MAGNUM DRILLING
SOLUTIONS

Motor Book

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KEEP IT IN THE HOLE!

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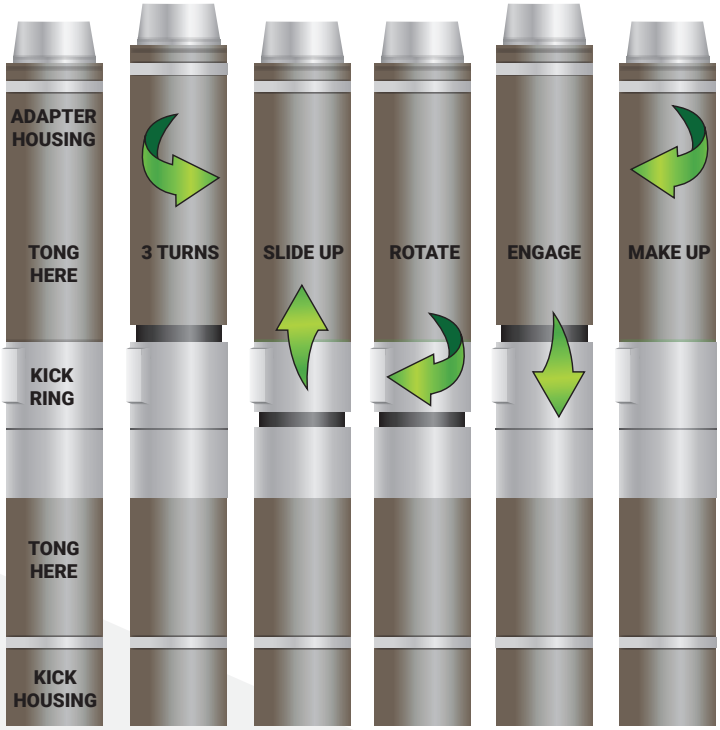
INTRODUCING THE MDS PERFORMANCE MUD MOTORS

The MDS Performance Mud Motors are technological spearheads for the drilling motor industry. The bearing assemblies are either coupled with a proprietary vibration-free transmission or our High Torque, Hot Hole transmission to assure performance, reliability, efficiency and long lifespan of our tools.

Our product lines include our mud lubricated, oil lubricated and sealed, dedicated curve and lateral short bit to bend, RSS and hot hole models with superior torque and bearing load carrying capacity. All motors are bored for float and equipped with rotor catch assemblies. Near bit stabilizers and offset kick pads are available upon request as well as fixed and adjustable bent housings.

ADJUSTABLE HOUSING SETTING PROCEDURE



1. Break connection with tongs as shown.
2. Back off Adapter Housing 3 turns.
3. Slide Kick Ring up.
4. Rotate Kick Ring until desired angle setting matches with Kick Housing.
5. Slide Kick Ring back to engage with Kick Housing.
6. Make up Adapter Housing to recommended torque value.

MAKE-UP TORQUE

5.00” – 16,000 LBFT (21,700 Nm)

6.50” – 28,000 LBFT (38,000 Nm)

8.00” – 40,000 LBFT (54,200 Nm)

MOTOR OPERATIONS

RUNNING IN HOLE

The drill string with a straight motor installed can be run into the hole normally. When using a bent sub, or a non-zero angle in the adjustable housing, be careful passing the motor through the blowout preventers, casing shoes, liner hangers, ledges, or key seats to ensure that the motor or drill bit does not hang up. Do not run into bottom, or “bottom fill”, as it could plug the bit or damage the motor. Note: Running into bottom can damage thrust bearings, and excessive over-pull on a stuck bit can damage off bottom bearings in the sealed bearing assembly.

WARMING A MOTOR FOR HIGH BHT

When running into a hot hole, it is important to gradually warm the motor during its descent.

1. Run in hole and stop at the depth where the expected down-hole temperatures are in the range of 240°F to 260°F.
2. Stop and pump drilling fluid to cool the motor.
3. Pump for about three minutes every 400-500’ until you reach bottom.
4. At bottom start at around half the de-rated pressure and work up to the max de-rated pressure over thirty minutes. Please contact coordinator for max derated parameters.

Avoid long periods without circulation if possible.

WARMING A MOTOR IN COLD CLIMATES

Warming up a motor in colder climates may be completed to aid in the makeup of connections to the drill string and bit and is recommended for increasing reliability of the motor. When performing this process using steam, the motor should be evenly heated to the point it is warm to touch. One option is to run the motor down into the BOP and put the steam hose down in the BOP next to it and leave it for 10-15 minutes to warm up. Spot heating or heating the motor until it is too hot to touch can cause damage to seals, the stator elastomer, or other components. Circulation should be started slowly and increased gradually to avoid damaging the cold elastomeric liner.

STARTING THE MOTOR

Begin circulating off bottom with the bit turning freely. Perform circulation and pressure tests at the same circulation rates as the surface test and note the readings. The pressure will be higher due to the restrictions of the drill-string components added. The off bottom pressures noted may be higher than calculated. This is caused by drag on the side of the hole due to the bent sub, adjustable housing angle, and stabilization.

MOTOR OPERATIONS

DRILLING

After a short hole cleaning circulation period, slowly lower the bit to bottom. When bottom is tagged, the standpipe pressure gauge will show an immediate increase. Increase the bit weight slowly to achieve the desired build up rate and/or rate of penetration. Do not exceed the recommended maximum differential pressure across the motor. The off bottom pressure is the total system pressure (read on the stand pipe gauge), from the standpipe, through the drill-string, the annulus, and back to the drilling nipple, while circulating with the bit off bottom (i.e. zero weight on bit). Periodically recheck the off bottom pressure. The standpipe pressure will slowly increase after hole cleaning due to the hydraulic energy required to lift the cuttings. The torque applied to the bit while on bottom is directly proportional to the difference between the on bottom and off bottom pressures (i.e. there are no friction losses through the rotating drill-string). An increase in the weight on bit produces an increase in torque. As the bit drills off, the weight on bit decreases and correspondingly the pressure and torque decrease. The standpipe pressure gauge can therefore be used as a torque indicator. When the drilling conditions permit, the rotary can be engaged.

It is policy is to run motors at no greater than 80% of the theoretical specified differential pressure to ensure optimal performance. Damages incurred due to a motor being ran at greater than 80% will be client's responsibility.

REAMING AND BACK REAMING BEST PRACTICE

Back reaming is a high-risk operation. It can lead to a stuck BHA, a packed off hole, and formation damage and hole collapse.

Back reaming causes several unique stresses on the motor as well as increased shock and vibration. This leads to backoff, premature bearing failure, and housing failure.

It is important to note that back reaming will tend to treat the symptom of a problem (i.e. like hole cleaning or well bore stability) as opposed to the problem itself.

If a situation arises where back reaming is deemed unavoidable the following suggestions could help extend the life of the components prior to failure or twist off:

- Consider only reaming down as opposed to back reaming. Vibration is generally worse when back reaming because the bottom of the BHA is no longer supported. Also, the tension on the motor reduces the shoulder compression on the connections making them susceptible to backoff.
- The maximum string rotation should not exceed RPM limits for bend settings outlined in table found on pages 10–13 or 40 RPM, whichever number is higher.
- Reduce flow if the operation and hole will allow. Reaming frequently induces sloughing and high flow can turn a slough into a pack off very quickly.

REAMING AND BACK REAMING BEST PRACTICE

- Differential pressure and torques should be closely monitored as an indicator as to how the motor is handling the reaming operation, and as to whether the hole conditions are improving or worsening.
- Block speed should be kept to a reasonable rate as excessive speed can amplify damage to the hole and BHA components.
- Consider alternative methods of hole conditioning.

MDS does not recommend back reaming because it can cause significant damage to motor components and could lead to connection backoffs downhole. Damages incurred due to back reaming will be client's responsibility.

MAXIMUM RECOMMENDED RPM FOR CURVED HOLE

Motor Size	Hole Size	Bend Angle				
		0.00	0.39	0.78	1.15	1.50
3.75	4.75	80	60	40	40	40
3.75	5 1/2	80	80	50	50	40
3.75	5 7/8	80	80	50	50	40
4.75	6	80	80	50	50	40
4.75	6 1/8	80	80	50	50	40
4.75	6 1/4	80	80	50	50	40
4.75	6 1/2	80	80	50	50	40
4.75	6 3/4	80	80	50	50	40
5.00	6	80	80	50	50	40
5.00	6 1/8	80	80	50	50	40
5.00	6 1/4	80	80	50	50	40
5.00	6 1/2	80	80	50	50	40
5.00	6 3/4	80	80	50	50	40
6.25	7 7/8	80	80	50	50	40
6.25	8 1/2	80	80	50	50	40
6.25	8 3/4	80	80	50	50	40
6.50	7 7/8	80	80	50	40	40
6.50	8 1/2	80	80	50	50	40
6.50	8 3/4	80	80	50	50	40
6.75	8 1/2	80	80	50	50	40
6.75	8 3/4	80	80	50	50	40
6.75	9 7/8	80	80	60	50	40
7.75	9 7/8	80	60	50	50	40
7.75	10 5/8	80	80	50	50	40
7.75	12 1/4	80	80	80	60	60
9.625	12 1/4	80	80	60	50	40
9.625	14 3/4	80	80	60	50	40
9.625	17 1/2	80	80	60	50	40
		14° / 100’				

Bend Angle							
1.83	2.00	2.12	2.25	2.38	2.60	2.77	3.00
30	30	20	20				
40	40	30	30	20			
40	40	30	20	20			
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40	40	20	20				
40	40	40	40	20			
40	40	40	40	20			
10° / 100’		7.5 ° / 100’					

MAXIMUM RECOMMENDED RPM FOR STRAIGHT HOLE

Motor Size	Hole Size	Bend Angle					
		0.00	0.39	0.78	1.15	1.50	1.75
3.75	4.75	100	80	80	70	60	50
3.75	5 1/2	100	100	100	80	60	50
3.75	5 7/8	100	100	100	80	60	50
4.75	6	100	100	100	80	60	50
4.75	6 1/8	100	100	100	80	60	50
4.75	6 1/4	100	100	100	80	60	50
4.75	6 1/2	100	100	100	80	60	50
4.75	6 3/4	100	100	100	80	60	50
5.00	6	100	100	100	80	60	50
5.00	6 1/8	100	100	100	80	60	50
5.00	6 1/4	100	100	100	80	60	50
5.00	6 1/2	100	100	100	80	60	50
5.00	6 3/4	100	100	100	80	60	50
6.25	7 7/8	100	100	100	70	50	40
6.25	8 1/2	100	100	100	80	80	70
6.25	8 3/4	100	100	100	80	80	70
6.50	7 7/8	100	100	100	60	40	30
6.50	8 1/2	100	100	100	80	80	70
6.50	8 3/4	100	100	100	80	80	70
6.75	8 1/2	100	100	100	80	80	70
6.75	8 3/4	100	100	100	80	80	70
6.75	9 7/8	100	100	100	80	80	70
7.75	9 7/8	100	80	80	70	60	50
7.75	10 5/8	100	100	100	80	80	70
7.75	12 1/4	100	100	100	80	80	70
9.625	12 1/4	100	80	80	70	60	60
9.625	14 3/4	100	100	100	80	80	70
9.625	17 1/2	100	100	100	80	80	70

Bend Angle							
1.83	2.00	2.12	2.25	2.38	2.60	2.77	3.00
40	40	20	20				
50	50	40	40	20			
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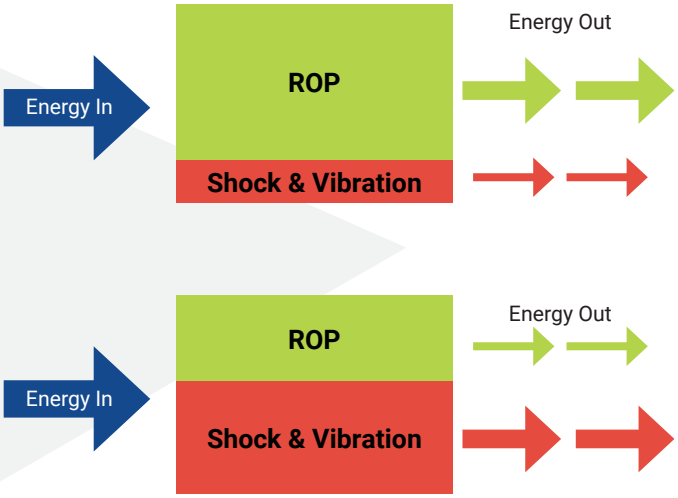
60	60	60	60	60			
60	60	60	60	60			

VIBRATION OVERVIEW

Although BHA, MWD, and motor component fatigue can occur over an extended period, optimization analysis has confirmed that many motor fractures and MWD failures/ damages occur as the result of vibration induced fatigue over a single run or single event. As such, it is important to mitigate vibration to avoid related downhole equipment failures and unscheduled downtime or costly fishing trips.

