimum)	in²	17.57	mm²	11,335
Number of chambers			3 - Triple chamber	
Drill out bit diameter	in	7 3/8	mm	187.32
Tool Weight (typical)	Lbs	256.2	Kgs	116.4

TOP Sub				
Length (minimum / maximum)	in	18 / 24	cm	45.72 / 60.96
Maximum OD	in	8 5/8†	mm	219.08
Minimum ID	in	7.511	mm	190.78
Drift Diameter	in	7.386	mm	185.06

Rupture Disc (Model 206XXX – 12UN C-276)				
Rupture Disc (bore)	in	1 1/2	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	4
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Operational Information				
Operating Temperature§	°C	> 450	°F	> 752
Operating Pressure (Typically)	Psi/gpm	1	MPa/lps	0.1093
Burst pressure (SF = 1.1)	Psi	11,624	Mpa	80.14
Collapse pressure (SF = 1.125)	Psi	9,541	Mpa	67.78
Axial Yield (SF = 1.6)	Kips	970.6	MT	440
Maximum operating WOB	Kips	225	MT	102.06
Absolute maximum WOB	Kips	250	MT	113.40
Minimum activation flow	gpm	<30	lps	< 1.89
Recommended operating flow rate	gpm	> 175	lps	> 11.04
Maximum operating flow rate	gpm	1500	lps	94.63
Maximum DLS (operating)	°/100 ft	15°	°/30m	14.76°
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components			

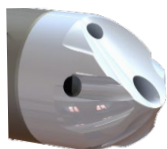
Further / Optional Configurations	
Rupture discs	Requirement to be defined by customer for each tool. Can be installed offsite prior to field deployment.
Float / no-return valves	Single or double drillable floats available as an option

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suit customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.
 † Standard port size shown. Can be modified to suit customer/well requirements if needed.
 ‡ Flushed connections only. Larger for threaded couplings
 § Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature.



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0963-1225-NGX-NRGZ 47#-VT_110KSI	GeoproHYDRA™	nGX™2	9 5/8 in	12 1/4 in



NGX™ BLADED ECCENTRIC NOSE PROFILE WITH AXIALLY DIRECTED GROOVED PORTS



NGX™XTREME ANTI-JAMMING BEARING

Design Features:

- Ultra-high speed reaming system.
- Bladed eccentric nose profile.
- Dual reaming action: nose and stabilized body.
- Advanced **FasTDrill™** optimized internal drillable aluminium components and nose.
- Axially directed grooved fluid ports for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **nGX™XTREME** anti-jamming bearing assembly
- Entire tool spins.
- Freely rotates by hand.
- Tungsten carbide inserts (TCI) cutting structure.
- Low operating pressure.
- Low activation flow rates.
- Customisable to meet downhole conditions and well objectives.

Dimensional Information

	Oilfield		Metric	
Casing/Tubular size (suitability)	in	9 5/8	mm	311.15
Tool diameter (min / max)	in	10 5/8	mm	270.00
Maximum blade OD (nose / stabilised housing)	in	11 1/2 / 11 5/8	mm	292.1 / 301.63
Standard Length / Extended Length	in	36 / 54	cm	91 / 137
Total Number of Ports/Nozzles			7	
Centre Port diameter (minimum)*	in	2	mm	50.8
Radial Ports diameter†	in	1.5	mm	38.1
Total Flow Area (TFA) at Nose (minimum)	in ²	13.74	mm ²	8,867
Number of chambers			3 - Triple chamber	
Drill out bit diameter	in	8 1/2	mm	215.9
Tool Weight (typical)	Lbs	319	Kgs	145

TOP Sub

Length (minimum / maximum)	in	18 / 24	cm	45.72 / 60.96
Maximum OD	in	10 5/8	mm	269.88
Minimum ID	in	8.681	mm	220.50
Drift Diameter	in	8.525	mm	216.54

Rupture Disc (Model 206XXX – 12UN C-276)

Rupture Disc (bore)	in	1 1/2	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	4
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Operational Information

Operating Temperature‡	°C	> 450	°F	> 752
Operating Pressure (Typically)	Psi/gpm	1	MPa/lps	0.1093
Burst pressure (SF = 1.1)	Psi	16,017	Mpa	110.43
Collapse pressure (SF = 1.125)	Psi	16,260	Mpa	112.10
Axial Yield (SF = 1.6)	Kips	2,027	MT	921.57
Maximum operating WOB	Kips	225	MT	102.06
Absolute maximum WOB	Kips	250	MT	113.40
Minimum activation flow	gpm	<35	lps	< 2.21
Recommended operating flow rate	gpm	> 175	lps	> 11.04
Maximum operating flow rate	gpm	1500	lps	94.63
Maximum DLS (operating)	°/100 ft	15°	°/30m	15.24°
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components			

Further / Optional Configurations

Rupture discs	Requirement to be defined by customer for each tool. Can be installed offsite prior to field deployment.
Float / no-return valves	Single or double drillable floats available as an option

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suit customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.

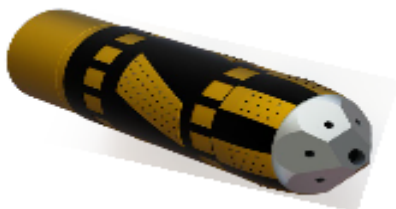
† Standard port size shown. Can be modified to suit customer/well requirements if needed.

‡ Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature.





