

Black Diamond UltraMotor Handbook



BLACK  DIAMOND

INNOVATION | TECHNOLOGY | SERVICES



UltraMotor Handbook



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INTRODUCTION



Black Diamond

Black Diamond motors have established an enviable reputation for performance, reliability and excellent service. Our motors provide superior performance and longer operating life, in today's extremely demanding drilling conditions.

We provide a versatile range of sizes and types of motors for a wide range of applications. Black Diamond Motors incorporate numerous exclusive technology improvements in its bearing assemblies and drive line designs.

◆ OEM = Unrivaled Process Control ◆

As the Original Equipment Manufacturer (OEM) of UltraMotors, Black Diamond not only designs and builds each motor to exacting standards but also manages the entire service process, delivering exceptional reliability and performance across the motor's entire life cycle. By owning every phase - from design and production to service and end-of-life planning - we maintain rigorous quality control that ensures UltraMotors perform consistently, even in demanding environments.

Our commitment to quality extends to robust testing and inspection protocols that verify performance at every stage. Every UltraMotor undergoes comprehensive testing to meet our stringent specifications before it reaches the field, and our service process includes meticulous maintenance and quality checks to maximize operational uptime and durability.

At the end of the motor's operational life, we also offer end-of-life rotor and motor planning, ensuring sustainable and efficient reuse or disposal. This full-service approach allows us to provide unmatched dependability, streamlined maintenance, and optimized performance, making Black Diamond UltraMotors a top choice for long-term reliability and support.

This handbook presents the technical specifications for the motor assemblies provided by Black Diamond.

The handbook includes the following sections:

- Motor Description
- Motor Assembly Configuration Summaries
- Motor Specifications
- Tables and Formulas





Motor Description



Positive displacement mud motors (PDMs) are essential tools in directional drilling, designed to convert the hydraulic energy of drilling fluid into mechanical rotation. These motors use a rotor-and-stator assembly to generate torque and rotational power, allowing the drill bit to operate independently of the drill string's rotation. PDMs are highly versatile, offering improved performance in challenging formations, better control over directional trajectories, and the ability to maintain consistent drilling rates under variable downhole conditions.

Rotor Catch

The rotor catch system is built into the upper section of the motor and is designed to reduce the risk of losing motor components downhole in case of a major failure. When an external motor connection fails, it results in a significant pressure drop while drilling. If the motor separates, the Bottom Hole Assembly (BHA) is lifted off-bottom, triggering the catch system. This mechanism keeps the motor sections together, causing a pressure spike to alert the drilling crew of potential motor damage. The motor should then be tripped out right away, avoiding over-pull or rotation, to increase the likelihood of safely retrieving the entire motor.

Power Section

The Moineu principle progressing cavity power section converts hydraulic horsepower of the drilling fluid (pressure and flow) into mechanical horsepower (torque and rpm). The power section of the motor includes the rotor and stator, which convert the hydraulic energy of drilling fluid into rotational horsepower as the fluid is pumped down from the surface. The rotor—a long spiral shaft—fits within the stator and is made from solid stainless steel, coated with chrome or carbide to protect against corrosion and reduce friction. The stator, in turn, is a non-rotating, heat-treated tube lined with elastomer, featuring a spiral geometry to match the rotor.

In a positive displacement setup, the rotor has one less lobe than the stator, creating a series of sealed cavities as the rotor moves. The performance characteristics of these power sections are determined by the lobe configuration and number of stages. As drilling fluid flows through these cavities under high pressure, the rotor rotates eccentrically within the stator.

This rotation is governed by certain parameters: the rotor speed is proportional to fluid flow rate, and torque depends on the pressure differential across the power section. Additionally, power sections with higher lobe ratios produce more torque at a slower rotary speed, while longer stages increase torque but reduce RPM at a given flow rate.

Black Diamond offers a wide range of configurations to provide the performance required by our customers

Bent Housing

By introducing a bend in the motor the Bent Housing provides directional drilling ability and control. An oversized bore through the Black Diamond Bent Housing will accept the large diameter drive lines and universal joints necessary to transmit the higher torques developed by today's power sections. Black Diamond also offers Straight Housings.

Drive Shaft and Universal Joint

The Drive Shaft fitted with a Universal Joint at each end, connects the rotor in the power section to the output mandrel in the bearing assembly. The Universal Joints change the eccentric rotation of the rotor, to concentric rotation of the output mandrel. Black Diamond assemblies incorporate a patented design, greatly increasing torsional strength and reliability.

Bearing Assembly

The Bearing Assembly contains the rotating output shaft and must resist extreme radial and axial forces. A range of bearing assemblies, designed to meet the diverse requirements of the drilling industry, are available. These bearing assemblies utilize components specifically designed to withstand the increased torques developed by current power sections.





UltraMotor Excellence



Designed with patented technology for reliability Black Diamond's UltraMotors incorporate the latest developments in high torque – high speed power sections to provide users with an exemplary tool for delivering superior performance in aggressive wells. In-house manufactured components adhere to Black Diamond's high standard of premium materials and quality production.

FEATURES & BENEFITS

M Series UltraMotors

Black Diamond UltraMotors offer the flexibility needed to meet the wide range of applications in which they are deployed. Utilizing patented driveline technology, maximized thru-bore and bypass ports, and enhanced geometry, the M Series gives you a tool you can count on for superior performance. Each of the three M-Series motors can be trusted to perform in any section of the well but are also recognized for their specific designs which are proven to succeed in the most challenging operations:

- **M40** - A standard bit-to-bend length makes this high performance motor the choice for the drilling of high precision curves.
- **M41** - A longer bit-to-bend and increased WOB and overpull capacities make this the standard solution for laterals and shallow tangents.
- **M42** - Also known as the Matador, this system has been designed specifically for motor assisted RSS operations. >30% reduction in fluid bypass ensures maximum flow reaches the RSS. The tool is often deployed in a pin-down configuration.



Market Leading Flex-Shaft Drivelines

Black Diamond are in a unique position to offer TWO market leading drivelines - the legendary WK5 and the streamlined ST1. The unique designs allow for unparalleled flexibility in navigating the complexities of down-hole environments while delivering exceptional strength and resilience. This results in unmatched reliability while supporting higher torque limits and maximizes drilling efficiency by transmitting power with minimal loss.

WK5

The legendary Maxi-Torque WK5 Hybrid Flex Driveline features a superior lower universal and single-piece upper connection. The single articulating CV joint features surface hardening and provides over 100% more contact area to keys.

Additionally, a single piece drive-shaft-to-rotor connection eliminates accelerated wear. It is the optimum choice for use with even wall technology, hard rubber, and other high torque power sections.



ST1

The ST1 Hybrid Flex Driveline sets a new benchmark in downhole performance offering superior durability, efficiency, and reliability in the toughest drilling environments. With a two-component articulating joint, the ST1 outshines traditional multi-component designs, significantly reducing wear and tear. This streamlined construction not only extends the ST1's usage life but also ensures consistent performance in challenging conditions. Designed for higher torsional and shear stress capacity, the ST1 Hybrid Flex delivers greater power and resilience, enabling it to tackle high-demand drilling operations with ease. Its advanced hybrid design minimizes vibration, maximizes torque transfer, and promotes smoother operations - all while improving overall efficiency.

For a driveline that works harder, lasts longer, and powers through the toughest tasks, choose a Black Diamond Driveline. Stronger. Smarter. Built for your success.



BLACK DIAMOND





UltraMotor Excellence



Proven Bearing Technology

Our bearings are custom designed for mud lubricated applications. The industry proven thrust and radial bearings deliver superior uniform and consistent load distribution and maximized WOB capacity. This is all achieved with our proprietary compact design.