Shock and vibration take energy away from the drilling process:

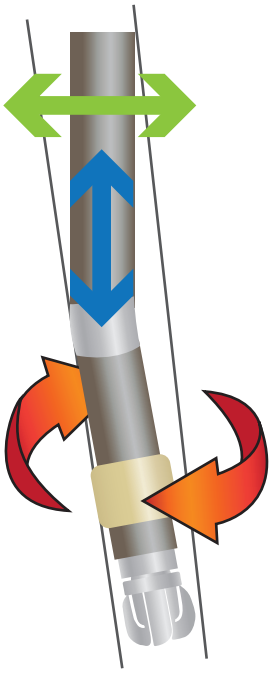


MODES OF VIBRATION

There are 3 modes of vibration that can occur when drilling:

- Lateral Vibration (Bit / BHA Whirl)
- Axial Vibration (Bit Bounce)
- Torsional Vibration (Stick Slip)

In excessive quantity, these vibrations can considerably reduce drilling performance and in extreme cases, can cause significant damage to the bit, motor, MWD, and other downhole components. There is a complex combination of factors that can influence down hole vibration.



LATERAL VIBRATION (BIT / BHA WHIRL)

Lateral vibration is caused by the high bending stresses in the BHA and drill string resulting in the assembly impacting on the borehole wall. Lateral vibration can be extremely damaging to all drill string components and result in energy being removed from the system that would otherwise be used to drill ahead. High lateral vibration will result in a reduction in penetration rate and premature bit, motor, and MWD damages/failures.

CAUSES

- Excessive RPM
- Low WOB with high RPM
- Lack of BHA stabilization
- Incorrect parameter selection
- Harmonic resonance of drill string
- High tortuosity of the wellbore
- Reaming/back reaming

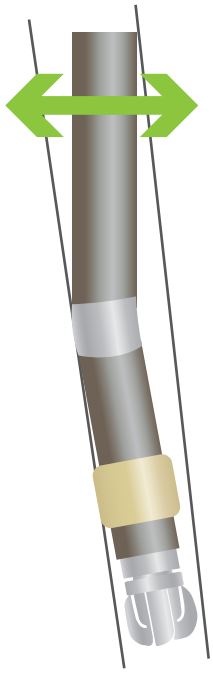
SYMPTOMS

- Real-time and stored lateral vibration data from MWD tool
- Poor penetration rates than expected for formation
- Rotary torque fluctuations

LATERAL VIBRATION (BIT / BHA WHIRL)

SOLUTIONS

- Pick up off bottom and hold string stationary to release all torque. Go back on bottom with reduced RPM and increase WOB. Monitor with MWD tool.
- Improve the lubrication qualities of the drilling fluid.
- Use stabilization or roller reamers to improve borehole quality.
- Improve the tortuosity of the borehole by minimizing the motor bend setting and DLS.



AXIAL VIBRATION (BIT BOUNCE)

Axial vibration is caused by a cyclical loading and unloading of the bit and the BHA in the axial direction. It is also often referred to as 'bit bounce'; however, be very clear that it rarely results in the bit leaving the bottom of the hole. It normally results in a rapid cyclical movement of the neutral point in the BHA that causes the WOB to rapidly increase and decrease. Extreme torsional vibration can also contribute to axial vibration resulting in the cyclical shortening and lengthening of the drill string.

CAUSES

- Hard formations with high compressive strengths (Hard sandstone, hard limestone, quartzite etc.)
- Excessive WOB with high RPM
- Axial harmonic resonance of drill string

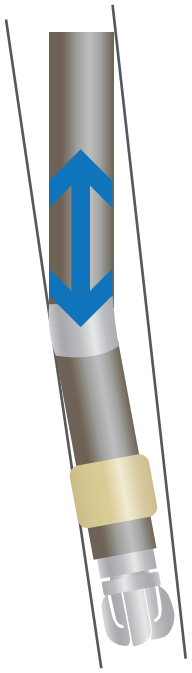
SYMPTOMS

- Real-time and stored axial vibration data from MWD tool
- Poor penetration rates than expected for formation
- Large WOB fluctuations (shaking hoisting equipment)

AXIAL VIBRATION (BIT BOUNCE)

SOLUTIONS

- Pick up off bottom and hold string stationary to release all torque. Go back on bottom with increase RPM and decrease WOB. Monitor with MWD tool.
- Back off on GPM if an agitator is in the string.
- Discuss agitator placement (30-40% of Lateral Length is recommended).



TORSIONAL VIBRATION (STICK SLIP)

Torsional vibration is the cyclical rotational acceleration and deceleration of the bit, BHA, or drill string. If the torsional vibration is severe, stick slip can occur. Stick slip is the momentary stop in rotation of the bit or BHA that can cause the drill string to instantly torque up then release, accelerating the BHA to dangerously high speeds (often 2-3 times rotary speed, but can go as high as 15 times). This is also known as micro-stalling. Heat checking on the bit is usually an indication that stick slip has occurred. Torsional vibration and stick slip may occur downhole even when a constant RPM is input at the surface.

CAUSES

- High WOB with low RPM
- Incorrect bit selection - overly aggressive PDC bit
- Improper BHA stabilization - undersize stabilizers
- Insufficient stiffness in DP and BHA
- Lack of lubrication in drilling mud
- Tortuous hole geometries, high dogleg angles
- Abrasive stringers, formations with high friction coefficients

SYMPTOMS

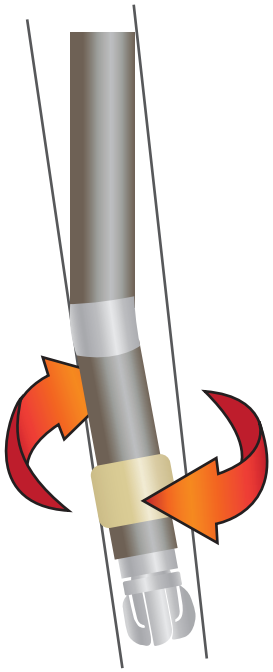
- Real-time and stored vibration data from MWD tool
- Large and erratic RPM and torque fluctuations, especially noticeable on a top drive

TORSIONAL VIBRATION (STICK SLIP)

- Whirling sound from top drive
- Poor hole cleaning; under-gauge or washed out hole

SOLUTIONS

- Pick up off bottom and hold string stationary to release all torque. Go back on bottom with increase RPM and decrease WOB. Monitor with MWD tool.
- Use stabilization or roller reamers to improve borehole quality.
- Improve the lubrication qualities of the drilling fluid.
- Increase weight and stiffness of BHA (Inclination <60°).



MUD PULSE SHOCK PARAMETERS

LEVEL	CATEGORY	VIBRATIONS RANGE (G'S RMS)	SHOCK RANGE (G'S)	ACTIONS
0	Low	≤5	≤50	None
1	Moderate	>5	>50	Be on Alert Notify DD
2	High	>10	>75	Mitigate Notify All Personnel
3	Severe	>15	>100	Mitigate Notify All Personnel

EVO SHOCK PARAMETERS

LEVEL	CATEGORY	MAX SHOCK CPS OVER 75 G'S	ACTIONS
0	Low	CPS ≤ 2	None
1	Moderate	2< CPS ≤ 5	Be on Alert Notify DD
2	High	5 < CPS ≤10	Mitigate Notify All Personnel
3	Severe	CPS ≥10	Mitigate Notify All Personnel

SHOCK AND VIBRATION MITIGATION

'Shock and Vibration Mitigation' is the attempt to eliminate or reduce the amount of shock and vibration that the drill string/BHA is undergoing. It has shown that management of shock and vibrations dramatically influences tool health and increases Mean Time Between Failures (MTBF). The most effective way to manage shock and vibration is awareness and the use of mitigation tools

- MWD tools with program capabilities to provide real-time vibration data while drilling ahead
- MWD tools capable to record data for post run analysis
- MWD batteries with smart chips to confirm recorded and decoded tool data
- Command center data evaluation support and optimization
- Education / Communication / Reporting

When deciding whether to increase RPM and WOB, factors such as maximum allowable rotary RPM for a given motor bend setting and bit specifications must be considered.

SHOCK AND VIBRATION MITIGATION

STANDARDS

The scale below is based on a calculated CPS

Shock Level: 0
Severity: Low
Response: No immediate action is required

Shock Level: 1
Severity: Moderate
Response: Monitor Closely:

- Make contact with the Directional Driller and discuss.
- Be prepared to take action and collect supporting data to communicate to appropriate personnel.

Shock Level: 2
Severity: High
Response: Take IMMEDIATE Action:

- Pick up off bottom.
- Bring surface RPM to zero and wait for the string to settle.
- Engage rotary drive to+/- 5% of previous RPM and resume drilling.
- Contact coordinator and command center to start the reporting process (document all changes made).
- Provide an updated EDR LAS and decode files to the command center.
- If vibration is not reduced to acceptable levels, repeat all steps above and adjust WOB +/- 5% from previous setting.

If combined RPM and WOB adjustments do not mitigate the vibration to acceptable levels, repeat all steps above; changing RPM first by an additional 5% and then WOB by an additional 5%, if necessary.

Shock Level: 3
Severity: Severe
Response: Take IMMEDIATE Action:

- Pick up off bottom.
- Bring surface RPM to zero and wait for the string to settle.
- Engage rotary drive to+/- 5% of previous RPM and resume drilling.
- Contact coordinator and command center to start the reporting process (document all changes made).
- Provide an updated EDR LAS and decode files to the command center.
- If vibration is not reduced to acceptable levels, repeat all steps above and adjust WOB +/- 5% from previous setting.
- If combined RPM and WOB adjustments do not mitigate the vibration to acceptable levels, repeat all steps above; changing RPM first by an additional 5% and then WOB by an additional 5%, if necessary.

HOISTING OFF BOTTOM

The purpose of the following policy is to ensure that the proper precautions are followed when hoisting a motor off bottom. Following the outlined procedures can help prevent motor and MWD incidents during a stall event.

These items should be communicated during the pre-job meeting and can be posted in the Directional Shack and the Dog House.

PULLING OFF BOTTOM ROTATING

A. Top Drive System

- Allow WOB to drill off.
- Differential pressure should be as close to zero as practical.
- Stop top drive rotary.
- Begin to lift drill string slowly while paying close attention to weight and SPP.
- At the first sign of excessive drag stop hoisting.
- Reverse direction if necessary.

B. Rotary Table Drive System

- Allow WOB to drill off.
- Differential pressure should be as close to zero as practical.
- At Kelly-down allow residual string torque to stabilize and slow rotary to zero.
- Begin to lift drill string slowly while paying close attention to weight and SPP.
- At the first sign of excessive drag, stop hoisting and allow SPP to reduce.

HOISTING OFF BOTTOM

- Reverse direction if necessary, set bushings and engage rotary

PULLING OFF BOTTOM SLIDING

A. Top Drive System

- Allow differential pressure to drill off as far as practical.
- Ensure the bit has completely disengaged the rock face, and residual string torque has been released, continue hoisting an additional 6-10'.
- Ensure the hole drag is not excessive and residual string torque has been released.
- Engage rotary and work slide interval if possible.

B. Rotary Table Drive System

- Allow differential to drill off as far as practical.
- Hoist while monitoring hole drag and differential pressure.
- Ensure the bit has completely disengaged from formation and residual string torque has been released, continue hoisting as high as possible preferably to start the slide if not a minimum of 6-10 feet.
- Set bushings and engage rotary to work slide interval if possible.

HOISTING OFF BOTTOM

STALLING

Motor stalling typically occurs when the application of excessive weight on bit or hole sloughing stops the bit from rotating, and the power section of the drilling motor is not capable of providing enough torque to power through. This is indicated by a sudden sharp increase in pump pressure. This pressure increase is due to the rotor no longer being able to rotate inside the stator, forming a long seal between the two. If circulation is continued, the drilling fluid forces its way through the power section by deflecting the stator rubber. Drilling fluid will still circulate through the motor, but the bit will not turn. Operating in this state will erode and possibly chunk the stator in a very short period, resulting in extensive damage. It is very important to avoid this operating condition. When stalling occurs, corrective action must be taken immediately.

- Stop flow completely – kill pumps.
- Release any built-up drill string torque.

  Bleed SPP off at surface through standpipe if possible.
- Slowly pull off bottom to neutral/free point.

  Watch for any excessive overpull.
- Slowly idle pumps up ensuring bit is free and motor is no longer in stall.