Product Number	Brand	Model	Casing Size	Hole Size
HYD-1400-1450_1600	GeoproHYDRA™	nGX	14 in	16 in



Design Features:

- Ultra-high speed reaming capabilities
- Eccentric nose profile
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives
- Bicentre extrusion

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 14.00	mm 355.60
Tool diameter (min / max)	in 14.00	mm 355.60
Maximum blade OD (nose / stabilised housing)	in 14.35	mm 364.49
Standard Length / Extended Length	in 52 / 72	cm 124.80 / 182.88
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 3	mm 76.2
Radial Ports diameter†	in 1.75	mm 44.45
Total Flow Area (TFA) at Nose (minimum)	in ² 21.500	mm ² 13,871
Number of chambers		4 - Quad chamber
Drill out/Drift diameter‡	in ± 12.25	mm 311.15
Special feature – Bicentric Extrusion	TBD	TBD

Operational Information		
Operating Temperature§	°C > 450	°F > 752
Burst Rating (minimum)**	psi 10,890	MPa 75.08
Collapse Rating (minimum)**	psi 7,382	MPa 50.89
Axial Yield (minimum)**	Kips 3,520.4	MT 1,596.64
Maximum operating WOB	Kips 250	MT 113.40
Absolute maximum WOB	Kips 300	MT 136.08
Minimum activation flow	gpm < 150	lps < 9.464
Recommended operating flow rate	gpm > 275	lps > 17.350
Maximum operating flow rate	gpm 1500	lps 94.64
Material	110 KSI steel (standard) / As per customer requirement Aluminium 6061-T6 and Aluminium 7175 drillable components	

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements
 † Standard port size shown. Can be modified to suit customer/well requirements if needed
 ‡ Depends on casing weight, special drift, or customer requirements
 § Limited by the melting point of Aluminium 6160-T6 (630 °C / 1202 °F) to 70% (433 °C / 811 °F) of the melting point temperature
 ** Depends on steel grade. Values shown are for 110 KSI steel
 †† Depends on steel grade. Values shown are for 110 KSI steel
 ††† Depends on steel grade. Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0963-1225-NGX-NRGZ-ULTIMATE_47#-VT_110KSI	GeoproHYDRA™	nGX™2 ULTIMATE	9 5/8 in	12 1/4 in



NGX™XTREME ANTI-JAMMING BEARING

Design Features:

- Ultra-high speed reaming system.
- Bladed Bronze-Copper Alloy eccentric nose profile with TCI cutters
- Dual reaming action: nose and stabilized body.
- Advanced **FasTDrill™** optimized internal drillable components.
- Axially directed “grooved” fluid ports for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **nGX™XTREME anti-jamming bearing assembly**
- Entire tool spins.
- Freely rotates by hand.
- Tungsten carbide inserts (TCI) cutting structure on reamer body and nose.
- Low operating pressure.
- No sudden or additional stall pressure(s).
- Low activation flow rates.
- Customisable to balance expected downhole conditions with surface parameters.

Dimensional Information

	Oilfield		Metric	
Casing/Tubular size (suitability)	in	9 5/8	mm	311.15
Tool diameter (min / max)	in	10 5/8	mm	270.00
Maximum blade OD (nose / stabilised housing)	in	11 7/8 / 12	mm	301.63 / 304.80
Standard Length	in	38 / 54	cm	96.52
Total Number of Ports/Nozzles			7	
Centre Port diameter (minimum)*	in	2	mm	50.8
Radial Ports diameter†	in	1.75	mm	44.5
Total Flow Area (TFA) at Nose (minimum)	in ²	17.57	mm ²	11,337
Number of chambers			3 - Triple chamber	
Drill out bit diameter	in	8 1/2	mm	215.9
Tool Weight (typical)	Lbs	403	Kgs	183.20

TOP Sub

Length	in	18	cm	45.72
Maximum OD	in	10 5/8	mm	269.88
Minimum ID	in	8.681	mm	220.50
Drift Diameter	in	8.525	mm	216.54

Rupture Disc (Model 206XXX – 12UN C-276) - OPTIONAL

Rupture Disc (bore)	in	1 1/2	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	4
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Operating Information‡

Operating Temperature§	°C	> 450	°F	> 752
Operating Pressure (Typically)	Psi/gpm	1	MPa/lps	0.1093
Burst pressure (SF = 1.1)	Psi	16,017	Mpa	110.43
Collapse pressure (SF = 1.125)	Psi	16,260	Mpa	112.10
Axial Yield (SF = 1.6)	Kips	2,027	MT	921.57
Maximum operating WOB	Kips	225	MT	102.06
Absolute maximum WOB	Kips	250	MT	113.40
Minimum activation flow	gpm	<60	lps	< 3.785
Recommended operating flow rate	gpm	> 215	lps	> 13.564
Maximum operating flow rate	gpm	1500	lps	94.63
Maximum DLS (operating)	°/100 ft	15°	°/30m	15.24°
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement, Tungsten Carbide Inserts, Aluminium 6061-T6 drillable components, Bronze-Copper Alloy			

Further / Optional Configurations

Rupture discs	Requirement to be defined by customer for each tool. Can be installed onsite if required.
---------------	--

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suit customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.