Performance Optimized Elastomers

Black Diamond recognizes that operational success often relies on flexibility to exactly meet the environmental constraints faced in the current industry. To this end we offer a wide range of elastomers and work closely with our suppliers to ensure the highest quality is always delivered.

Adding a range of fit options ensures power delivery exactly matches operational needs.

Housing and Mandrel Connections

The UltraMotor housing connections feature increased thread root radii, which enables more effective cold working of threads and reduces stress applied to connections for improved fatigue life under increased side loads. Additionally, our new mandrel boasts a larger OD that substantially increases torque capacity and rigidity.

RSS Ready

As Motor Assisted RSS (MARSS) operations become more common Black Diamond is ready to provide the best motor solutions. Pin Down mandrel & straight housing options achieve high downhole RPM with RSS, while the M42 **Matador** Motor has been specifically designed for MARSS operations.

Typical mud-lubricated motors can start a run with 5% bypass which can increase to 15% or more by the end of the run. This loss of effective flow at the RSS can severely affect its performance and even its functionality which would be further amplified in flow control situations.

Black Diamond's **Matador** solves this effective loss of RSS performance by optimizing the fluid bypass across the entire run. By maintaining a consistent fluid loss the RSS achieves expected pad force and so predictable, high-performance directional control leading to higher effective ROP and a better quality well-bore.



- 30 % decrease in bypass compared to competition
- High torque rotor connection
- New bearing assembly optimized for 5.25" OD
- Tough integral mandrel catch mechanism will not back off in a fishing operation





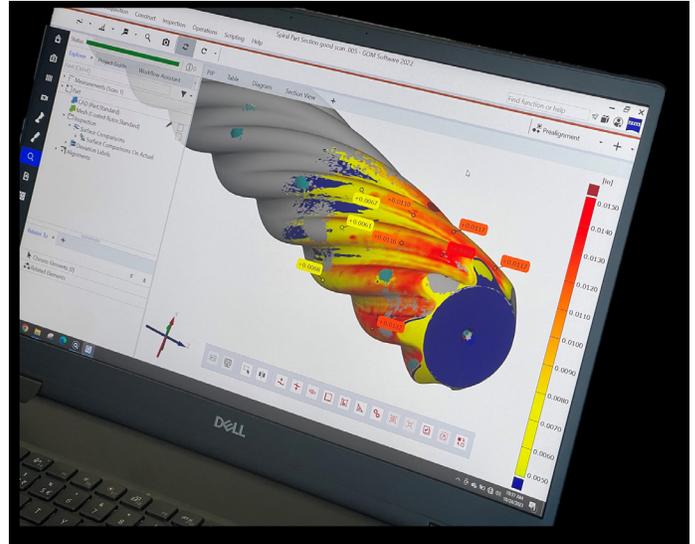
UltraMotor Excellence



End of Life Motor & Rotor Planning

Black Diamond owns every step of the manufacture and service of UltraMotors placing us in the enviable position of having control of ALL data collected during the entire life cycle of a motor. Employing advanced testing and scanning technologies combined with sophisticated data analysis Black Diamond ensures timely retirement and replacement of all critical parts before any risk of failure can be encountered.

The robust, and ever evolving, program effectively mitigates costly age related failures and ultimately delivers the quality and trust for which Black Diamond is famed.





CONFIGURATION SUMMARIES

UltraMotor Options



UltraMotor Options																				
Bearing Assembly	5-1/4				5-1/4				5-1/2				5-3/4				6-1/2			
Series	M40				M42				M40				M40				M40			
Bit to Fixed Bend (inches)	40				N/A				43				47				51			
Bit to Adjustable Bend (inches)	N/A				N/A				N/A				58				N/A			
Top Sub Options ¹	NC38 (3-1/2 IF), XT-39, DS42, NC40				NC38 (3-1/2 IF), XT-39, DS42				NC38 (3-1/2 IF), XT-39, DS42				NC38 (3-1/2 IF), XT-39, DS42				NC50 (5 XH, 4-1/2 IF), NC46 (4 IF, 4-1/2 XH)			
Bit Box Options ¹	3-1/2 Reg, NC40 (4 FH), XT-39 Pin Down				XT-39 Pin Down				3-1/2 Reg, NC40 (4 FH), XT-39 Pin Down				3-1/2 Reg, NC40 (4 FH), XT-39 Pin Down				4-1/2 Reg, 4-1/2 IF Pin Down			
Powers Size Configuration RPG Flow Range	525	7/8 8.3	0.480	200-400	525	7/8 8.3	0.480	200-400	550	7/8 8.5	0.500	240-440	575	6/7 10.6	0.600	300-500	625	7/8 3.0	0.196	300-600
																	650	7/8 6.0	0.288	300-650
																	650	7/8 3.0	0.155	300-600
																	663	5/6 9.5	0.340	450-750
																	675	7/8 6.4	0.288	300-650
																	675	7/8 5.7	0.242	300-650
Fixed Bend Options	Straight, 150, 175, 183, 2.00, 2.12, 2.25, 2.38				Straight				Straight, 150, 175, 183, 2.00, 2.12, 2.25, 2.38				Straight, 150, 175, 183, 2.00, 2.12, 2.25, 2.38				Straight, 150, 175, 183, 2.00, 2.12, 2.25, 2.38			
Adjustable Bend Options	N/A				N/A				N/A				0.00 - 3.00				N/A			
Stabilization Options	True Slick Integrated Integral Blade Stabilizer				True Slick Integrated Integral Blade Stabilizer				True Slick Integrated Integral Blade Stabilizer				True Slick Integrated Integral Blade Stabilizer				True Slick Integrated Integral Blade Stabilizer Slick Sleeve Screw-On Stabilizer			

¹other options are available on request

Bearing Assembly	7-1/4				7-1/4				8-1/4				9-5/8			
Series	M40				M41				M40				M40			
Bit to Fixed Bend (inches)	45				60				52				78			
Bit to Adjustable Bend (inches)	57				72				66				94			
Top Sub Options ¹	NC50 (5 XH, 4-1/2 IF), NC46 (4 IF, 4-1/2 XH)				NC50 (5 XH, 4-1/2 IF), NC46 (4 IF, 4-1/2 XH)				6-5/8 IF				6-5/8 IF			
Bit Box Options ¹	4-1/2 Reg, 4-1/2 IF Pin Down				4-1/2 Reg, 4-1/2 IF Pin Down				6-5/8 Reg, 7-5/8 Reg, 6-5/8 Reg Pin Down				6-5/8 Reg, 7-5/8 Reg			
Powers Size Configuration RPG Flow Range	675	7/8 5.7	0.242	300-650	675	7/8 5.7	0.242	300-650	800	7/8 3.4	0.089	400-900	962	5/6 4.0	0.108	600-1200
	700	6/7 4.6	0.150	400-800	700	6/7 4.6	0.150	400-800	800	7/8 4.0	0.166	400-900	800	7/8 3.4	0.089	400-900
	700	5/6 8.3	0.380	350-750	700	7/8 8.5	0.240	400-750	825	7/8 7.0	0.166	400-1000	800	7/8 4.0	0.166	400-900
	700	7/8 8.5	0.240	400-750	725	5/6 9.6	0.380	350-700					825	7/8 7.0	0.166	400-1000
	725	5/6 9.6	0.380	350-700	725	6/7 12.1	0.400	300-800								
	725	6/7 12.1	0.400	300-800												
Fixed Bend Options	Straight, 150, 175, 183, 2.00, 2.12, 2.25, 2.38				Straight, 150, 175, 183, 2.00, 2.12, 2.25, 2.38				Straight, 150, 175, 183, 2.00, 2.12, 2.25, 2.38				Adjustable Housing 0.00 - 3.00			
Adjustable Bend Options	0.00 - 3.00				0.00 - 3.00				0.00 - 3.00				0.00 - 3.00			
Stabilization Options	True Slick Integrated Integral Blade Stabilizer				True Slick Integrated Integral Blade Stabilizer				True Slick Integrated Integral Blade Stabilizer Slick Sleeve Screw-On Stabilizer				Slick Sleeve Screw-On Stabilizer			