MOTOR OPERATIONS

AIR DRILLING

For sealed bearing motors, compressed air can be used as a drive medium. High torque combined with a slow speed motor are the most effective when air drilling.

Lubrication: The addition of lubrication (petroleum-based , polymers, soap and mist) to the compressed air is required to reduce friction.

Air Volume: Air volume requirements vary depending on motor sizes and other factors. Enough air is required to not only run the motor, but also enough to properly clean the hole of drill fines.

Fire Hazards: Care must be used while air drilling and exposure to highly volatile or low flash point additives such as helium or oxygen. When starting to drill, allowing the air volume to reach operating volumes before touching bottom is critical.

Bit on Bottom: When setting bit on bottom, ease the weight gently. When lifting off bottom, reduce air volume by 50% to minimize vibrations in the drill string. Because motor stalls are difficult to detect when drilling with gasses, monitoring vibration, especially lack thereof, will indicate a possible stall.

Friction: Due to friction between the rubber stator and chrome rotor, always use a friction reducing medium to minimize the amount of wear on the motor.

Optimal Parameters: Contact us to help determine optimal air volume requirements.

MOTOR QUALITY SERVICE CYCLE

5" Motors

#1
Receipt of Motor From Field

#2
Teardown, Reporting and Documentation Started

#3
MPI & Non-Destructive Inspection Performed

#4
Quality Check Performed/ Parts Replaced

#5
Build to Suit Takes Place Per Tool Order

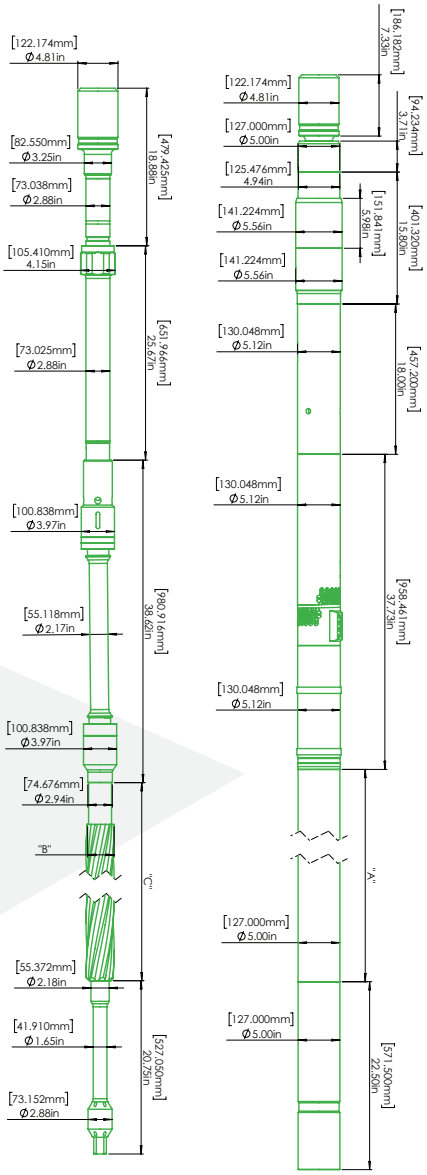
#6
Motor QA per Request While Being Painted

#7
Staged and Ready For Dispatch

MDS

MAGNUM DRILLING SOLUTIONS KEEP IT IN THE HOLE!

5" FISHING DIAGRAM



		POWER SECTION		
		6/7 8.0	7/8 2.6	7/8 3.8
Stator Length	A	246 in	229.3 in	187 in
Rotor OD	B	3.018 in	3.095 in	2.945 in
Rotor Length	C	230.5 in	220 in	178 in

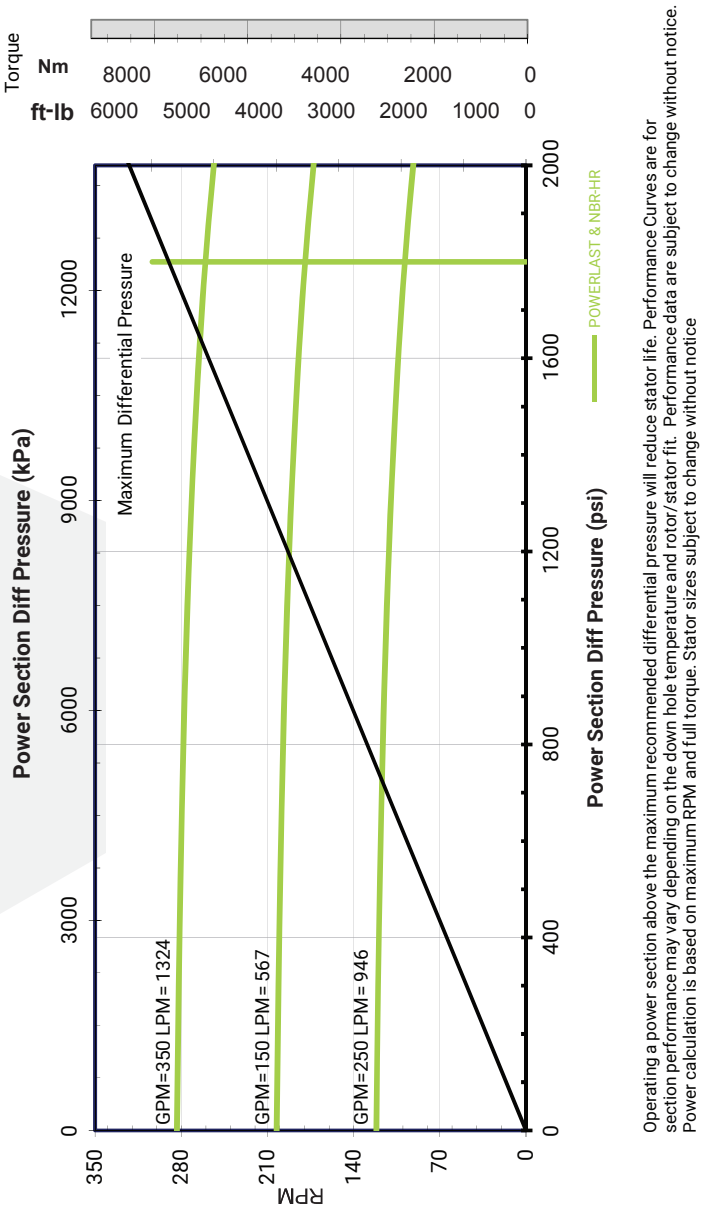
5" SPECIFICATIONS

SPECIFICATIONS		
Bit Box to Stabilizer	11 in	0.28 m
Bit Box to Bend	58 (64) *in	1.47 (1.63)* m
Bit Box to Top Sub	356 in	9.04m
Maximum Dynamic Weight On Bit	90,000 lb	400 kN
Max. Dynamic Pull to Re-Run Motor	60,000 lb	267 kN
Max. Static Pull to Re-Run Motor	170,000 lb	756 kN
Pull to Yield Motor	440,000 lb	1,950 kN
Standard Bit Box Connections	3 1/2 Reg, XT39 Pin Down	
Driveline Connections Torque Limit	12,500 ft-lbs	17,000 Nm
Housing Connections Torque Limit	12,500 ft-lbs	17,000 Nm
Side Load Limit (Static)	105,000 lbf	142,000 N
Side Load Limit (Dynamic)	64,000 lbf	87,000 N

*With Adjustable Bend Housing

5" 6/7 8.0

5" 6/7 8.0



Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

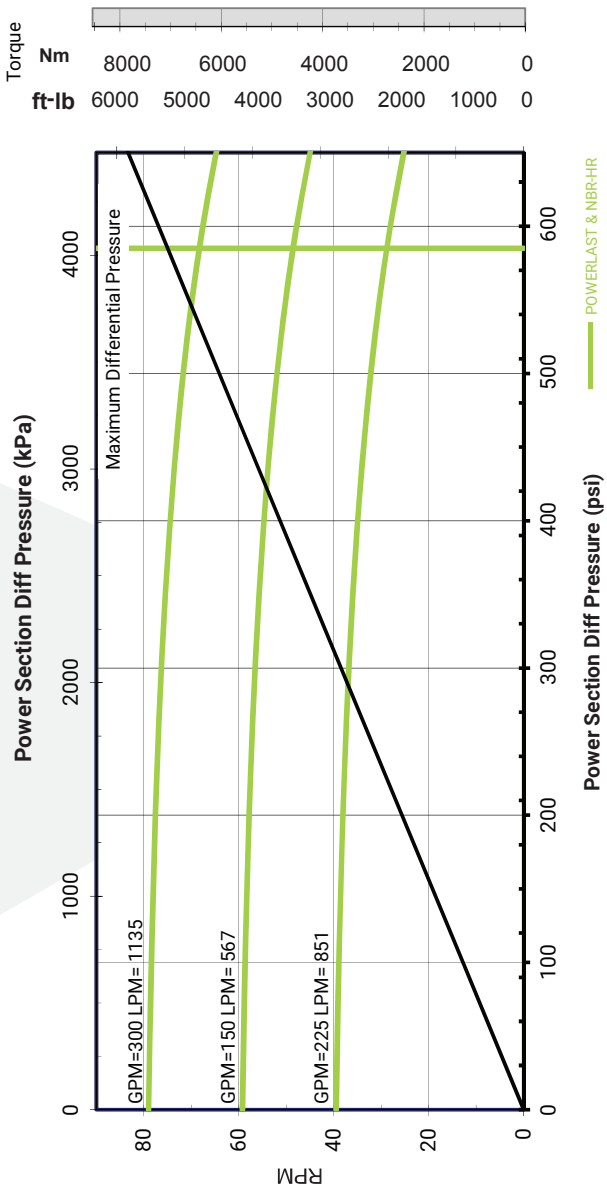
SPECIFICATIONS		
Flow Range	150 - 350 gpm	570 - 1,320 lpm
Revolutions per Volume	0.810 rev/gal	0.214 rev/l
Speed Range	121 - 290 rpm	
Max. Differential Pressure	1,800 psi	12,410 kPa
Torque @ Max. Diff. Pressure	5,720 lb-ft	7,760 Nm
Stall Torque	8,580 lb-ft	11,630 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	6"	6.25"	6.75"	6"	6.25"	6/75"
	152 mm	159 mm	171 mm	152 mm	159 mm	171 mm
0.39	1.1	0.5	-	1.5	1.7	1.9
0.78	3.7	3	1.8	4.3	4.2	4
1.15	6.1	5.5	4.2	7.1	7	6.7
1.5	8.4	7.7	6.5	9.1	9.6	9.3
1.83	10.5	9.9	8.6	12.3	12.2	11.8
2.12	12.4	11.8	10.5	14.5	14.4	14
2.38	14.1	13.5	12.2	16.4	16.3	16
2.6	15.6	14.9	13.7	18.1	18	17.7
2.77	16.7	16	14.8	19.4	19.3	19
2.9	17.5	16.9	15.6	20.4	20.3	20
2.97	18	17.3	16.1	20.9	20.8	20.5
3.00	18.2	17.5	16.3	21.1	21	20.7

*With Adjustable Bend Housing

5" 7/8 2.6

5" 7/8 2.6



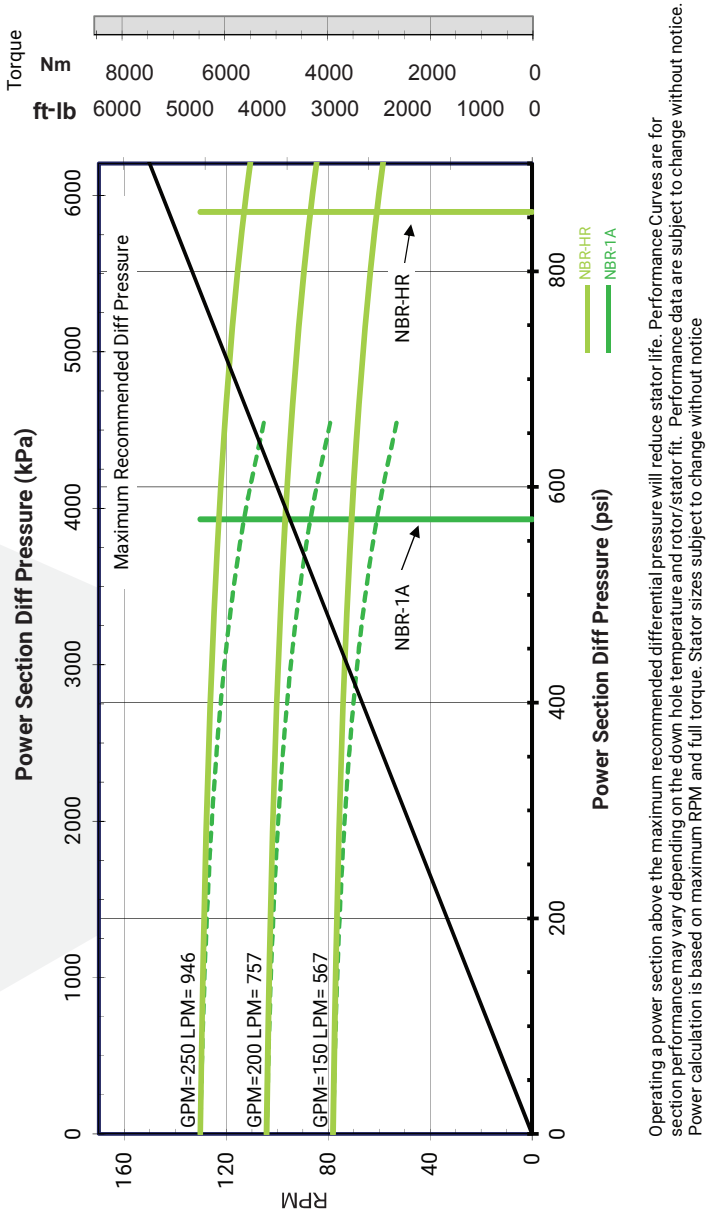
Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