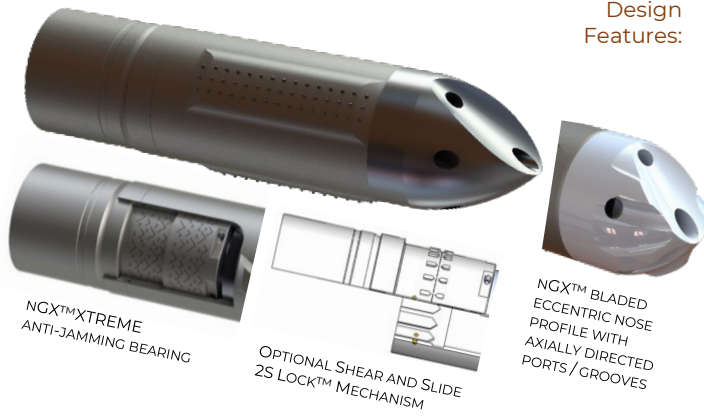
† Standard port size shown. Can be modified to suit customer/well requirements if needed.

‡ Based on 4140/4145 110Ksi Steel

§ Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature. Melting Point of Bronze-Copper alloy is ± 950° C (1,742° F).



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0963-1225-NGX-NRGZ-2SL_47#-VT_110KSI	GeoproHYDRAT™	nGX™2	9 5/8 in	12 1/4 in



Design Features:

- Ultra-high speed reaming system.
- Bladed eccentric nose profile.
- Dual reaming action: nose and stabilized body.
- Advanced **FastDrill™** optimized internal drillable aluminium components and nose.
- **2SL™ Locking** mechanism.
- Axially directed grooved fluid ports for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **nGX™XTREME** anti-jamming bearing assembly
- Entire tool spins.
- Freely rotates by hand.
- Tungsten carbide inserts (TCI) cutting structure.
- Low operating pressure.
- Low activation flow rates.
- Customisable to meet downhole conditions and well objectives.

Dimensional Information

	Oilfield	Metric
Casing/Tubular size (suitability)	in 9 5/8	mm 311.15
Tool diameter (min / max)	in 10 5/8	mm 270.00
Maximum blade OD (nose / stabilised housing)	in 11 1/2 / 11 7/8	mm 292.1 / 301.63
Standard Length / Extended Length	in 36 / 54	cm 91 / 137
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 2	mm 50.8
Radial Ports diameter†	in 1.5	mm 38.1
Total Flow Area (TFA) at Nose (minimum)	in ² 13.74	mm ² 8,867
Number of chambers		3 - Triple chamber
Drill out bit diameter	in 8 1/2	mm 215.9
Tool Weight (typical)	Lbs 319	Kgs 145

TOP Sub

Length (minimum / maximum)	in 18 / 24	cm 45.72 / 60.96
Maximum OD	in 10 5/8	mm 269.88
Minimum ID	in 8.681	mm 220.50
Drift Diameter	in 8.525	mm 216.54

Rupture Disc (Model 206XXX – 12UN C-276)

Rupture Disc (bore)	in 1 1/2	mm 38.1
Rupture Disc (# per tool)	minimum 2	maximum 3
Pressure Rating (from / to)	Psi 1500 / 3000	MPa 10.342 / 20.684

Operational Information

Operating Temperature‡	°C > 450	°F > 752
Operating Pressure (Typically)	Psi/gpm 1	MPa/lps 0.1093
Burst pressure (SF = 1.1)	Psi 16,017	Mpa 110.43
Collapse pressure (SF = 1.125)	Psi 16,260	Mpa 112.10
Axial Yield (SF = 1.6)	Kips 2,027	MT 921.57
Maximum operating WOB	Kips 225	MT 102.06
Absolute maximum WOB	Kips 250	MT 113.40
Minimum activation flow	gpm <35	lps < 2.21
Recommended operating flow rate	gpm > 175	lps > 11.04
Maximum operating flow rate	gpm 1500	lps 94.63
Maximum DLS (operating)	°/100 ft 15°	°/30m 15.24°
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components	

Further / Optional Configurations

Rupture discs	Requirement to be defined by customer for each tool. Can be installed offsite prior to field deployment.
Float / no-return valves	Single or double drillable floats available as an option

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suit customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.

† Standard port size shown. Can be modified to suit customer/well requirements if needed.

‡ Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature.



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0963-1063-NGX-NRGZ 53.5#-SF_140KSI	GeoproHYDRA™	nGX	9 5/8 in	10½ in



NGX™XTREME
ANTI-JAMMING
BEARING

Design Features:

- Ultra-high speed reaming capabilities
- Bladed eccentric nose profile
- Dual reaming action: nose and stabilized body
- Advanced **FasTDrill™** optimized internal drillable aluminium components and nose
- Axially directed port fluid grooves for enhanced bottom hole cleaning and cement deposition
- **NRGZ™** – Energized torsional housing with 97% propulsion efficiency
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 9 5/8	mm 244.475
Tool diameter (min / max)	in 9 7/8	mm 250.83
Maximum blade OD (nose / stabilised housing)	in 10½	mm 266.70
Standard Length	in 37	cm 94
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 2	mm 50.8
Radial Ports diameter†	in 1.75	mm 44.45
Total Flow Area (TFA) at Nose (minimum)	in ² 17.58	mm ² 11,339
Number of chambers		3 - Triple chamber
Drill out/Drift diameter‡	in 8½ [§]	mm 215.9
Operational Information		
Operating Temperature**	°C > 450	°F > 752
Burst Rating (minimum)††	psi 16,970	MPa 117.00
Collapse Rating (minimum)‡‡	psi 13,744	MPa 94.76
Axial Yield (minimum)§§	Kips 2,693	MT 1,222
Maximum operating WOB	Kips 225	MT 102.06
Absolute maximum WOB	Kips 250	MT 113.40
Minimum activation flow	gpm < 35	lps < 2.21
Recommended operating flow rate	gpm > 175	lps > 11.04
Maximum operating flow rate	gpm 1200	lps 76.37
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components	