¹other options are available on request





CONFIGURATION SUMMARIES

Bearing Assemblies



Motor Size (in.)		5 1/4	5 1/4	5 1/2	5 3/4	6 1/2	7 1/4	7 1/4	8 1/4	9 5/8
Nominal BA OD (in.)		5.25	5.25	5.50	5.75	6.50	7.25	7.25	8.25	9.625
Series		M40	M42 ¹	M40	M40	M40	M40	M41	M40	M40
Bit Box to Stabilizer (in.)		22	N/A	29	29	29	25	30	29	46
Bit Box to Fixed Bend (in.)		40	N/A	43	47	51	45	60	52	78
Hole Size (in.)		6 1/8 - 7 7/8	6 1/8 - 7 7/8	6 3/4 - 8 1/2	6 3/4	7 7/8 - 9 7/8	8 1/2 - 9 7/8	8 1/2 - 9 7/8	9 7/8 - 12 1/4	12 1/4 - 17 1/2
Standard Bit Box Thread		3-1/2 Reg NC40 (4 FH) XT-39 Pin Down	XT-39 Pin Down	3-1/2 Reg NC40 (4 FH) XT-39 Pin Down	3-1/2 Reg NC40 (4 FH) XT-39 Pin Down	4-1/2 Reg 4-1/2 IF Pin Down	4-1/2 Reg 4-1/2 IF Pin Down	4-1/2 Reg 4-1/2 IF Pin Down	6-5/8 Reg 7-5/8 Reg 6-5/8 Reg Pin Down	6-5/8 Reg 7-5/8 Reg
Op. Capacity	WOB (klbs)	68	74	48.5	57.5	90.2	92	95.1	97.25	132
	Bit Overpull (klbs)	68	74	48.5	57.5	90.2	92	95.1	97.25	132
	Torsional Limit (klbf-ft)	9	10	11	12	17	21	21	28	41.5
	Flow Rate (gpm)	450	450	550	550	600	850	850	1,200	1,500
Static Capacity	WOB to Re-run (klbs)	181	230	231	254	358	355	487.5	463	772
	Bit Overpull to Re-run (klbs)	127	155	169	212	222	319	131.5	326	485
	Absolute Body Overpull (klbs)	424	424	440	499	524/ 545/ 539	539/ 659	539/ 659	783	1,177
	Torsional Limit (klbf-ft)	14	14	16	17	27	34	34	45	66

¹ Matador - Motor Assisted RSS Operations





CONFIGURATION SUMMARIES

Power Sections 5 1/4" - 6 3/4"



Motor Size (in.)	Power Config.	Speed Range (RPM)	Rotation (rev/gal)	Torque Slope (rev/gal)	Elastomer	Max Diff. Pressure (psi)	Stall Torque (lbf-ft)	Max Power (hp)
5 1/4	7/8 8.3	100-190	0.48	4.800	NBR-HPO/ NBR-HPW	1,960	9,370	340
5 1/2	7/8 8.5	120-220	0.5	5.087	XR/ XP	1,910	14,590	348
					XE	2,130	16,220	386
5 3/4	6/7 10.6	180-300	0.6	4.290	XR/ XP	2,390	15,350	490
					XE	2,650	17,050	544
6 1/4	7/8 3.0	59-117	0.196	12.639	HR	680	12,800	172
					XP	750	14,220	164
					XE	830	15,640	178
6 1/2	7/8 6.0	86-187	0.288	9.300	HR	1,350	18,830	410
					XR	1,350	18,830	398
					XP	1,500	20,930	406
					XE	1,650	23,020	441
6 1/2	7/8 3.0	46-93	0.155	16.001	NBR-1A	450	10,800	110
					XR/ HR	680	16,200	165
					XP	750	18,000	183
6 5/8	5.6 9.5	150-260	0.340	7.49	NBR-HPO/ NBR-HPW	2,240	26,350	828
6 3/4	7/8 6.4	86-187	0.288	9.300	HR	1,440	20,090	437
					XR	1,440	20,090	425
					XP	1,600	22,320	433
					XE	1,760	24,550	469
6 3/4	7/8 5.7	73-157	0.242	10.698	HR	1,280	20,580	378
					XR	1,280	20,580	363
					XP	1,430	22,870	366
					XE	1,570	25,150	395





CONFIGURATION SUMMARIES

Power Sections 7" - 9 5/8"



Motor Size (in.)	Power Config.	Speed Range (RPM)	Rotation (rev/gal)	Torque Slope (rev/gal)	Elastomer	Max Diff. Pressure (psi)	Stall Torque (lbf-ft)	Max Power (hp)
7	5/6 8.3	130-290	0.380	6.68	NBR-HPW/ NBR-HPO	1,960	20,530	720
7	6/7 4.6	60-120	0.150	17.173	HR	1,040	26,660	353
					XR	1,040	26,660	332
					XP	1,150	29,620	316
					XE	1,270	32,590	338
7	7/8 8.5	96-180	0.240	9.783	HR	1,910	28,060	588
					XR	1,910	28,060	570
					XP	2,130	31,180	580
					XE	2,340	34,300	627
7 1/4	6/7 12.1	120-320	0.400	6.44	HR	2,720	26,300	1,011
					XR	2,720	26,300	987
					XP	3,030	29,220	1,023
					XE	3,330	32,140	1,112
7 1/4	5/6 9.6	130-270	0.380	6.68	NBR-HPW NBR-HPO	2,260	23,740	730
8	7/8 3.4	36-80	0.089	28.040	HR	770	32,180	289
					XR	770	32,180	273
					XP	850	35,750	269
					XE	940	39,330	290
8	7/8 4.0	66-149	0.166	16.589	HR	900	22,400	387
					XR	900	22,400	374
					XP	1,000	24,880	379
					XE	1,100	27,370	409
8 1/4	7/8 7.0	66-166	0.166	15.323	HR	1,580	36,200	700
					XR	1,580	36,200	678
					XP	1,750	40,220	695
					XE	1,930	44,250	752
9 5/8	5/6 4.0	65-130	0.108	21.373	HR	900	28,850	412
					XR	900	28,850	387
					XP	1,000	32,060	356
					XE	1,100	35,270	380





MOTOR SPECIFICATIONS



Introduction

This section provides essential information on the physical attributes and performance specifications of Black Diamond drilling motors.

Black Diamond is dedicated to the continual advancement of its drilling motor technology and operational procedures. As part of this commitment, the information in this guide may be updated periodically without prior notice.

For each motor, we provide detailed graphs illustrating the correlation between flow rate, RPM, torque, and differential pressure. Correct interpretation of these graphs is essential for operating the motors within recommended limits.

Power Graph Interpretation

To determine the speed (RPM) of the motor:

1. Identify the required differential pressure on the horizontal axis.
2. Project a vertical line upwards from the differential pressure until intersects the RPM curve for the desired flow rate.
3. Project a horizontal line from the intersection point to the vertical RPM axis on the left to determine the bit speed for the given flow rate and differential pressure.

Note that the RPM graph can be extrapolated to determine speeds for flow rates not shown. Flow Rate lines can be added by determining the starting position on the vertical axis and then drawing a line parallel to the other flow rate curves.