SPECIFICATIONS		
Flow Range	150 - 350 gpm	570 - 1,135 lpm
Revolutions per Volume	0.263 rev/gal	0.214 rev/l
Speed Range	39 - 79 rpm	
Max. Differential Pressure	590 psi	12,410 kPa
Torque @ Max. Diff. Pressure	5,250 lb-ft	7,760 Nm
Stall Torque	7,880 lb-ft	10,680 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	6"	6.25"	6.75"	6"	6.25"	6/75"
	152 mm	159 mm	171 mm	152 mm	159 mm	171 mm
0.39	1.1	0.5	-	1.5	1.7	1.9
0.78	3.7	3	1.8	4.3	4.2	4
1.15	6.1	5.5	4.2	7.1	7	6.7
1.5	8.4	7.7	6.5	9.1	9.6	9.3
1.83	10.5	9.9	8.6	12.3	12.2	11.8
2.12	12.4	11.8	10.5	14.5	14.4	14
2.38	14.1	13.5	12.2	16.4	16.3	16
2.6	15.6	14.9	13.7	18.1	18	17.7
2.77	16.7	16	14.8	19.4	19.3	19
2.9	17.5	16.9	15.6	20.4	20.3	20
2.97	18	17.3	16.1	20.9	20.8	20.5
3.00	18.2	17.5	16.3	21.1	21	20.7

*With Adjustable Bend Housing

5" 7/8 3.8



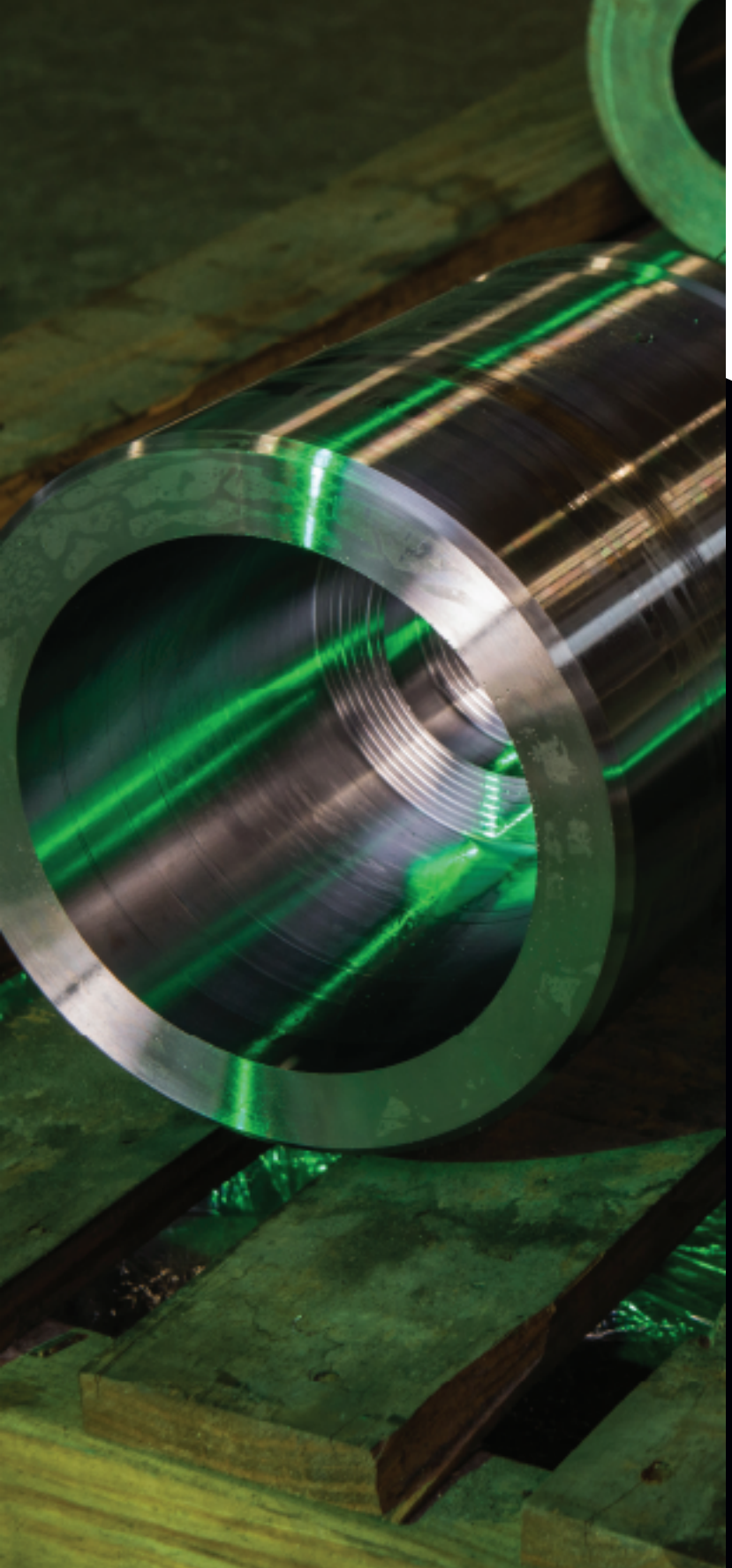
Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

5" 7/8 3.8

SPECIFICATIONS		
Flow Range	150 - 250 gpm	570 - 1,320 lpm
Revolutions per Volume	0.521 rev/gal	0.214 rev/l
Speed Range	78 - 130 rpm	
Max. Differential Pressure	860 psi	12,410 kPa
Torque @ Max. Diff. Pressure	4,450 lb-ft	7,760 Nm
Stall Torque	6,670 lb-ft	9,050 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	6"	6.25"	6.75"	6"	6.25"	6/75"
	152 mm	159 mm	171 mm	152 mm	159 mm	171 mm
0.39	1.3	0.6	-	1.7	1.9	2.3
0.78	4.2	3.5	2.0	5.0	4.7	4.6
1.15	6.9	6.2	4.8	8.2	8.0	7.6
1.5	9.5	8.8	7.4	11.3	11.1	10.7
1.83	12.0	11.3	9.8	14.2	14.0	13.6
2.12	14.1	13.4	12.0	16.8	16.5	16.2
2.38	16.1	15.3	13.9	19.1	18.8	18.5
2.6	17.7	17.0	15.5	21.0	20.8	20.4
2.77	19.0	18.2	16.8	22.5	22.3	21.9
2.9	19.9	19.2	17.8	23.6	23.4	23.0
2.97	20.4	19.7	18.3	24.3	24.0	23.9
3.00	20.6	19.9	18.5	24.5	24.2	23.9

*With Adjustable Bend Housing

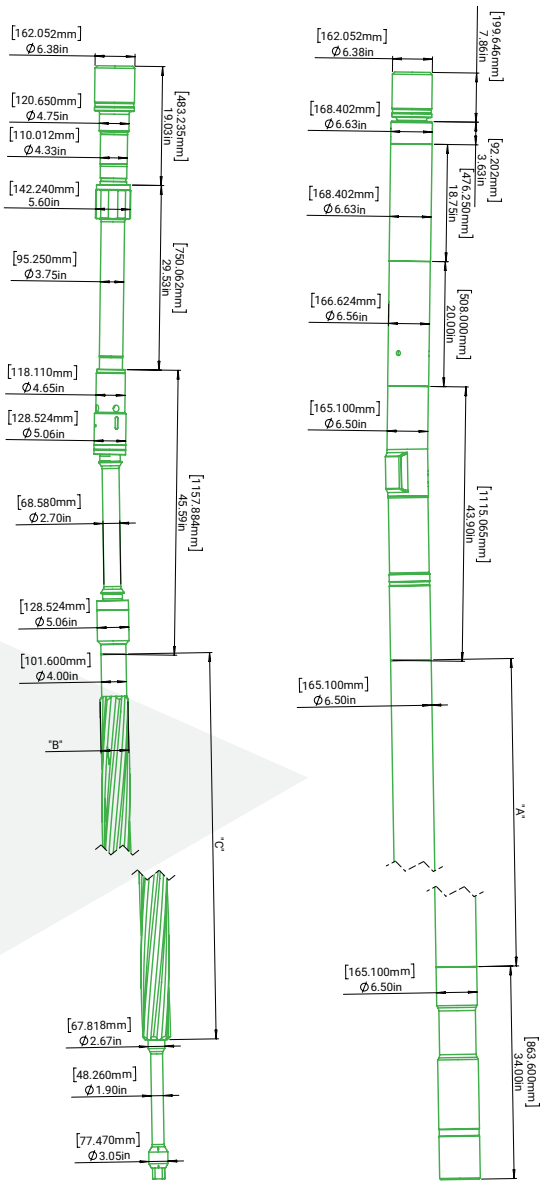


6.5" - 6.75" MOTORS

MAGNUM DRILLING SOLUTIONS

KEEP IT IN THE HOLE!

6.5" - 6.75" FISHING DIAGRAM



		POWER SECTION				
		4/5 7.0	5/6 8.2	7/8 3.0 slow	7/8 5.0	7/8 5.7
Stator Length	A	214.6 in	246 in	245 in	194 in	260 in
Rotor OD	B	4.22 in	4.370 in	4.0 in	4.52 in	4.64 in
Rotor Length	C	202.5 in	233 in	238.5 in	188 in	252 in

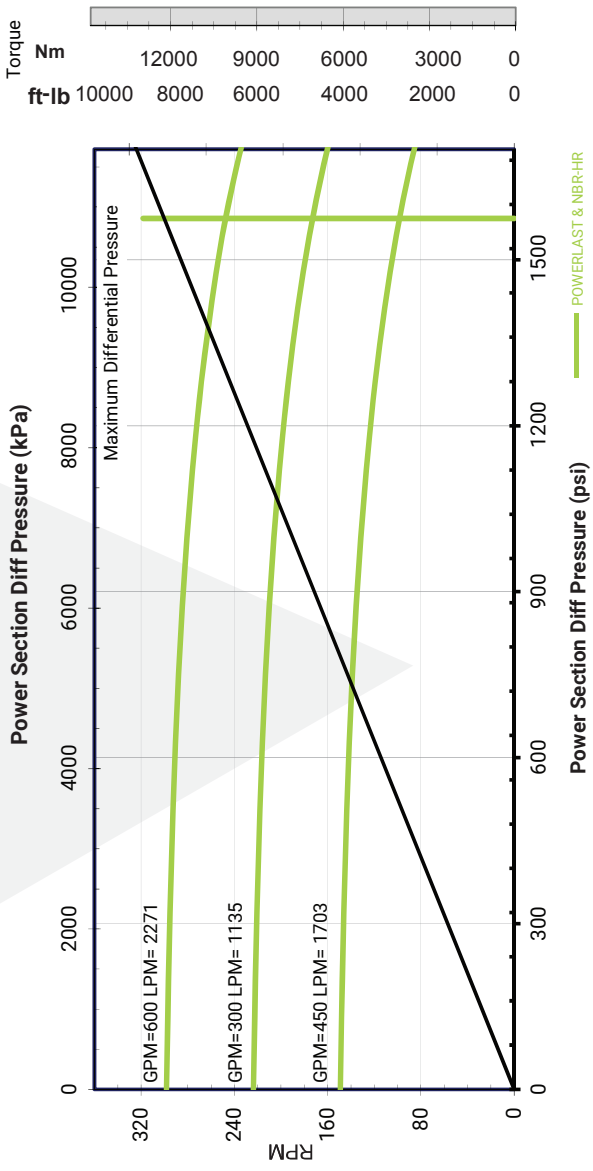
6.5" - 6.75" SPECIFICATIONS

SPECIFICATIONS		
Bit Box to Stabilizer	18 in	0.46 m
Bit Box to Bend	62 (71)* in	1.57 (1.80)* m
Bit Box to Top Sub	336 in	8.53
Maximum Dynamic Weight On Bit	154,000 lb	685 kN
Max. Dynamic Pull to Re-Run Motor	80,000 lb	355 kN
Max. Static Pull to Re-Run Motor	260,000 lb	1,156 kN
Pull to Yield Motor	650,000 lb	2,900 kN
Standard Bit Box Connections	4 1/2 Reg, 6 5/8 Reg	
Driveline Connections Torque Limit	25,500 ft-lbs	34,500 Nm
Housing Connections Torque Limit	28,000 ft-lbs	38,000 Nm
Side Load Limit (Static)	145,000 lbf	196,500 N
Side Load Limit (Dynamic)	71,500 lbf	97,000 N