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements

† Standard port size shown. Can be modified to suit customer/well requirements if needed

‡ Depends on casing weight, special drift, or customer requirements

§ Requires special drift

** Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature

†† Depends on steel grade. Values shown are for 110 KSI steel

‡‡ Depends on steel grade. Values shown are for 110 KSI steel

§§ Depends on steel grade. Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-0963-1063-NGX-NRGZ 53.5#-SF_140KSI	GeoproHYDRA™	nGX	9 5/8 in	10½ in



NGX™XTREME
ANTI-JAMMING
BEARING

Design Features:

- Ultra-high speed reaming capabilities
- Bladed eccentric nose profile
- Dual reaming action: nose and stabilized body
- Advanced **FasTDrill™** optimized internal drillable aluminium components and nose
- Axially directed port fluid grooves for enhanced bottom hole cleaning and cement deposition
- **NRGZ™** – Energized torsional housing with 97% propulsion efficiency
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 9 5/8	mm 244.475
Tool diameter (min / max)	in 9 7/8	mm 250.83
Maximum blade OD (nose / stabilised housing)	in 10 1/2	mm 266.70
Standard Length	in 37	cm 94
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 2	mm 50.8
Radial Ports diameter†	in 1.75	mm 44.45
Total Flow Area (TFA) at Nose (minimum)	in ² 17.58	mm ² 11,339
Number of chambers		3 - Triple chamber
Drill out/Drift diameter‡	in 8 1/2 [§]	mm 215.9
Operational Information		
Operating Temperature**	°C > 450	°F > 752
Burst Rating (minimum)††	psi 16,970	MPa 117.00
Collapse Rating (minimum)‡‡	psi 13,744	MPa 94.76
Axial Yield (minimum)§§	Kips 2,693	MT 1,222
Maximum operating WOB	Kips 225	MT 102.06
Absolute maximum WOB	Kips 250	MT 113.40
Minimum activation flow	gpm < 35	lps < 2.21
Recommended operating flow rate	gpm > 175	lps > 11.04
Maximum operating flow rate	gpm 1200	lps 76.37
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components	

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements

† Standard port size shown. Can be modified to suit customer/well requirements if needed

‡ Depends on casing weight, special drift, or customer requirements

§ Requires special drift

** Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature

†† Depends on steel grade. Values shown are for 110 KSI steel

‡‡ Depends on steel grade. Values shown are for 110 KSI steel

§§ Depends on steel grade. Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-1075-1225 nGX_RAPID-3-18-15*	GeoproHYDRA™	nGX	10 ¾ in	12 ¼ in



Design Features:

- Ultra-high speed reaming capabilities
- Eccentric nose profile
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- RAPID Quick Drill composite internals and nose
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 10.75	mm 273.05
Tool body diameter (min / max)†	in 11.565 / 11.75	mm 293.75 / 298.45
Maximum blade OD (nose / stabilised housing)	in 12.00 / 12.00	mm 304.80
Standard Length / Extended Length‡	in 36 / 55	cm 91.44 / 139.7
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)§	in 2.5	# 63.50
Radial Ports diameter**	in 1.5	mm 38.1
Total Flow Area (TFA) at Nose (minimum)	in ² 15.51	mm ² 10,007
Number of chambers		3- Triple Chamber
Drill out/Drift diameter††	in ± 9.00	mm 228.6

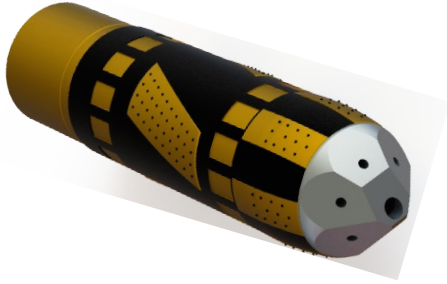
Operational Information				
Operating Temperature‡‡	°C	> 220	°F	> 428
Burst Rating (minimum)§§	psi	14,981	MPa	103.29
Collapse Rating (minimum)***	psi	15,367	MPa	105.95
Axial Yield (minimum)†††	Kips	3,317	MT	1,504.56
Maximum operating WOB	Kips	150	MT	68.04
Absolute maximum WOB	Kips	175	MT	79.38
Minimum activation flow	gpm	< 100	lps	< 6.31
Recommended operating flow rate	gpm	> 250	lps	> 15.77
Maximum operating flow rate	gpm	1,200	lps	75.71
Material Composition		<ul style="list-style-type: none"> ▪ AISI 4140 /4145 steel (standard) / As per customer requirement ▪ Aluminium 6061-T6 Drillable components ▪ RAPID Quick Drill composite internals and nose ▪ Tungsten Carbide Inserts (TCI) cutting structure 		