To determine the output torque of the motor:

1. Identify the required differential pressure on the horizontal axis.
2. Project a vertical line upwards until it intersects the torque line.
3. Project a horizontal line from the intersection point to the vertical torque axis on the right to determine the torque for the given and differential pressure.



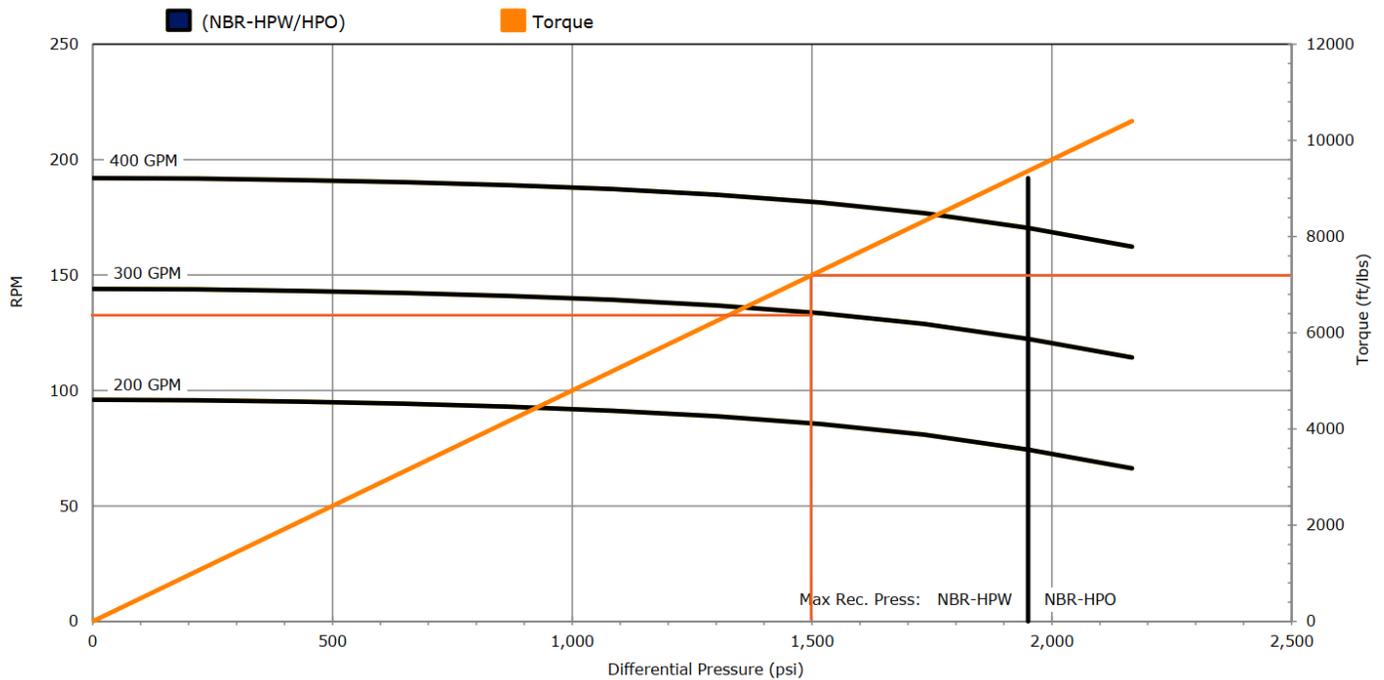


Motor Specifications



Example

For a flow rate of 300 GPM and a differential pressure of 1,500 psi the motor speed will be 135 RPM. The motor will generate 7,200 lbf-ft of torque.





5.25" UltraMotor

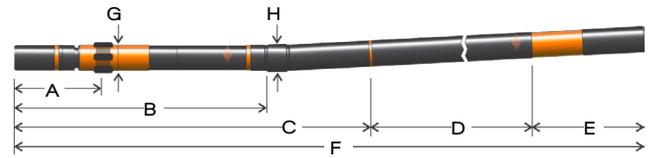
7/8 - 8.3 Stages M40



Motor Specifications

Bit Box to Stabilizer	A	22 in.
Bit Box to Bend (FBH)	B	40 in.
Bottom End Length	C	84 in.
Power Section Length	D	see Power Section
Top End Length	E	45 in.
Total Length	F	C + D + E
Body Outer Diameter	G	5.25 in.
Crown Pad Radius	H	2.93 in.
Recommended Hole Size	6-1/8 - 7-7/8 in.	
Standard Bit Box Connection ¹	3-1/2 REG, NC40 (4 FH),	
Standard Pin Down Connection ¹	XT-39	
Standard Top Box Connection ¹	NC 38 (3-1/2 IF), XT-39, DS42	
Total Weight	1,103 lbs	
Operating Capacity	Max. WOB	68,000 lbs
	Max. Bit Overpull	68,000 lbs
	Torsional Limit	9,000 lbf-ft
Static Capacity	Max. WOB to Re-run	181,000 lbs
	Max. Bit Overpull to Re-run	127,000 lbs
	Absolute Body Overpull	424,000 lbs
	Torsional Limit	14,000 lbf-ft

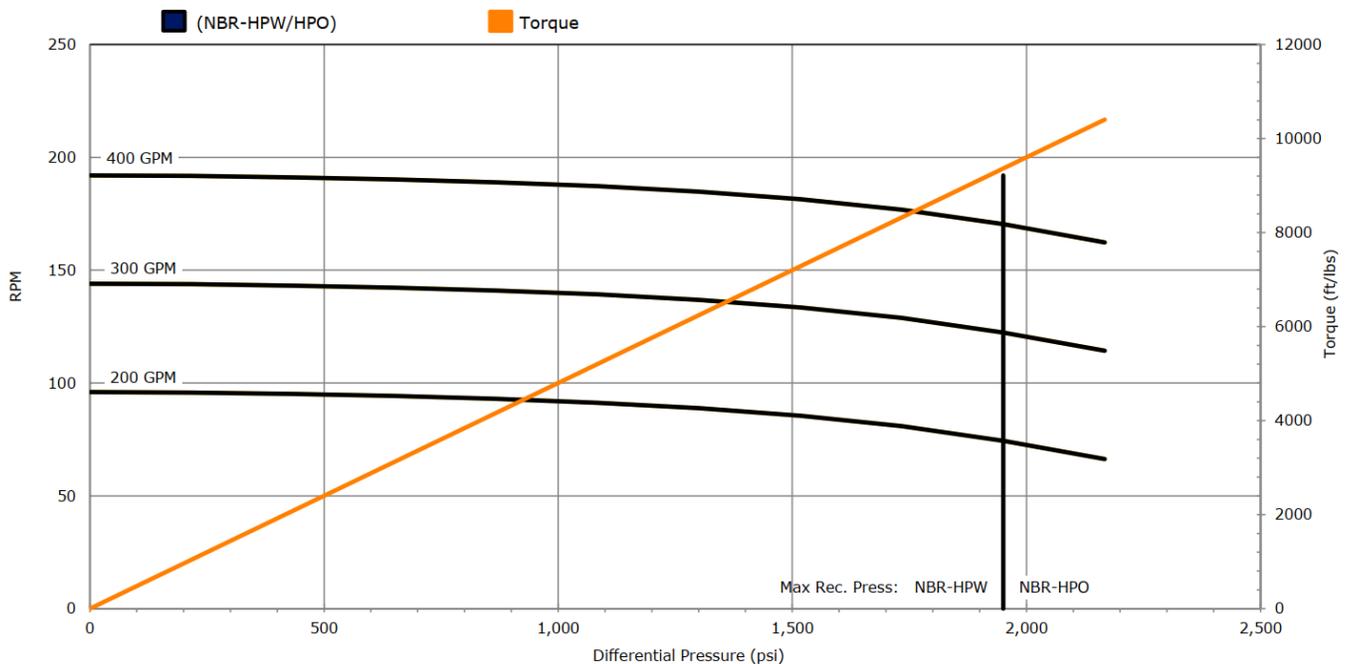
¹other options available on request



Power Section

Elastomer	NBR-HPO/ NBR-HPW
Configuration	7/8 Lobes 8.3 Stages
Stator Length New (in.)	275
Stator OD (in.)	5.25
Speed Range (rpm)	100-190
Flow Range (gpm)	200-400
Rotation (rev/gal)	0.480
Torque Slope (rev/gal)	4.80
Off Bottom Pressure (psi)	110
Max Diff Pressure (psi)	1,960
Max Torque (lbf-ft)	9,370
Stall Diff Pressure (psi)	3,080
Stall Torque (lbf-ft)	14,750
Max Power (hp)	340