*With Adjustable Bend Housing

6.5" - 6.75" 4/5 7.0

6.5" - 6.75" 4/5 7.0



Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

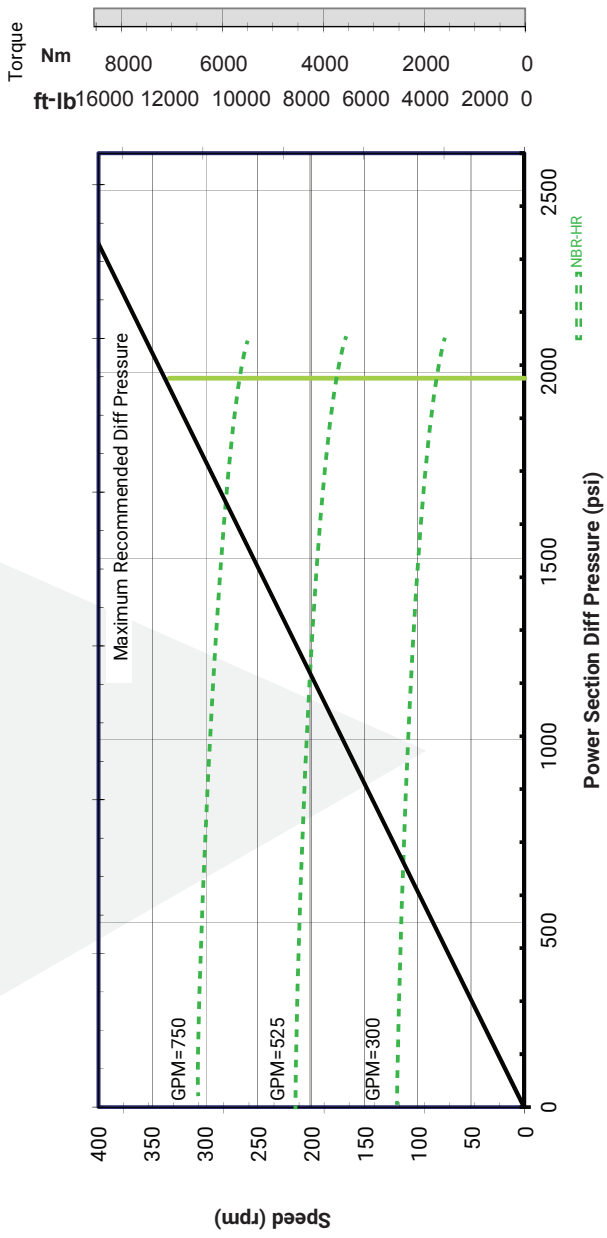
SPECIFICATIONS		
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Revolutions per Volume	0.497 rev/gal	0.214 rev/l
Speed Range	149 - 300 rpm	
Max. Differential Pressure	1,580 psi	10,860 kPa
Torque @ Max. Diff. Pressure	9,090 lb-ft	12,330 Nm
Stall Torque	13,630 lb-ft	18,490 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.50"	8.75"	7.875"	8.50"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.8	-	-	0.6	2.1	2.3
0.78	3.4	1.9	1.4	3.5	4.3	4.4
1.15	5.9	4.4	3.9	6.5	7.1	6.9
1.5	8.2	6.8	6.2	9.3	9.9	9.7
1.83	10.5	9.0	8.5	12.0	12.6	12.4
2.12	12.4	11.0	10.4	14.3	14.9	14.7
2.38	14.2	12.7	12.2	16.4	17.0	16.8
2.6	15.7	14.2	13.6	18.2	18.8	18.6
2.77	16.8	15.4	14.8	19.5	20.1	20.0
2.9	17.7	16.2	15.7	20.6	21.2	21.0
2.97	18.1	16.7	16.1	21.2	21.7	21.6
3.00	18.4	16.9	16.3	21.4	21.9	21.8

*With Adjustable Bend Housing

6.5" - 6.75" 5/6 8.2

6.5" - 6.75" 5/6 8.2



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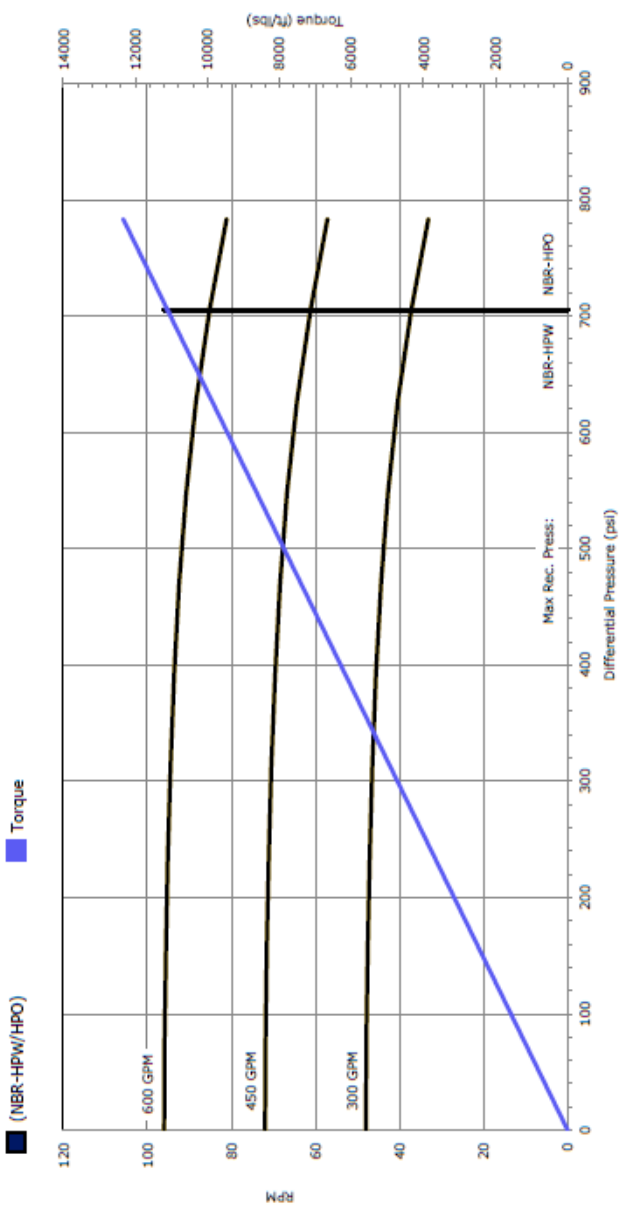
SPECIFICATIONS	
Flow Range	450-750 gpm
Revolutions per Volume	0.40 rev/gal
Speed Range	178-298 rpm
Max. Differential Pressure	1,760 psi
Torque @ Max. Diff. Pressure	11,090 lb-ft
Stall Torque	16,630 lb-ft

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.5"	8.75"	7.875"	8.5"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.8	-	-	4.6	2.6	1.7
0.78	3.2	1.9	1.3	7.0	4.9	4.1
1.15	5.4	4.1	3.6	9.2	7.2	6.3
1.5	7.5	6.2	5.7	11.3	9.3	8.5
1.83	9.5	.2	7.7	13.3	11.3	10.5
2.12	11.3	10.0	9.5	15.1	13.0	12.2
2.38	12.9	11.6	11.0	16.7	14.6	13.8
2.6	14.2	12.9	12.4	18.0	15.9	15.1
2.77	15.2	13.9	13.4	19.0	17.0	16.2
2.9	16.0	14.7	14.2	19.8	17.8	16.9
2.97	16.	15.1	14.6	20.2	18.2	17.4
3.00	16.6	15.3	14.8	20.4	18.4	17.6

*With Adjustable Bend Housing

6.5" - 6.75" 7/8 3.0 slow

6.5" - 6.75" 7/8 3.0 slow



Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

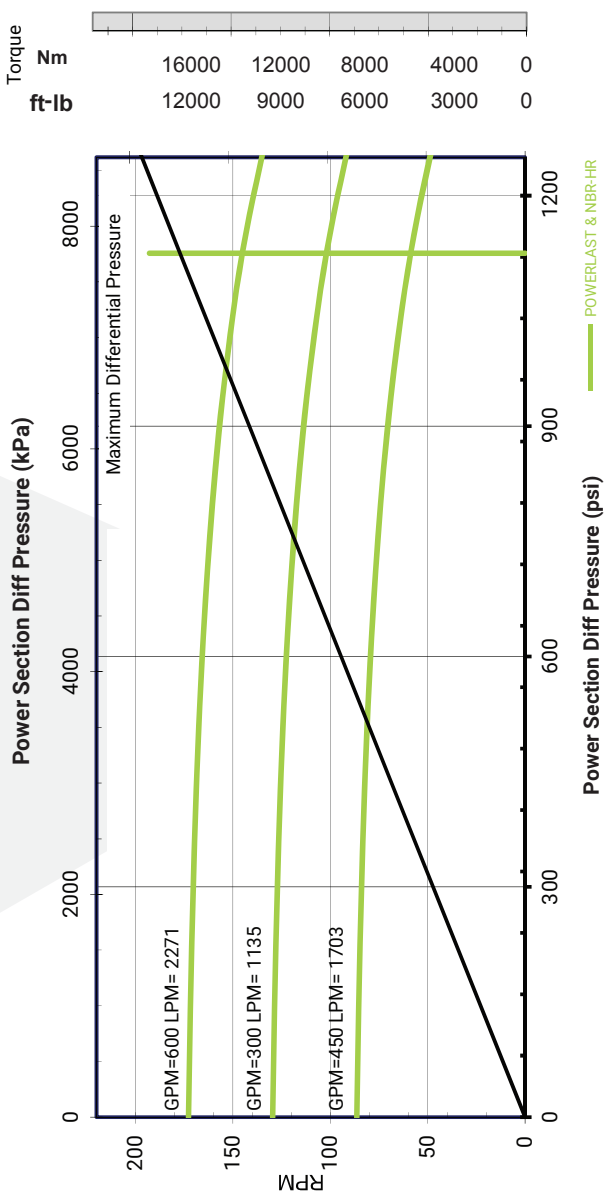
SPECIFICATIONS		
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Revolutions per Volume	0.16 rev/gal	0.0423 rev/l
Speed Range	50-100 rpm	
Max. Differential Pressure	710 psi	4,900 kPa
Torque @ Max. Diff. Pressure	11,110 kPa	15,100 Nm
Stall Torque	17,490 lb-ft	23,800 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.50"	8.75"	7.875"	8.50"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.8	-	-	1.9	2.2	2.4
0.78	3.5	2.0	1.4	4.7	4.4	4.6
1.15	6.1	4.6	4.0	7.7	7.3	7.1
1.5	8.5	7.0	6.4	10.7	10.2	10.1
1.83	10.8	9.3	8.7	13.4	13.0	12.8
2.12	12.8	11.3	10.7	15.9	15.4	15.2
2.38	14.6	13.1	12.5	18.0	17.6	17.4
2.6	16.1	14.7	14.1	19.9	19.4	19.2
2.77	17.3	15.8	15.2	21.3	20.8	20.7
2.9	18.2	16.6	16.1	22.4	21.9	21.8
2.97	18.7	17.2	16.6	23.0	22.5	22.3
3.00	18.9	17.4	16.8	23.2	22.7	22.5