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard minimum restriction inside the tool for this configuration is 15 mm. Tool is customizable to meet customer objectives
 † Dependent on connection type, drift requirements and casing weight
 ‡ Extended lengths are for additional specifications such as floats valves or screens to be included in the tool or as a additional length for rig floor handling.
 § Standard port size shown. Can be modified to suit customer/well requirements
 ** Standard port size shown. Can be modified to suit customer/well requirements if needed
 †† Depends on casing weight and/or special drift requirements
 ‡‡ Limited by the melting point of Composite Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature
 §§ Depends on steel grade. Values shown are for 110 KSI steel
 *** Depends on steel grade. Values shown are for 110 KSI steel
 ††† Depends on steel grade. Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-1075-1225 nGX-3-18-12*	GeoproHYDRA™	nGX	10 ¾ in	12 ¼ in



Design Features:

- Ultra-high speed reaming capabilities
- Eccentric nose profile
- Dual reaming action: nose and stabilized body
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 10.75	mm 273.05
Tool body diameter (min / max) [†]	in 11.565 / 11.75	mm 293.75 / 298.45
Maximum blade OD (nose / stabilised housing)	in 12.00 / 12.00	mm 304.80
Standard Length / Extended Length	in 36 / 55	cm 91.44 / 139.7
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum) [‡]	in 2.5	# 63.50
Radial Ports diameter [§]	in 1.5	mm 38.1
Total Flow Area (TFA) at Nose (minimum)	in ² 15.51	mm ² 10,007
Number of chambers		3- Triple Chamber
Drill out/Drift diameter**	in ± 9.625	mm 244.48

Operational Information				
Operating Temperature ^{††}	°C	> 450	°F	> 752
Burst Rating (minimum) ^{‡‡}	psi	14,981	MPa	103.29
Collapse Rating (minimum) ^{§§}	psi	15,367	MPa	105.95
Axial Yield (minimum) ^{***}	Kips	3,317	MT	1,504.56
Maximum operating WOB	Kips	200	MT	90.72
Absolute maximum WOB	Kips	250	MT	113.40
Minimum activation flow	gpm	< 60	lps	< 3.78
Recommended operating flow rate	gpm	> 250	lps	> 15.77
Maximum operating flow rate	gpm	1,200	lps	75.71
Material		AISI 4140 /4145 steel (standard) / As per customer requirement Aluminium 6061-T6 and Aluminium 7175 drillable components		

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard minimum restriction inside the tool for this configuration is 12 mm. Tool is customizable to meet customer objectives

† Dependent on connection type, drift requirements and casing weight

‡ Standard port size shown. Can be modified to suit customer/well requirements

§ Standard port size shown. Can be modified to suit customer/well requirements if needed

** Depends on casing weight and/or special drift requirements

†† Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature

‡‡ Depends on steel grade. Values shown are for 110 KSI steel

§§ Depends on steel grade. Values shown are for 110 KSI steel

*** Depends on steel grade. Values shown are for 110 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
HYD-1338-XXXX-NGX-NRGZ XXX#-XX_110KSI	GeoproHYDRA™	nGX™2	13¾ in	16 - 17½ in



Design Features:

- Ultra-high speed reaming system.
- Bladed eccentric nose profile.
- Dual reaming action: nose and stabilized body.
- Advanced **FasDrill™** optimized internal drillable aluminium components and nose.
- Axially directed port fluid grooves for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **NGX™XTREME anti-jamming bearing assembly.**
- Entire tool spins.
- Freely rotates by hand.
- Drillable design.
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure.
- No sudden or stall pressure(s).
- Low activation flow rates
- Customisable to balance expected downhole conditions with surface parameters

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 13¾	mm 340
Tool diameter (min / max)	in 14¾	mm 375
Maximum blade OD (16" / 17½" hole)	in 15¾ / 16¾	mm 400 / 429
Standard Length	in 42	cm 107
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 3	mm 76.2
Radial Ports diameter†	in 2	mm 50.8
Total Flow Area (TFA) at Nose (minimum)	in² 25.92	mm² 16,721
Number of chambers (minimum)		3 - Triple chamber
Drill out bit diameter‡	in 12¼§	mm 311.15
Tool Weight (typical)	Lbs 812	Kgs 369

Operating Information	Oilfield	Metric
Operating Temperature**	°C > 450	°F > 752
Operating Pressure (Typically)††	Psi/gpm 1	MPa/lps 0.1093
Burst pressure (SF = 1.1)	Psi 14,009	Mpa 96.58
Collapse pressure (SF = 1.125)	Psi 14,353	Mpa 98.96
Axial Yield (SF = 1.6)††	Kips 3,456	MT 1,571
Maximum operating WOB	Kips 275	MT 125
Absolute maximum WOB	Kips 325	MT 148
Minimum activation flow	gpm <125	lps < 7.89
Recommended operating flow rate	gpm > 350	lps > 22.08
Maximum operating flow rate	gpm 1500	lps 94.63
Maximum DLS (operating)	°/100 ft 10°	°/30m 9.84°
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components	

Optional Configurations	
Rupture discs§§	Dependent on customer requirement

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.
 † Standard port size shown. Can be modified to suit customer/well requirements if needed.
 ‡ Depends on casing weight, special drift, or customer requirements.
 § May requires special drift.
 ** Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature.
 †† Pressure drop across the tool when tool activates.
 †† Depends on steel grade. Values shown are for 110 KSI steel.
 §§ Rupture discs are available and can be added just below the threaded connection should it be required. This will be according to customer specification.