POWER SECTION POWER CURVES



BLACK DIAMOND





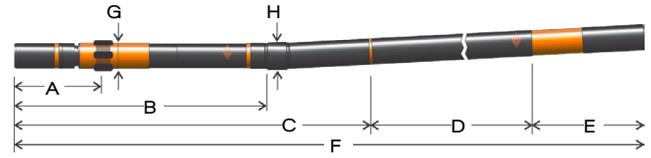
5.5" UltraMotor

7/8 - 8.5 Stages M40



Motor Specifications

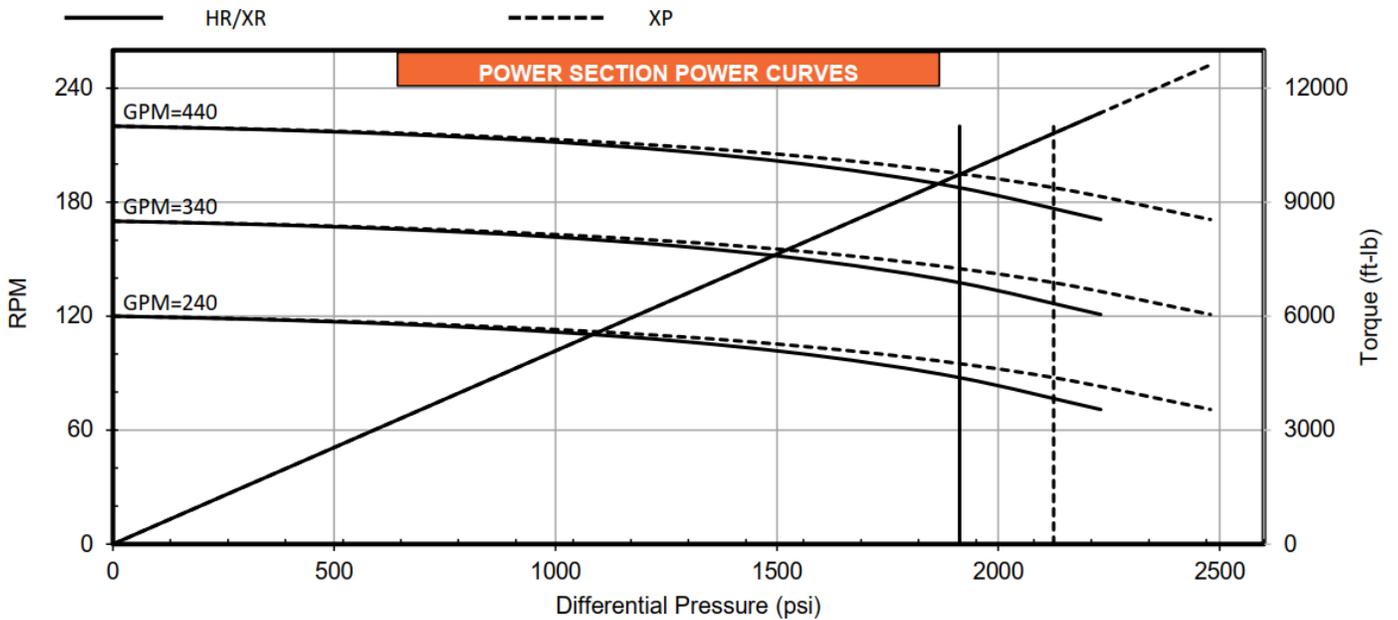
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	43 in.
Bottom End Length	C	91 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	5.50 in.
Crown Pad Radius	H	3.06 in.
Recommended Hole Size		6-3/4 in.
Standard Bit Box Connection ¹		3-1/2 REG, NC40 (4 FH),
Standard Pin Down Connection ¹		XT-39
Standard Top Box Connection ¹		NC38 (3-1/2 IF), XT39, DS42, NC40
Total Weight		1,935 lbs
Operating Capacity	Max. WOB	48,500 lbs
	Max. Bit Overpull	48,500 lbs
	Torsional Limit	11,000 lbf-ft
Static Capacity	Max. WOB to Re-run	231,000 lbs
	Max. Bit Overpull to Re-run	169,000 lbs
	Absolute Body Overpull	474,000 lbs
	Torsional Limit	16,000 lbf-ft



Power Section

Elastomer	XR	XP	XE
Configuration	7/8 Lobes 8.5 Stages		
Stator Length New (in.)	280		
Stator OD (in.)	5.50		
Speed Range (rpm)	120 - 220		
Flow Range (gpm)	240 - 440		
Rotation (rev/gal)	0.5		
Torque Slope (rev/gal)	5.087		
Off Bottom Pressure (psi)	135		
Max Diff Pressure (psi)	1,910	1,910	2,130
Max Torque (lbf-ft)	9,730	9,370	10,810
Stall Diff Pressure (psi)	2,870	2,870	3,190
Stall Torque (lbf-ft)	14,590	14,590	16,220
Max Power (hp)	348	348	386

¹other options available on request



Maximum Differential Pressure Shown as Vertical Lines



BLACK DIAMOND





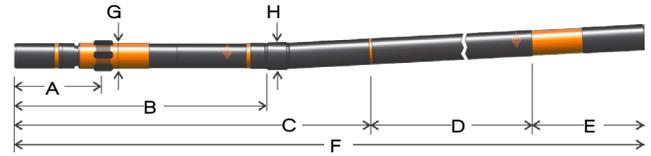
5.75" UltraMotor

6/7 - 10.6 Stages M40



Motor Specifications

Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	47 in.
Bit Box to Adj. Bend	B	58 in.
Bottom End Length	C	88 in.
Power Section Length	D	see Power Section
Top End Length	E ²	31 in.
	E ³	54 in.
Total Length	F	C + D + E
Body Outer Diameter	G	5.75 in.
Crown Pad Radius	H	3.19 in.
Recommended Hole Size		6-3/4 in.
Standard Bit Box Connection ¹		3-1/2 REG, NC40 (4 FH)
Standard Pin Down Connection ¹		XT-39
Standard Top Box Connection ¹		NC38 (3 1/2 IF), XT39, DS42
Total Weight		XXXXX lbs
Operating Capacity	Max. WOB	57,500 lbs
	Max. Bit Overpull	57,500 lbs
	Torsional Limit	12,000 lbf-ft
Static Capacity	Max. WOB to Re-run	254,000 lbs
	Max. Bit Overpull to Re-run	212,000 lbs
	Absolute Body Overpull	499,000 lbs
	Torsional Limit	17,000 lbf-ft