*With Adjustable Bend Housing

6.5" - 6.75" 7/8 5.0

6.5" - 6.75" 7/8 5.0



Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

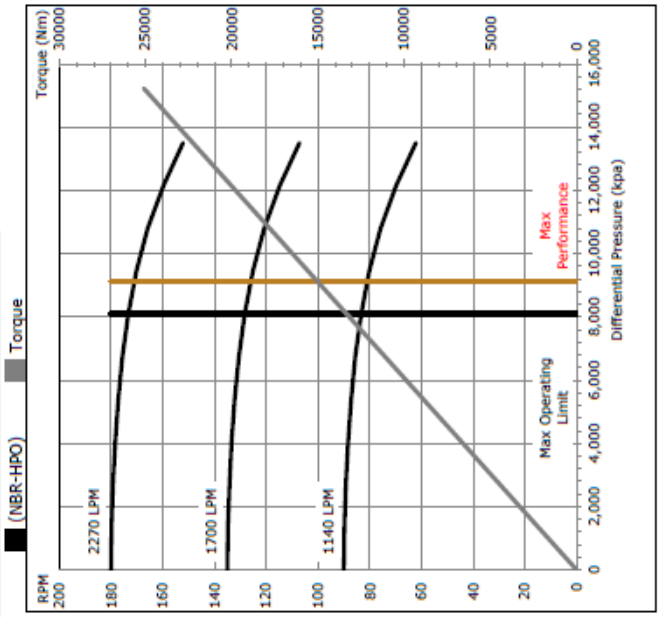
SPECIFICATIONS		
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Revolutions per Volume	0.288 rev/gal	0.076 rev/l
Speed Range	86 - 175 rpm	
Max. Differential Pressure	1,130 psi	7,760 kPa
Torque @ Max. Diff. Pressure	10,460 kPa	14,190 Nm
Stall Torque	15,690 lb-ft	21,280 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.50"	8.75"	7.875"	8.50"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.8	-	-	1.9	2.2	2.4
0.78	3.5	2.0	1.4	4.7	4.4	4.6
1.15	6.1	4.6	4.0	7.7	7.3	7.1
1.5	8.5	7.0	6.4	10.7	10.2	10.1
1.83	10.8	9.3	8.7	13.4	13.0	12.8
2.12	12.8	11.3	10.7	15.9	15.4	15.2
2.38	14.6	13.1	12.5	18.0	17.6	17.4
2.6	16.1	14.7	14.1	19.9	19.4	19.2
2.77	17.3	15.8	15.2	21.3	20.8	20.7
2.9	18.2	16.6	16.1	22.4	21.9	21.8
2.97	18.7	17.2	16.6	23.0	22.5	22.3
3.00	18.9	17.4	16.8	23.2	22.7	22.5

*With Adjustable Bend Housing

6.5" - 6.75" 7/8 5.0 EW

6.5" - 6.75" 7/8 5.0 EW



Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

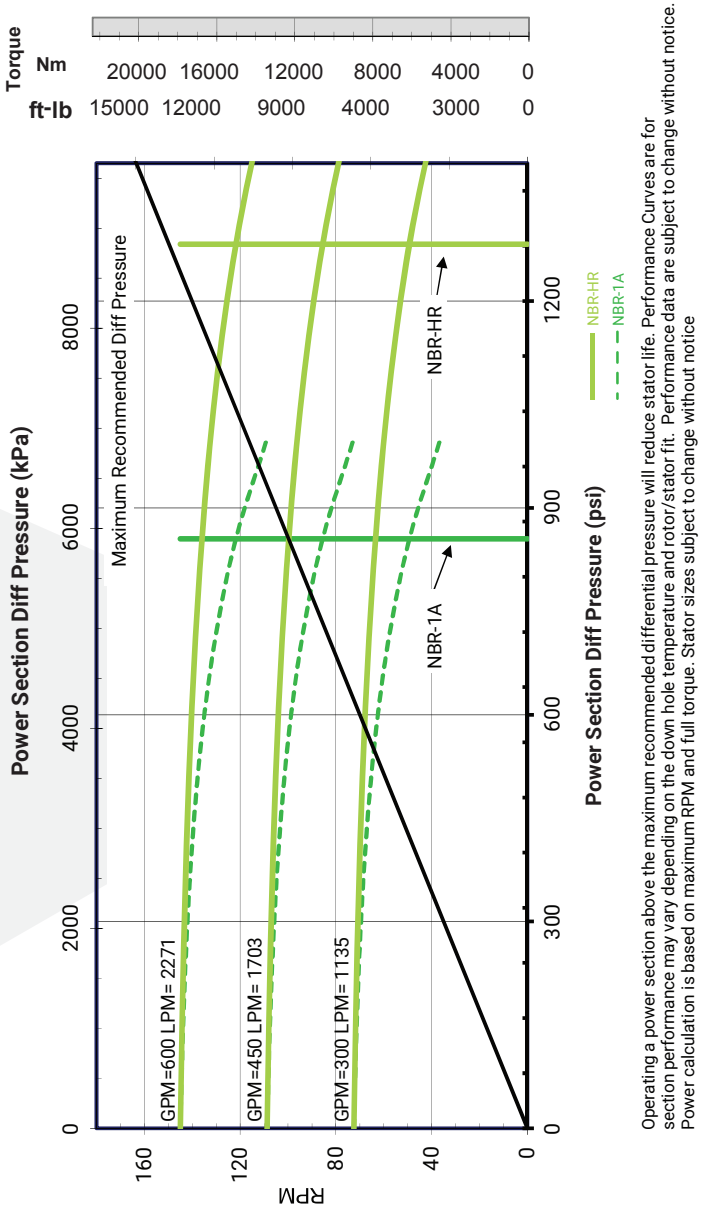
SPECIFICATIONS		
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Revolutions per Volume	0.300 rev/gal	0.0793 rev/l
Speed Range	90 - 100 rpm	
Max. Differential Pressure	1,330 psi	9.200 kPa
Torque @ Max. Diff. Pressure	11,110 kPa	15,100 Nm
Stall Torque	22,160 lb-ft	30,100 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.50"	8.75"	7.875"	8.50"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.8	-	-	1.9	2.2	2.4
0.78	3.5	2.0	1.4	4.7	4.4	4.6
1.15	6.1	4.6	4.0	7.7	7.3	7.1
1.5	8.5	7.0	6.4	10.7	10.2	10.1
1.83	10.8	9.3	8.7	13.4	13.0	12.8
2.12	12.8	11.3	10.7	15.9	15.4	15.2
2.38	14.6	13.1	12.5	18.0	17.6	17.4
2.6	16.1	14.7	14.1	19.9	19.4	19.2
2.77	17.3	15.8	15.2	21.3	20.8	20.7
2.9	18.2	16.6	16.1	22.4	21.9	21.8
2.97	18.7	17.2	16.6	23.0	22.5	22.3
3.00	18.9	17.4	16.8	23.2	22.7	22.5

*With Adjustable Bend Housing

6.5" - 6.75" 7/8 5.7

6.5" - 6.75" 7/8 5.7



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SPECIFICATIONS		
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Revolutions per Volume	0.23 rev/gal	0.062 rev/l
Speed Range	70 - 139 rpm	
Max. Differential Pressure	1,425 psi	9,825 kPa
Torque @ Max. Diff. Pressure	15,034 lb-ft	20,383 Nm
Stall Torque	20,580 lb-ft	27,910 Nm

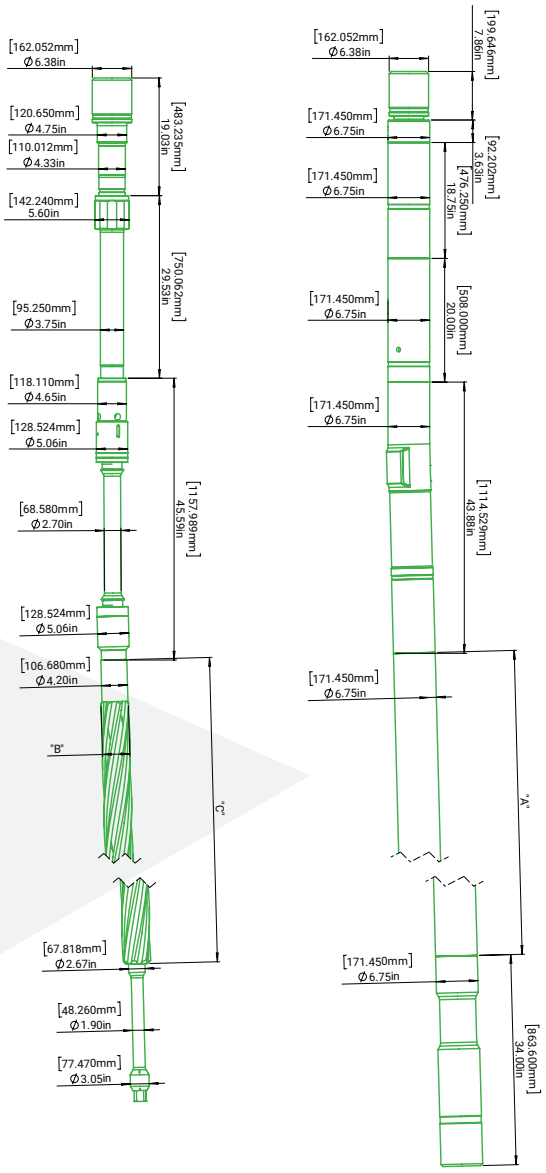
PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.50"	8.75"	7.875"	8.50"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.6	-	-	2.3	2.5	2.6
0.78	2.9	1.7	1.7	4.5	4.4	4.5
1.15	5.0	3.8	3.3	7.0	6.7	6.6
1.5	7.1	5.8	5.3	9.4	9.1	8.9
1.83	9.0	7.7	7.3	11.6	11.3	11.2
2.12	10.7	9.4	8.9	13.6	13.2	13.1
2.38	12.2	10.9	10.4	15.3	15.0	14.9
2.6	13.4	12.2	11.7	16.8	16.5	16.4
2.77	14.4	13.3	12.7	17.9	17.5	17.5
2.9	15.2	13.9	13.4	18.8	18.5	18.4
2.97	15.6	14.3	13.8	19.3	19.0	18.9
3.00	15.7	14.5	14.0	19.5	19.2	19.1

*With Adjustable Bend Housing

7"
MOTORS

MAGNUM DRILLING SOLUTIONS
KEEP IT IN THE HOLE!

7" Fishing Diagram



		POWER SECTION	
		7/8 5.7	7/8 8.5
Stator Length	A	260 in	300 in
Rotor OD	B	4.64 in	5.0 in
Rotor Length	C	252 in	294 in

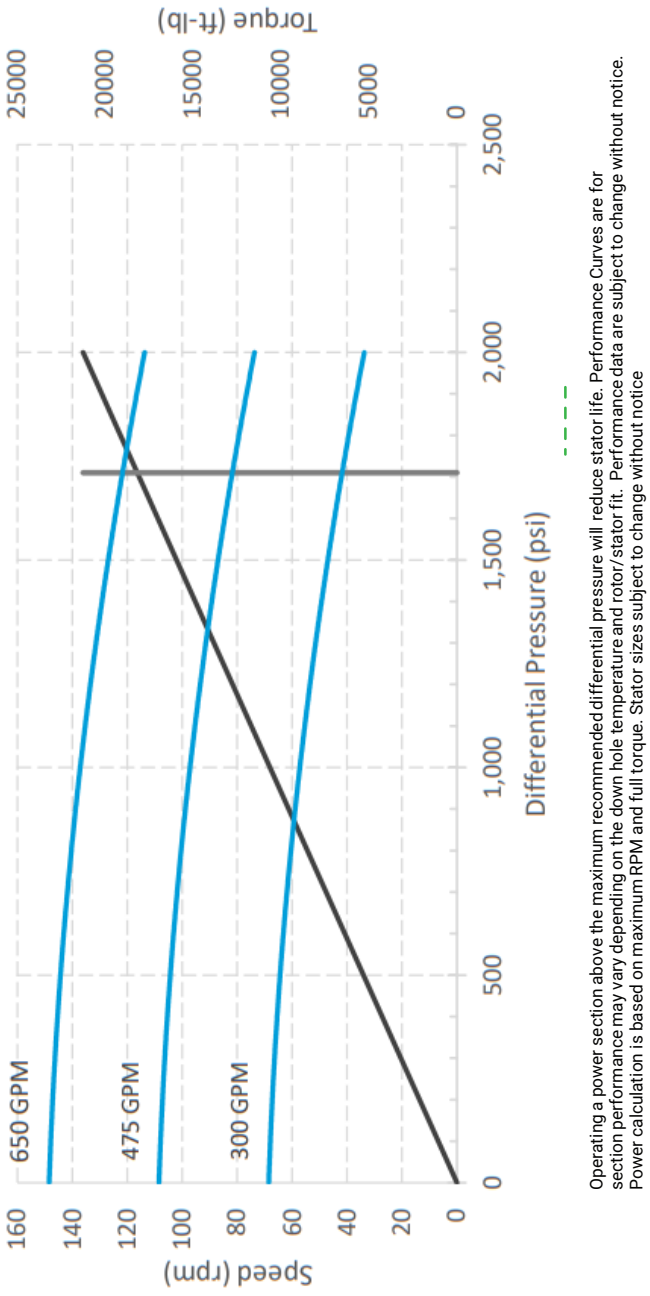
7" SPECIFICATIONS

SPECIFICATIONS		
Bit Box to Stabilizer	18 in	0.46 m
Bit Box to Bend	62 (71)* in	1.57 (1.80)* m
Bit Box to Top Sub	336 in	8.53
Maximum Dynamic Weight On Bit	154,000 lb	685 kN
Max. Dynamic Pull to Re-Run Motor	80,000 lb	355 kN
Max. Static Pull to Re-Run Motor	260,000 lb	1,156 kN
Pull to Yield Motor	650,000 lb	2,900 kN
Standard Bit Box Connections	4 1/2 Reg, 6 5/8 Reg	
Driveline Connections Torque Limit	25,500 ft-lbs	34,500 Nm
Housing Connections Torque Limit	28,000 ft-lbs	38,000 Nm
Side Load Limit (Static)	145,000 lbf	196,500 N
Side Load Limit (Dynamic)	71,500 lbf	97,000 N