Product Number	Brand	Model	Casing Size	Hole Size
HYD-1338-1600-NGX-NRGZ XXX#-XX_110KSI	GeoproHYDRAT™	nGX™2	13¾ in	16 in



Design Features:

- Ultra-high speed reaming system
- Bladed eccentric nose profile
- Dual reaming action: nose and stabilized body
- Advanced **FastDrill™** optimized internal drillable aluminium components and nose
- Axially directed port fluid grooves for enhanced bottom hole cleaning and cement deposition
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency
- **nGX™XTREME anti-jamming bearing assembly**
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Customisable to meet downhole conditions and well objectives

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 13¾	mm 340
Tool diameter (min / max)	in 14¾	mm 375
Maximum blade OD (nose / stabilised housing)	in 15½	mm 394
Standard Length / Extended Length	in 42 / 65	cm 107 / 165
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 3	mm 76.2
Radial Ports diameter†	in 2	mm 50.8
Total Flow Area (TFA) at Nose (minimum)	in ² 26	mm ² 16,721
Number of chambers (minimum)		3 - Triple chamber
Drill out bit diameter‡	in 12¼§	mm 311.15
Tool Weight (typical)	Lbs 812	Kgs 369

Operational Information	Oilfield	Metric
Operating Temperature**	°C > 450	°F > 752
Operating Pressure (Typically)††	Psi/gpm 1	MPa/lps 0.1093
Burst pressure (SF = 1.1)	Psi 14,009	Mpa 96.58
Collapse pressure (SF = 1.125)	Psi 14,353	Mpa 98.96
Axial Yield (SF = 1.6)‡‡	Kips 3,456	MT 1,571
Maximum operating WOB	Kips 275	MT 125
Absolute maximum WOB	Kips 325	MT 148
Minimum activation flow	gpm <125	lps < 7.89
Recommended operating flow rate (minimum)	gpm > 350	lps > 22.08
Maximum operating flow rate	gpm 1500	lps 94.63
Maximum DLS (operating)	5°/100 ft °	5.08°/30m °
Rotational speed at 250 gpm		>170 RPM
Rotational speed at 500 gpm		>420 RPM
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components	

Optional Configurations	Oilfield	Metric
Rupture discs§§	Dependent on customer requirement	
Float / no-return valves	Single or double drillable floats available as an option	
Optional 2SL™ Locking mechanism	Configurable to blanking dimensions of customer casing connections	

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements

† Standard port size shown. Can be modified to suit customer/well requirements if needed

‡ Depends on casing weight, special drift, or customer requirements

§ Requires special drift

** Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature

†† Pressure drop across the tool when tool activates

‡‡ Depends on steel grade. Values shown are for 110 KSI steel

§§ Rupture discs are available and can be added just below the threaded connection should it be required. This will be according to customer specification



Product Number	Brand	Model	Casing Size	Hole Size
HYD-1338-1600-NGX2-NRGZ-68#-XX_110KSI	GeoproHYDRA™	nGX™2	13¾ in	16 in



NGX™ BLADED ECCENTRIC NOSE PROFILE WITH AXIALLY DIRECTED GROOVED PORTS



NGX™XTREME ANTI-JAMMING BEARING

Design Features:

- Ultra-high speed reaming system.
- Bladed eccentric nose profile.
- Dual reaming action: nose and stabilized body.
- Advanced **FasTDrill™** optimized internal drillable aluminium components and nose.
- Axially directed grooved fluid ports for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **nGX™XTREME** anti-jamming bearing assembly
- Entire tool spins.
- Freely rotates by hand.
- Tungsten carbide inserts (TCI) cutting structure.
- Low operating pressure.
- Low activation flow rates.
- Customisable to meet downhole conditions and well objectives.

Dimensional Information

	Oilfield		Metric	
Casing/Tubular size (suitability)	in	13¾	mm	340
Tool diameter (min / max)	in	14¾	mm	375
Maximum blade OD (nose / stabilised housing)	in	15½	mm	394
Standard Length / Extended Length (top sub)	in	42 / 65	cm	107 / 165
Total Number of Ports/Nozzles			7	
Centre Port diameter (minimum)*	in	3	mm	76.2
Radial Ports diameter†	in	2	mm	50.8
Total Flow Area (TFA) at Nose (minimum)	in ²	26	mm ²	16,721
Number of chambers (minimum)			3 - Triple chamber	
Drill out bit diameter (standard API drift)	in	12¼	mm	311.15
Tool Weight (typical)	Lbs	812	Kgs	369

TOP Sub

Length (minimum / maximum)	in	18 / 24	cm	45.72 / 60.96
Maximum OD	in	14¾	mm	374.65
Minimum ID	in	12.415	mm	315.34
Drift Diameter	in	12.259	mm	311.38

Rupture Disc 206XXX – 12UN C-276

Rupture Disc (bore)	in	1½	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	4
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Operational Information

Operating Temperature‡	°C	> 450	°F	> 752
Operating Pressure (Typically)§	Psi/gpm	1	MPa/lps	0.1093
Burst pressure (SF = 1.1)	Psi	14,009	Mpa	96.58
Collapse pressure (SF = 1.125)	Psi	14,353	Mpa	98.96
Axial Yield (SF = 1.6)**	Kips	3,456	MT	1,571
Maximum operating WOB	Kips	275	MT	125
Absolute maximum WOB	Kips	325	MT	148
Minimum activation flow	gpm	<125	lps	< 7.89
Recommended operating flow rate	gpm	> 350	lps	> 22.08
Maximum operating flow rate	gpm	1500	lps	94.63
Maximum DLS (operating)	5°/100 ft	°	5.08°/30m	°
Material	AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components			

Further / Optional Configurations

Rupture discs	Requirement to be defined by customer for each tool. Can be installed offsite prior to field deployment.
Float / no-return valves	Single or double drillable floats available as an option

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suit customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.