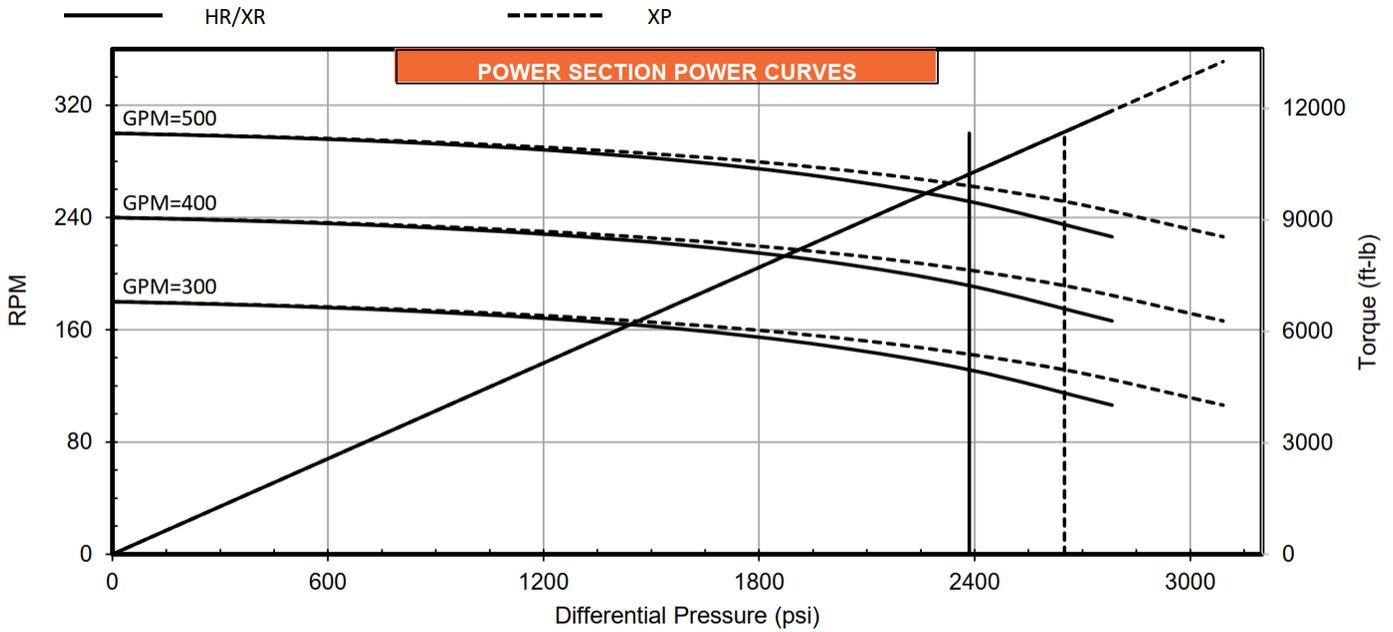
Power Section

Elastomer	XR	HR	XP
Configuration	6/7 Lobes 10.6 Stages		
Stator Length New (in.)	280		
Stator OD (in.)	5.75		
Speed Range (rpm)	180 - 300		
Flow Range (gpm)	300 - 500		
Rotation (rev/gal)	0.6		
Torque Slope (rev/gal)	4.290		
Off Bottom Pressure (psi)	193		
Max Diff Pressure (psi)	2,390	2,390	2,650
Max Torque (lbf-ft)	10,230	10,230	11,370
Stall Diff Pressure (psi)	3,580	3,580	3,980
Stall Torque (lbf-ft)	15,350	15,350	17,050
Max Power (hp)	490	490	544

¹other options available on request

²Rotor Retainer Sub w/Flex

³Rotor Retainer Sub + Flex Top Sub



Maximum Differential Pressure Shown as Vertical Lines



BLACK DIAMOND





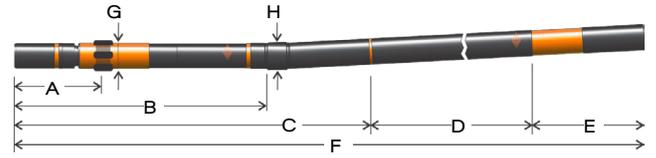
6.25" UltraMotor 7/8 3.0 Stages Slow M40



Motor Specifications

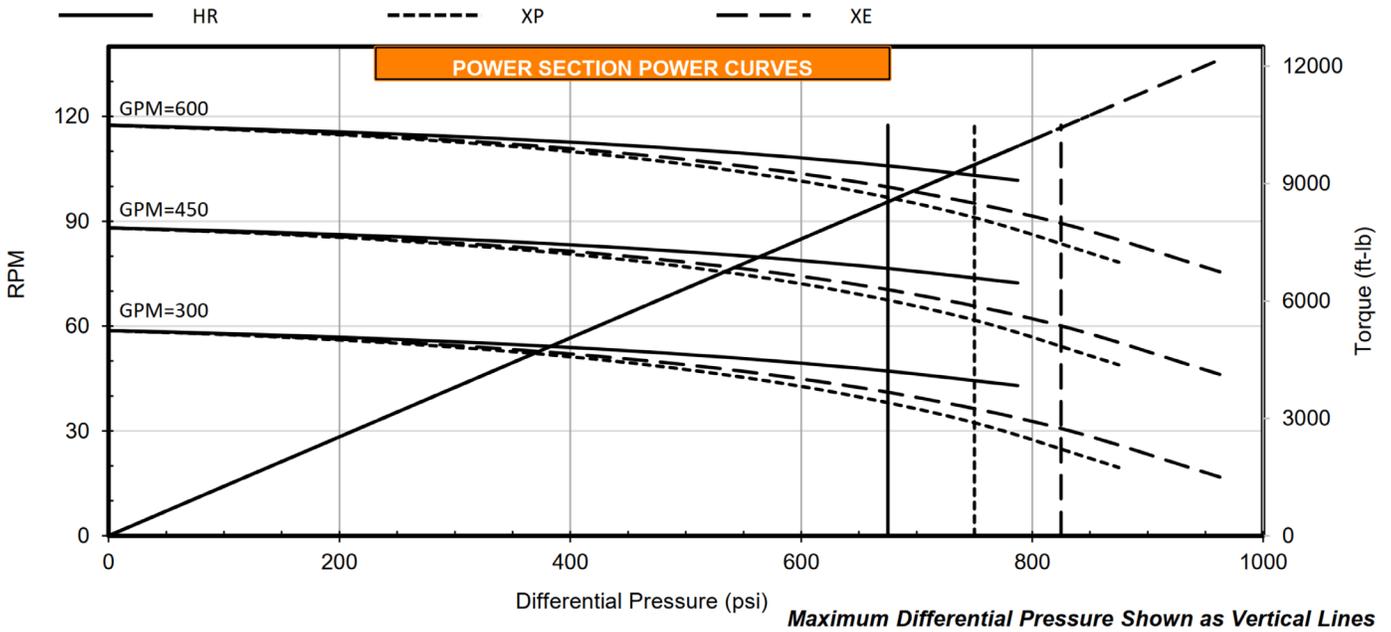
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	51 in.
Bottom End Length	C	101 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	6.50 in.
Crown Pad Radius	H	3.68 in.
Recommended Hole Size	7-7/8 - 9-7/8 in.	
Standard Bit Box Connection ¹	4-1/2 REG	
Standard Pin Down Connection ¹	4-1/2 IF	
Standard Top Box Connection ¹	NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)	
Total Weight	2,411 lbs	
Operating Capacity	Max. WOB	90,200 lbs
	Max. Bit Overpull	90,200 lbs
	Torsional Limit	17,000 lbf-ft
Static Capacity	Max. WOB to Re-run	358,000 lbs
	Max. Bit Overpull to Re-run	222,000 lbs
	Absolute Body Overpull	524,000 lbs
	Torsional Limit	27,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XP	XE
Configuration	7/8 Lobes 3.0 Stages		
Stator Length New (in.)	204		
Stator OD (in.)	6.25		
Speed Range (rpm)	59 - 117		
Flow Range (gpm)	300 - 600		
Rotation (rev/gal)	0.196		
Torque Slope (rev/gal)	12.639		
Off Bottom Pressure (psi)	87		
Max Diff Pressure (psi)	680	750	830
Max Torque (lbf-ft)	8,530	9,480	10,430
Stall Diff Pressure (psi)	1,010	1,130	1,240
Stall Torque (lbf-ft)	12,800	14,220	15,640
Max Power (hp)	172	164	178