*With Adjustable Bend Housing

7" 7/8 5.7 EW

7" 7/8 5.7 EW



Operating a power section above the maximum recommended differential pressure will reduce stator life. Performance Curves are for section performance may vary depending on the down hole temperature and rotor/stator fit. Performance data are subject to change without notice. Power calculation is based on maximum RPM and full torque. Stator sizes subject to change without notice

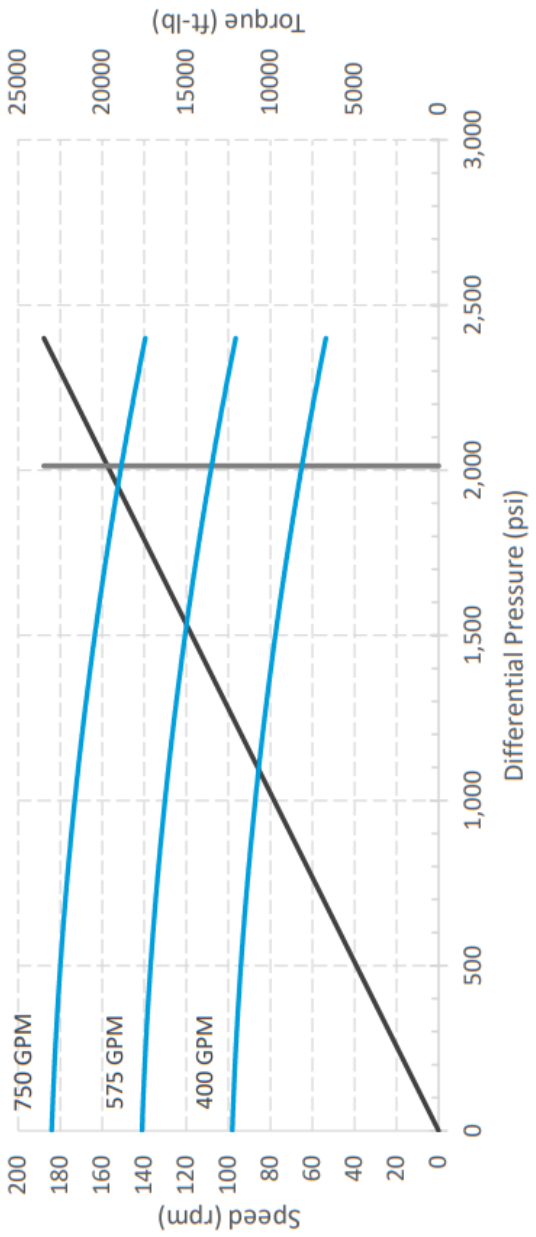
SPECIFICATIONS		
Flow Range	300 - 650 gpm	1,136 - 2,461 lpm
Revolutions per Volume	0.228 rev/gal	0.0602 rev/l
Speed Range	69 - 148 rpm	
Max. Differential Pressure	1,710 psi	11,790 kPa
Torque @ Max. Diff. Pressure	18,180 lb-ft	24,649 Nm
Stall Torque	28,500 lb-ft	38,641 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.50"	8.75"	7.875"	8.50"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.6	-	-	2.3	2.5	2.6
0.78	2.9	1.7	1.7	4.5	4.4	4.5
1.15	5.0	3.8	3.3	7.0	6.7	6.6
1.5	7.1	5.8	5.3	9.4	9.1	8.9
1.83	9.0	7.7	7.3	11.6	11.3	11.2
2.12	10.7	9.4	8.9	13.6	13.2	13.1
2.38	12.2	10.9	10.4	15.3	15.0	14.9
2.6	13.4	12.2	11.7	16.8	16.5	16.4
2.77	14.4	13.3	12.7	17.9	17.5	17.5
2.9	15.2	13.9	13.4	18.8	18.5	18.4
2.97	15.6	14.3	13.8	19.3	19.0	18.9
3.00	15.7	14.5	14.0	19.5	19.2	19.1

*With Adjustable Bend Housing

7" 7/8 8.5

7" 7/8 8.5



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SPECIFICATIONS		
Flow Range	400 - 750 gpm	1,510 - 2,840 lpm
Revolutions per Volume	0.260 rev/gal	0.0687 rev/l
Speed Range	100 - 200 rpm	
Max. Differential Pressure	2,000 psi	13,800 kPa
Torque @ Max. Diff. Pressure	19,540 kPa	26,500 Nm
Stall Torque	30.770 lb-ft	41,800 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	7.875"	8.50"	8.75"	7.875"	8.50"	8.75"
	200 mm	216 mm	222 mm	200 mm	216 mm	222 mm
0.39	0.8	-	-	1.9	2.2	2.4
0.78	3.5	2.0	1.4	4.7	4.4	4.6
1.15	6.1	4.6	4.0	7.7	7.3	7.1
1.5	8.5	7.0	6.4	10.7	10.2	10.1
1.83	10.8	9.3	8.7	13.4	13.0	12.8
2.12	12.8	11.3	10.7	15.9	15.4	15.2
2.38	14.6	13.1	12.5	18.0	17.6	17.4
2.6	16.1	14.7	14.1	19.9	19.4	19.2
2.77	17.3	15.8	15.2	21.3	20.8	20.7
2.9	18.2	16.6	16.1	22.4	21.9	21.8
2.97	18.7	17.2	16.6	23.0	22.5	22.3
3.00	18.9	17.4	16.8	23.2	22.7	22.5

*With Adjustable Bend Housing

8"
MOTORS

MDS

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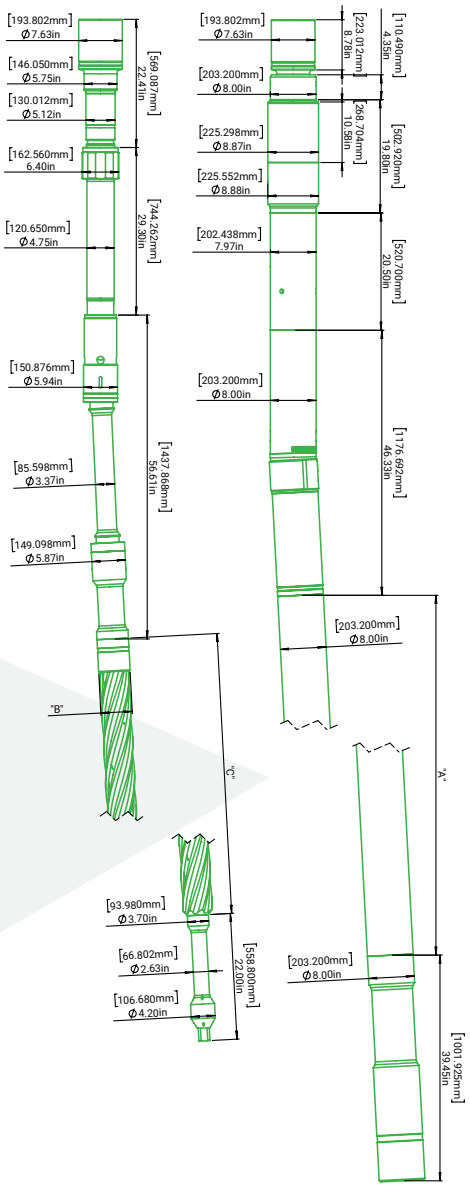
8" FISHING DIAGRAM



		POWER SECTION		
		4/5 6.0	7/8 4.0	7/8 5.9
Stator Length	A	260 in	203.2 in	300 in
Rotor OD	B	5.143 in	5.186 in	5.186 in
Rotor Length	C	252 in	196.3 in	285 in

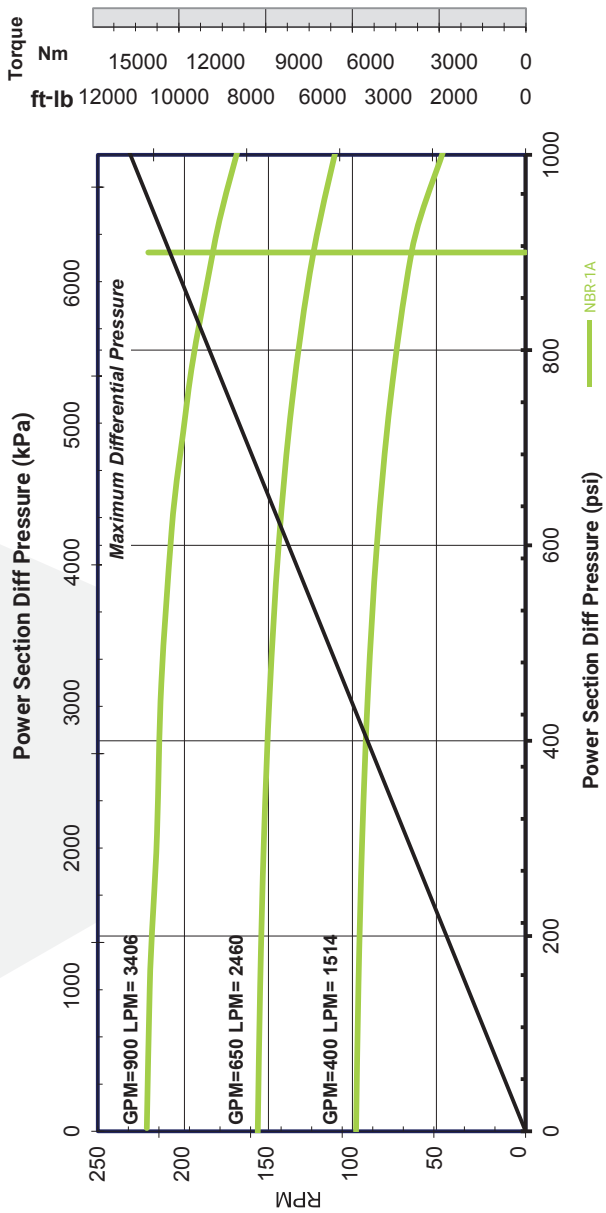
8" SPECIFICATIONS

SPECIFICATIONS		
Bit Box to Stabilizer	20 in	0.51 m
Bit Box to Bend	68 (76)* in	1.73 (1.93)* m
Bit Box to Top Sub	357 in	9.07 m
Maximum Dynamic Weight On Bit	205,000 lb	910 kN
Max. Dynamic Pull to Re-Run Motor	112,000 lb	500 kN
Max. Static Pull to Re-Run Motor	380,000 lb	1,690 kN
Pull to Yield Motor	1,000,000 lb	4,450 kN
Standard Bit Box Connections	6 5/8 Reg	
Driveline Connections Torque Limit	46,500 ft-lbs	63,000 Nm
Housing Connections Torque Limit	46,500 ft-lbs	63,000 Nm
Side Load Limit (Static)	210,000 lbf	934,000 N
Side Load Limit (Dynamic)	90,500 lbf	402,500 N