† Standard port size shown. Can be modified to suit customer/well requirements if needed.

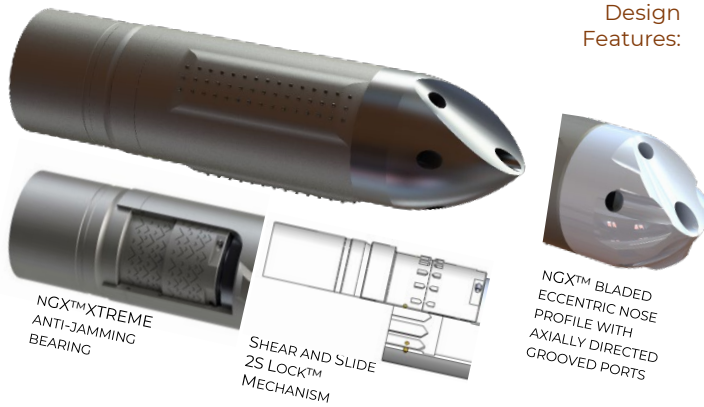
‡ Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature

§ Pressure drop across the tool when circulating/operating.

** Depends on steel grade. Values shown are for 110 KSI steel.



Product Number	Brand	Model	Casing Size	Hole Size
HYD-1338-1600-NGX2-NRGZ-2SL-XXX#-XX_110KSI	GeoproHYDRA™	nGX™2	13¾ in	16 in



- Ultra-high speed reaming system.
- Bladed eccentric nose profile.
- Dual reaming action: nose and stabilized body.
- Advanced **FasDrill™** optimized internal drillable aluminium components and nose.
- **2SL™ Locking** mechanism.
- Axially directed grooved fluid ports for enhanced bottom hole cleaning and cement deposition.
- **NRGZ™** – Energized torsional housing with 97% hydraulic efficiency.
- **nGX™ XTREME anti-jamming bearing assembly**
- Entire tool spins.
- Freely rotates by hand.
- Tungsten carbide inserts (TCI) cutting structure.
- Low operating pressure.
- Low activation flow rates.
- Customisable to meet downhole conditions and well objectives.

Dimensional Information

	Oilfield		Metric	
Casing/Tubular size (suitability)	in	13¾	mm	340
Tool diameter (min / max)	in	14¾	mm	375
Maximum blade OD (nose / stabilised housing)	in	15½	mm	394
Standard Length / Extended Length (top sub)	in	42 / 65	cm	107 / 165
Total Number of Ports/Nozzles			7	
Centre Port diameter (minimum)*	in	3	mm	76.2
Radial Ports diameter†	in	2	mm	50.8
Total Flow Area (TFA) at Nose (minimum)	in ²	26	mm ²	16,721
Number of chambers (minimum)			3 - Triple chamber	
Drill out bit diameter (standard API drift)	in	12¾	mm	311.15
Tool Weight (typical)	Lbs	812	Kgs	369

TOP Sub

Length (minimum / maximum)	in	18 / 24	cm	45.72 / 60.96
Maximum OD	in	14¾	mm	374.65
Minimum ID	in	12.415	mm	315.34
Drift Diameter	in	12.259	mm	311.38

Rupture Disc 206XXX – 12UN C-276

Rupture Disc (bore)	in	1½	mm	38.1
Rupture Disc (# per tool)	minimum	2	maximum	4
Pressure Rating (from – to)	Psi	1500 - 3000	MPa	10.342 – 20.684

Operational Information

Operating Temperature‡	°C	> 450	°F	> 752
Operating Pressure (Typically)§	Psi/gpm	1	MPa/lps	0.1093
Burst pressure (SF = 1.1)	Psi	14,009	Mpa	96.58
Collapse pressure (SF = 1.125)	Psi	14,353	Mpa	98.96
Axial Yield (SF = 1.6)**	Kips	3,456	MT	1,571
Maximum operating WOB	Kips	275	MT	125
Absolute maximum WOB	Kips	325	MT	148
Minimum activation flow	gpm	<125	lps	< 7.89
Recommended operating flow rate	gpm	> 350	lps	> 22.08
Maximum operating flow rate	gpm	1500	lps	94.63
Maximum DLS (operating)	5°/100 ft	0	5.08°/30m	0
Material		AISI 4140 /4145 steel 110KSI / As per customer requirement Aluminium 6061-T6 drillable components		

Further / Optional Configurations

Rupture discs	Requirement to be defined by customer for each tool. Can be installed offsite prior to field deployment.
Float / no-return valves	Single or double drillable floats available as an option

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suit customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements.

† Standard port size shown. Can be modified to suit customer/well requirements if needed.

‡ Limited by the melting point of Aluminium 6160-T6 (650 °C / 1202 °F) to 70% (455 °C / 851 °F) of the melting point temperature

§ Pressure drop across the tool when circulating/operating.