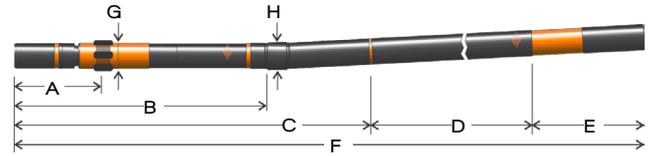
6.50" UltraMotor 7/8 6.0 Stages M40



Motor Specifications

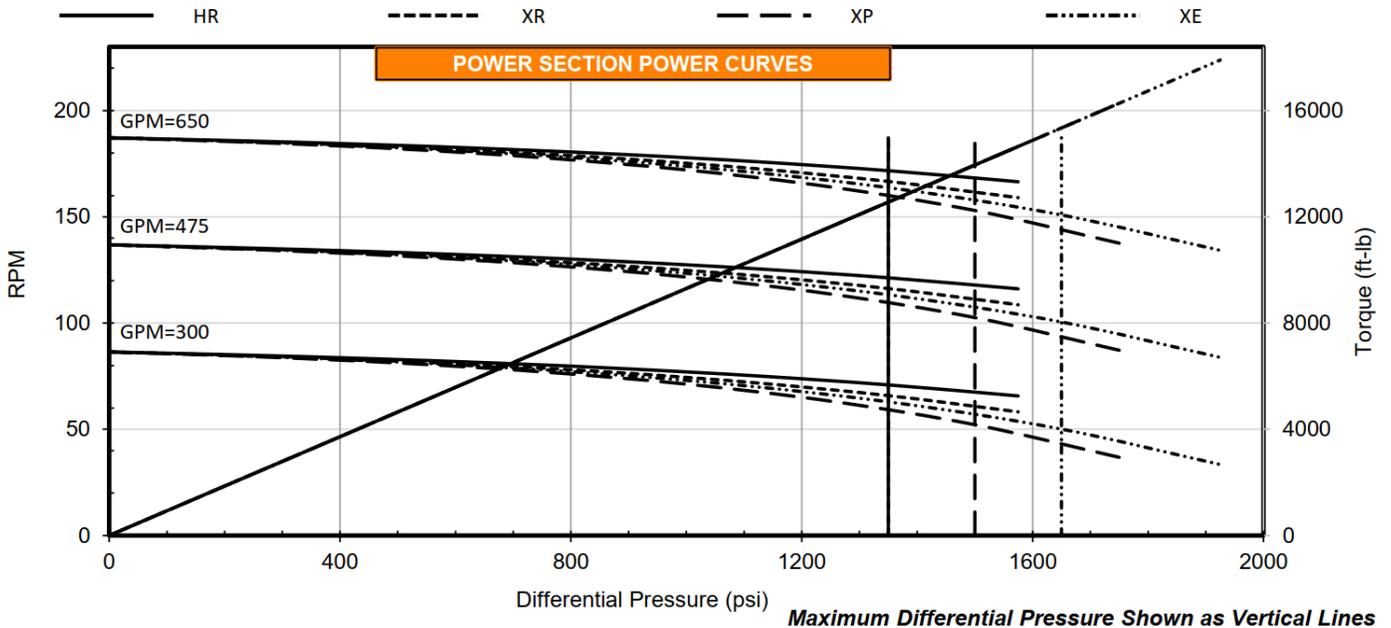
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	51 in.
Bottom End Length	C	101 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	6.50 in.
Crown Pad Radius	H	3.68 in.
Recommended Hole Size	7-7/8 - 9-7/8 in.	
Standard Bit Box Connection ¹	4-1/2 REG	
Standard Pin Down Connection ¹	4-1/2 IF	
Standard Top Box Connection ¹	NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)	
Total Weight	2,663 lbs	
Operating Capacity	Max. WOB	90,200 lbs
	Max. Bit Overpull	90,200 lbs
	Torsional Limit	17,000 lbf-ft
Static Capacity	Max. WOB to Re-run	358,000 lbs
	Max. Bit Overpull to Re-run	222,000 lbs
	Absolute Body Overpull	524,000 lbs
	Torsional Limit	27,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 6.0 Stages			
Stator Length New (in.)	232			
Stator OD (in.)	6.50			
Speed Range (rpm)	86 - 187			
Flow Range (gpm)	300 - 650			
Rotation (rev/gal)	0.288			
Torque Slope (rev/gal)	9.300			
Off Bottom Pressure (psi)	134			
Max Diff Pressure (psi)	1,350	1,350	1,500	1,650
Max Torque (lbf-ft)	12,560	12,560	13,950	15,350
Stall Diff Pressure (psi)	2,030	2,030	2,250	2,480
Stall Torque (lbf-ft)	18,830	18,830	20,930	23,020
Max Power (hp)	410	398	406	441





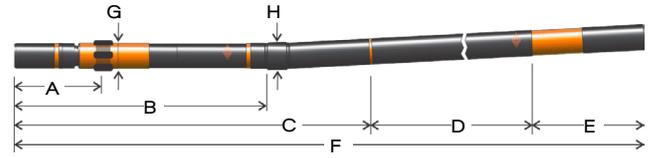
6.50" UltraMotor 7/8 3.0 Stages Slow M40