*With Adjustable Bend Housing

8" 4/5 6.0

8" 4/5 6.0



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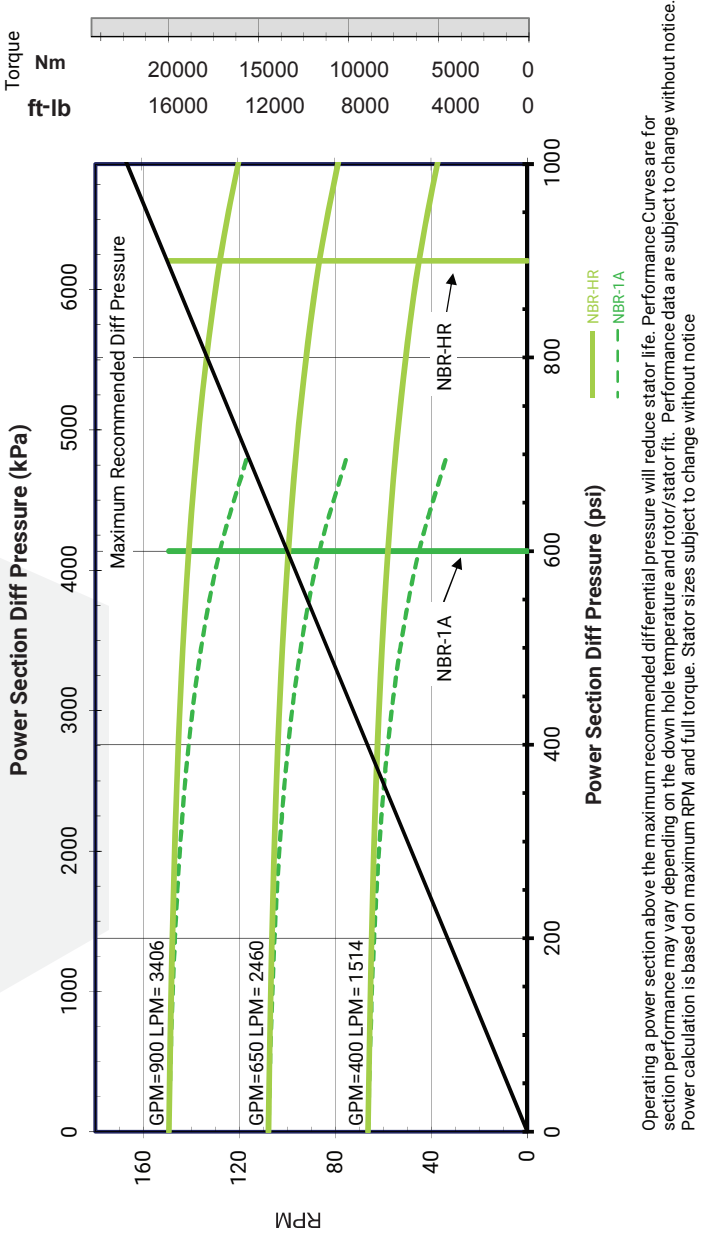
SPECIFICATIONS		
Flow Range	400 - 900 gpm	1,510 - 3,410 lpm
Revolutions per Volume	0.246 rev/gal	0.065 rev/l
Speed Range	98-230 rpm	
Max. Differential Pressure	1,350 psi	9,310 kPa
Torque @ Max. Diff. Pressure	15,300 kPa	20,750 Nm
Stall Torque	22,950 lb-ft	31,120 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	9.875"	10.625"	12.25"	9.875"	10.625"	12.25"
	251 mm	270 mm	311 mm	251 mm	270 mm	311 mm
0.39	-	-	-	3.1	0.9	-
0.78	2.2	0.8	-	5.3	3.2	-
1.15	4.3	2.9	-	7.5	5.3	0.6
1.5	6.4	5.0	1.9	9.5	7.4	2.7
1.83	8.3	6.9	3.8	11.4	9.3	4.6
2.12	10.0	8.6	5.5	13.1	11.0	6.3
2.38	11.5	10.1	7.0	14.6	12.5	7.8
2.6	12.8	11.4	8.3	15.9	13.8	9.1
2.77	13.8	12.4	9.3	16.9	14.8	10.1
2.9	14.5	13.1	10.0	17.7	15.5	10.8
2.97	15.0	13.5	10.4	18.1	15.9	11.2
3.00	15.1	13.7	10.6	18.3	16.1	11.4

*With Adjustable Bend Housing

8" 7/8 4.0

8" 7/8 4.0



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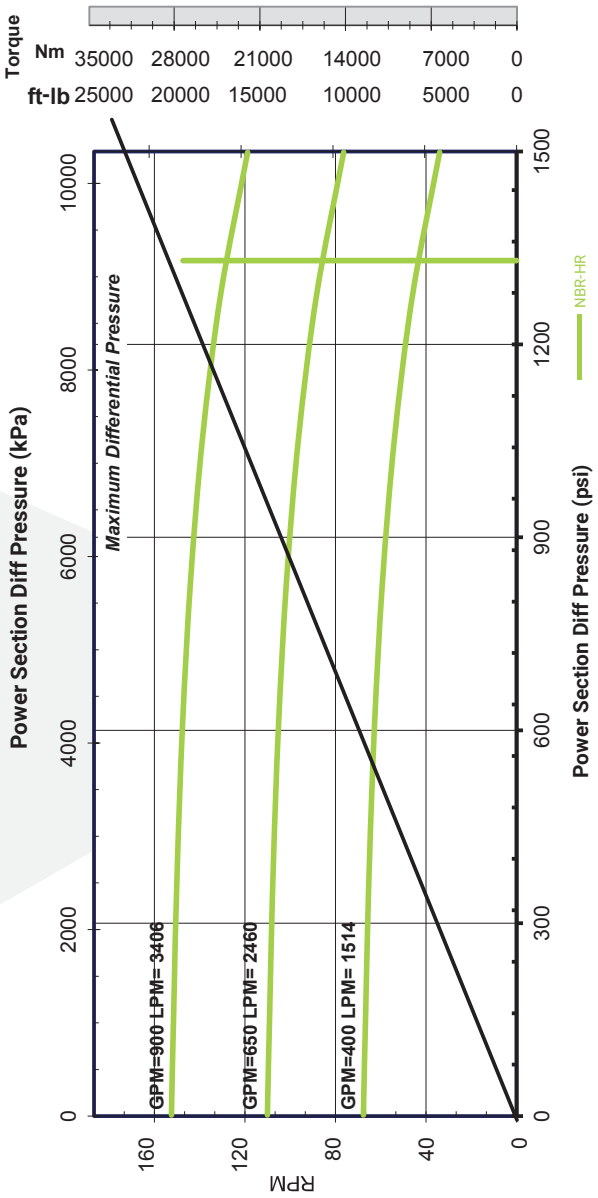
SPECIFICATIONS		
Flow Range	400 - 900 gpm	1,510 - 3,410 lpm
Revolutions per Volume	0.166 rev/gal	0.044 rev/l
Speed Range	66 - 150 rpm	
Max. Differential Pressure	900 psi	6,210 kPa
Torque @ Max. Diff. Pressure	14,930 lb-ft	20,240 Nm
Stall Torque	22,400 lb-ft	30,360 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	9.875"	10.625"	12.25"	9.875"	10.625"	12.25"
	251 mm	270 mm	311 mm	251 mm	270 mm	311 mm
0.39	0.6	-	-	2.3	2.5	3.4
0.78	2.9	1.7	-	4.5	4.4	5.4
1.15	5.0	3.8	0.6	7.0	6.5	7.5
1.5	7.1	5.8	2.6	9.6	9.1	9.4
1.83	9.5	8.0	4.9	12.1	11.7	11.2
2.12	11.6	10.1	6.8	14.4	14.0	13.1
2.38	13.4	11.8	8.6	16.5	16.1	15.2
2.6	15.0	13.2	10.0	18.2	17.8	16.9
2.77	16.2	14.5	11.2	19.6	19.2	18.3
2.9	16.9	15.4	12.0	20.5	20.1	19.2
2.97	17.4	15.9	12.5	21.3	20.8	19.8
3.00	17.5	16.1	12.7	21.5	21.0	20.0

*With Adjustable Bend Housing

8" 7/8 5.9

8" 7/8 5.9



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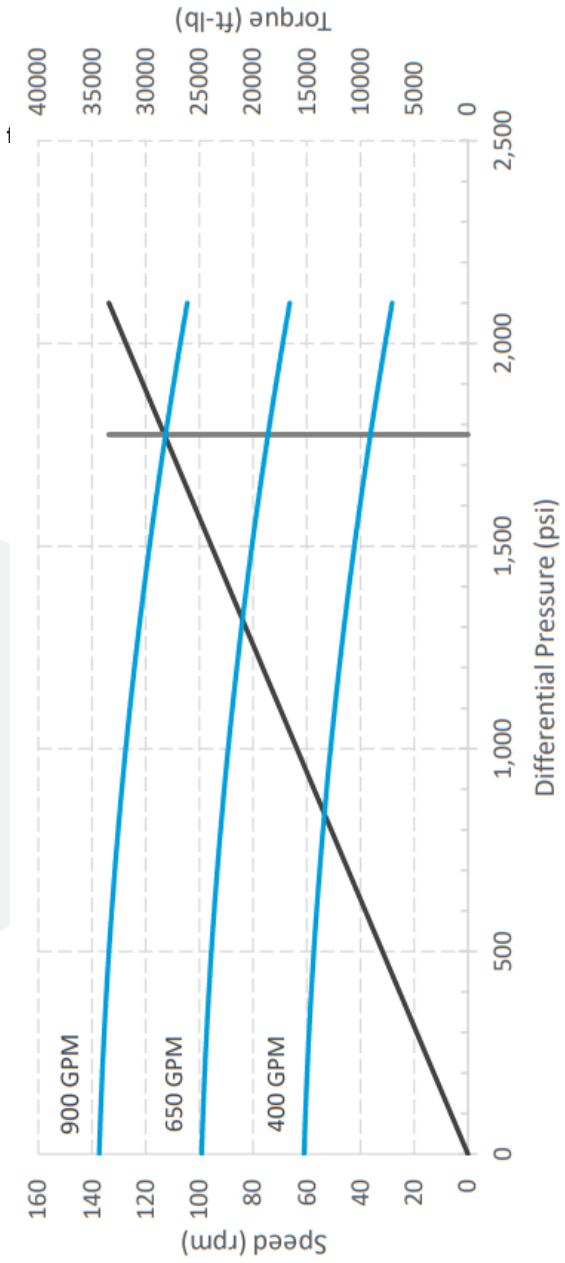
SPECIFICATIONS		
Flow Range	400 - 900 gpm	1,510 - 3,410 lpm
Revolutions per Volume	0.166 rev/gal	0.044 rev/l
Speed Range	66 - 150 rpm	
Max. Differential Pressure	1,330 psi	9,150 kPa
Torque @ Max. Diff. Pressure	22,020 lb-ft	29,860 Nm
Stall Torque	33,030 lb-ft	44,780 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	9.875"	10.625"	12.25"	9.875"	10.625"	12.25"
	251 mm	270 mm	311 mm	251 mm	270 mm	311 mm
0.39	-	-	-	2.7	0.8	-
0.78	2.0	0.7	-	4.8	2.8	-
1.15	3.9	2.6	-	6.8	4.8	0.5
1.5	5.8	4.5	1.7	8.6	6.7	2.4
1.83	7.5	6.3	3.4	10.4	8.4	4.1
2.12	9.1	7.8	5.0	11.9	9.9	5.7
2.38	10.5	9.2	6.4	13.3	11.3	7.1
2.6	11.6	10.3	7.5	14.5	12.5	8.2
2.77	12.5	11.2	8.4	15.4	13.4	9.1
2.9	13.2	11.9	9.1	16.1	14.1	9.8
2.97	13.6	12.3	9.5	16.4	14.5	10.2
3.00	13.8	12.5	9.7	16.6	14.6	10.4

*With Adjustable Bend Housing

8" 7/8 5.9 EW

8" 7/8 5.9 EW



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SPECIFICATIONS		
Flow Range	400 - 900 gpm	1,510 - 3,410 lpm
Revolutions per Volume	0.153 rev/gal	0.0404 rev/l
Speed Range	61-137 rpm	
Max. Differential Pressure	1,780 psi	12,273 kPa
Torque @ Max. Diff. Pressure	28,260 lb-ft	38,315 Nm
Stall Torque	44,410 lb-ft	60,212 Nm

PREDICTED BUILD RATES - DEGREES/100 FT (30 M)						
Bend Setting	Slick Hole Size			Single Stabilizer Hole Size		
	9.875"	10.625"	12.25"	9.875"	10.625"	12.25"
	251 mm	270 mm	311 mm	251 mm	270 mm	311 mm
0.39	-	-	-	2.7	0.8	-
0.78	2.0	0.7	-	4.8	2.8	-
1.15	3.9	2.6	-	6.8	4.8	0.5
1.5	5.8	4.5	1.7	8.6	6.7	2.4
1.83	7.5	6.3	3.4	10.4	8.4	4.1
2.12	9.1	7.8	5.0	11.9	9.9	5.7
2.38	10.5	9.2	6.4	13.3	11.3	7.1
2.6	11.6	10.3	7.5	14.5	12.5	8.2
2.77	12.5	11.2	8.4	15.4	13.4	9.1
2.9	13.2	11.9	9.1	16.1	14.1	9.8
2.97	13.6	12.3	9.5	16.4	14.5	10.2
3.00	13.8	12.5	9.7	16.6	14.6	10.4

*With Adjustable Bend Housing

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