** Depends on steel grade. Values shown are for 110 KSI steel.



Product Number	Brand	Model	Casing Size	Hole Size
GHD-1400-1475_1600-NGX2-BC-TSH623_113#_125KSI	GeoproHYDRA™	nGX2	14 in	14¾ - 16 in



Design Features:

- High speed reaming capabilities
- Eccentric nose profile
- Dual Bicentric reaming cutters
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives
- FastDrill optimised Aluminium internal components and nose

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 14.00	mm 355.60
Tool diameter	in 14.00	mm 355.60
Primary blade OD	14¾	mm 365.13
Bicentric blade OD (stabilised housing)	in 15¾	mm 400.05
Maximum Hole Diameter Accessed	in 16	mm 406.4
Standard Length / Extended Length	in 33 / 56	cm 83.62 / 142.24
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 3	mm 76.2
Radial Ports diameter†	in 1¾	mm 44.45
Total Flow Area (TFA) at Nose (minimum)	in ² 21½	mm ² 13,871
Number of chambers		3 - Triple chamber
Drift diameter‡	in 12¾	mm 311.15

Operational Information	Oilfield	Metric
Operating Temperature§	°C > 450	°F > 752
Burst Rating (minimum)**	psi 12,857	MPa 88.64
Collapse Rating (minimum)††	psi 8,647	MPa 59.62
Axial Yield (minimum)‡‡	Kips 4147	MT 1,881
Maximum operating WOB	Kips 250	MT 113.40
Absolute maximum WOB	Kips 300	MT 136.08
Minimum activation flow	gpm < 150	lps < 9.464
Recommended operating flow rate	gpm > 275	lps > 17.350
Maximum operating flow rate	gpm 1500	lps 94.64
Material		125 KSI steel Aluminium 6061-T6

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements
 † Standard port size shown. Can be modified to suit customer/well requirements if needed
 ‡ Depends on casing weight, special drift, or customer requirements
 § Limited by the melting point of Aluminium 6160-T6
 ** Depends on steel grade. Values shown are for 125 KSI steel
 †† Depends on steel grade. Values shown are for 125 KSI steel
 ‡‡ Depends on steel grade. Values shown are for 125 KSI steel



Product Number	Brand	Model	Casing Size	Hole Size
GHD-1600-1725_1850-NGX2-BC-SLIJ II_97#-125KSI	GeoproHYDRA™	nGX	16 in	17½ - 18½ in

Design Features:



- High speed reaming capabilities
- Eccentric nose profile
- Dual Bicentric reaming cutters
- Entire tool spins
- Freely rotates by hand
- Drillable design
- Tungsten carbide inserts (TCI) cutting structure
- Low operating pressure
- Low activation flow rates
- Infinitely customisable to meet downhole conditions and well objectives
- FastDrill™ optimised Aluminium internal components and nose

Dimensional Information	Oilfield	Metric
Casing/Tubular size (suitability)	in 16.00	mm 406.40
Tool diameter (min / max)	in 16¼	mm 412.75
Primary blade OD	16⅞	mm 428.63
Bicentric blade OD (stabilised housing)	in 17½	mm 444.50
Maximum Hole Diameter Accessed	in 18½	mm 469.90
Standard Length / Extended Length	in 38 / 62	cm 96.52 / 157.48
Total Number of Ports/Nozzles		7
Centre Port diameter (minimum)*	in 3	mm 76.2
Radial Ports diameter†	in 2	mm 50.8
Total Flow Area (TFA) at Nose (minimum)	in ² 25.9	mm ² 16,721
Number of chambers (minimum)		3- Triple chamber
Drift diameter‡ (API regular)	in ± 14.663	mm 372.44

Operational Information				
Operating Temperature [§]	°C	> 450	°F	> 752
Burst Rating (minimum)**	psi	8,086	MPa	55.75
Collapse Rating (minimum)††	psi	2,345	MPa	16.17
Axial Yield (minimum)‡‡	Kips	3,483	MT	1,580
Maximum operating WOB	Kips	250	MT	113.40
Absolute maximum WOB	Kips	300	MT	136.08
Minimum activation flow	gpm	< 160	lps	< 10.09
Recommended operating flow rate	gpm	> 370	lps	> 23.34
Maximum operating flow rate	gpm	2000	lps	126
Material		125 KSI steel (standard) / As per customer requirement Aluminium 6061-T6		

Design dimensions are for presentation purposes only. Final dimensions of the end-product may vary slightly to suite customer objectives.

* Standard port size shown. Can be modified to suit customer/well requirements
 † Standard port size shown. Can be modified to suit customer/well requirements if needed
 ‡ Depends on casing weight, special drift, or customer requirements
 § Limited by the melting point of Aluminium 6160-T6
 ** Depends on steel grade. Values shown are for 125 KSI steel
 †† Depends on steel grade. Values shown are for 125 KSI steel
 ‡‡ Depends on steel grade. Values shown are for 125 KSI steel



Summary

The GeoproHYDRA™ NGX is a versatile and robust technology and currently it is arguably the best-in-class amongst all hydraulically activated reamer shoe systems and has now become the new benchmark. Why? You may ask. We are constantly evaluating performance of each run and using run data to fine tune both the internal and external aspects of the technology. With over 300 runs thus far and industry leading performance across all tubular sizes, the GeoproHYDRA™ is still helping drilling crews reduce risk associated with tubular deployment and improving well engineering performance across the globe, from offshore Indonesia, to mainland Asia, across the Arabian Gulf, West African coast and Latin America. The list continues to grow as more customers adopt this innovative technology in their operations.



CONTACT INFORMATION

Find below regional contact information to discuss your requirements or you can send an email to hydra@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
www.geoprotech.com