Motor Specifications

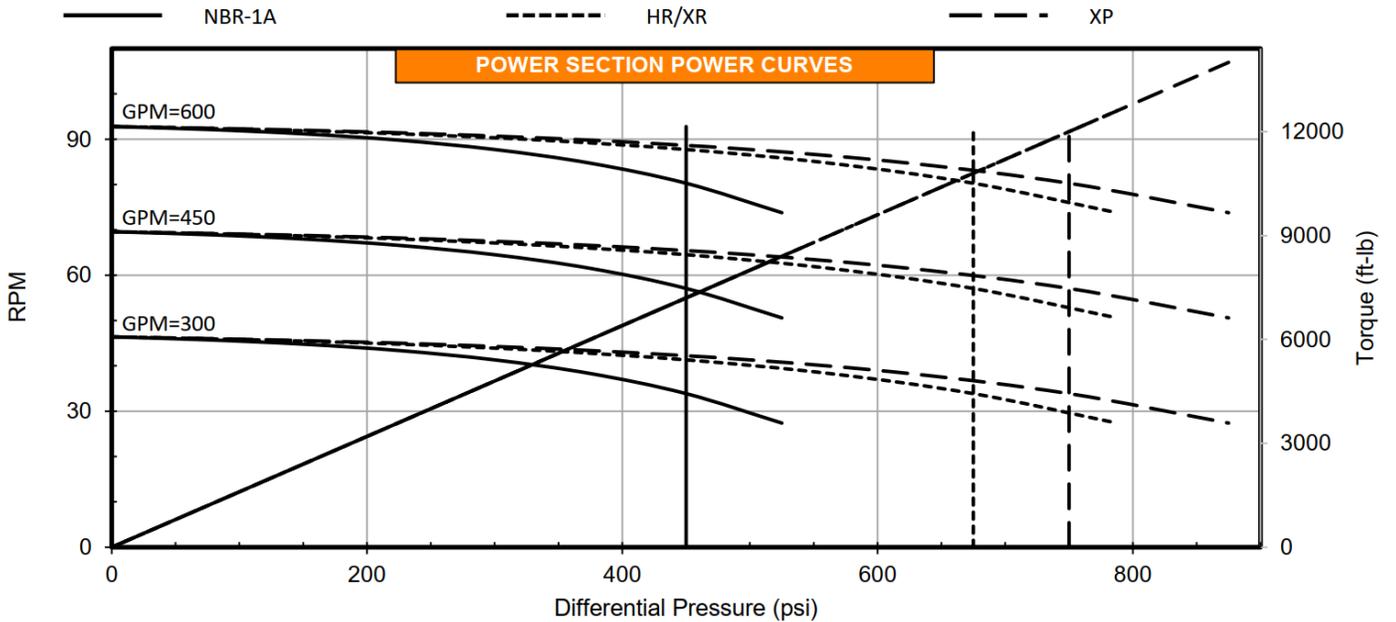
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	51 in.
Bottom End Length	C	101 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	6.50 in.
Crown Pad Radius	H	3.68 in.
Recommended Hole Size		7-7/8 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		2,410 lbs
Operating Capacity	Max. WOB	90,200 lbs
	Max. Bit Overpull	90,200 lbs
	Torsional Limit	17,000 lbf-ft
Static Capacity	Max. WOB to Re-run	358,000 lbs
	Max. Bit Overpull to Re-run	222,000 lbs
	Absolute Body Overpull	524,000 lbs
	Torsional Limit	27,000 lbf-ft

¹other options available on request



Power Section

Elastomer	NBR-1A	XR	HR	XP
Configuration	7/8 Lobes 3.0 Stages			
Stator Length New (in.)	204			
Stator OD (in.)	6.50			
Speed Range (rpm)	46 - 93			
Flow Range (gpm)	300 - 600			
Rotation (rev/gal)	0.155			
Torque Slope (rev/gal)	16.001			
Off Bottom Pressure (psi)	87			
Max Diff Pressure (psi)	450	680	680	750
Max Torque (lbf-ft)	7,200	10,800	10,800	12,000
Stall Diff Pressure (psi)	680	1,010	1,010	1,130
Stall Torque (lbf-ft)	10,800	16,200	16,200	18,000
Max Power (hp)	110	165	165	183



Maximum Differential Pressure Shown as Vertical Lines





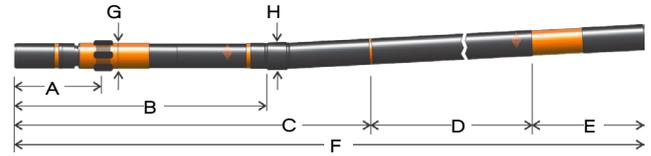
6.63" UltraMotor

5/6 9.5 Stages M40



Motor Specifications

Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	51 in.
Bottom End Length	C	101 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	6.50 in.
Crown Pad Radius	H	3.68 in.
Recommended Hole Size	7-7/8 - 9-7/8 in.	
Standard Bit Box Connection ¹	4-1/2 REG	
Standard Pin Down Connection ¹	4-1/2 IF	
Standard Top Box Connection ¹	NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)	
Total Weight	2,410 lbs	
Operating Capacity	Max. WOB	90,200 lbs
	Max. Bit Overpull	90,200 lbs
	Torsional Limit	17,000 lbf-ft
Static Capacity	Max. WOB to Re-run	358,000 lbs
	Max. Bit Overpull to Re-run	222,000 lbs
	Absolute Body Overpull	545,000 lbs
	Torsional Limit	27,000 lbf-ft

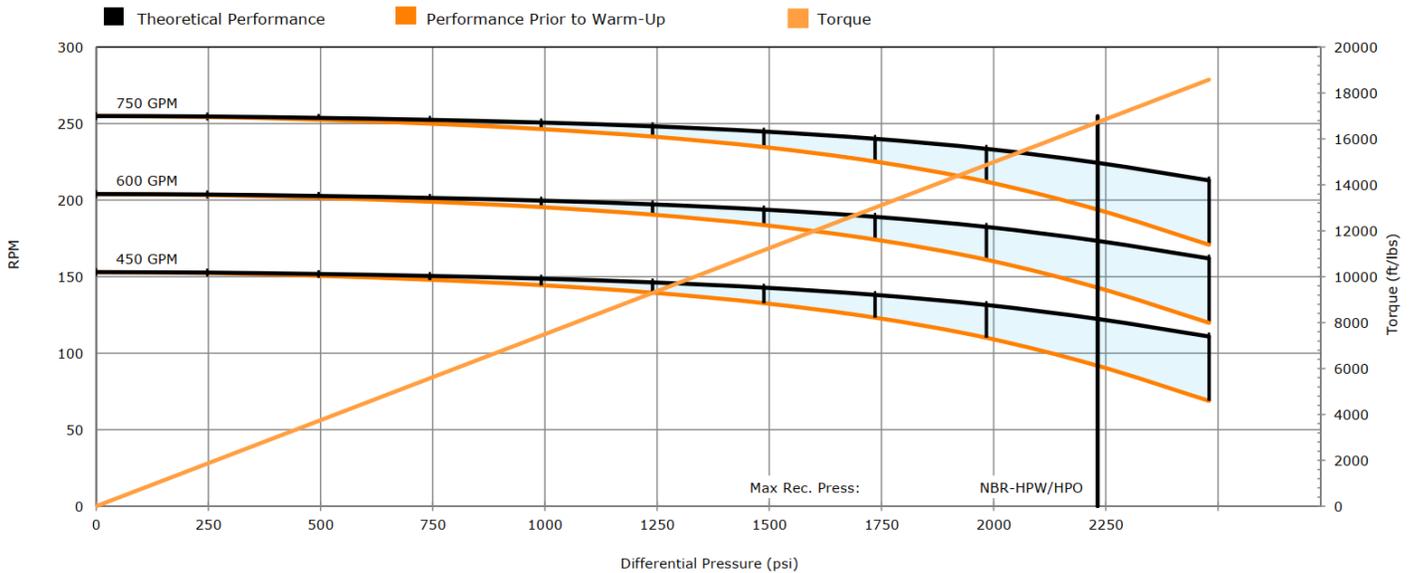


Power Section

Elastomer	NBR-HPO/ NBR-HPW
Configuration	5/6 Lobes 9.5 Stages
Stator Length New (in.)	300
Stator OD (in.)	6.63
Speed Range (rpm)	150 - 260
Flow Range (gpm)	450 - 750
Rotation (rev/gal)	0.340
Torque Slope (rev/gal)	7.49
Off Bottom Pressure (psi)	190
Max Diff Pressure (psi)	2,240
Max Torque (lbf-ft)	16,730
Stall Diff Pressure (psi)	3,520
Stall Torque (lbf-ft)	26,350
Max Power (hp)	828

¹other options available on request

POWER SECTION POWER CURVES



BLACK DIAMOND





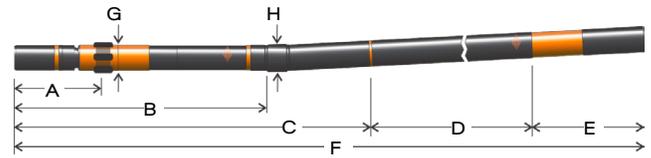
6.75" UltraMotor 7/8 6.4 Stages M40



Motor Specifications

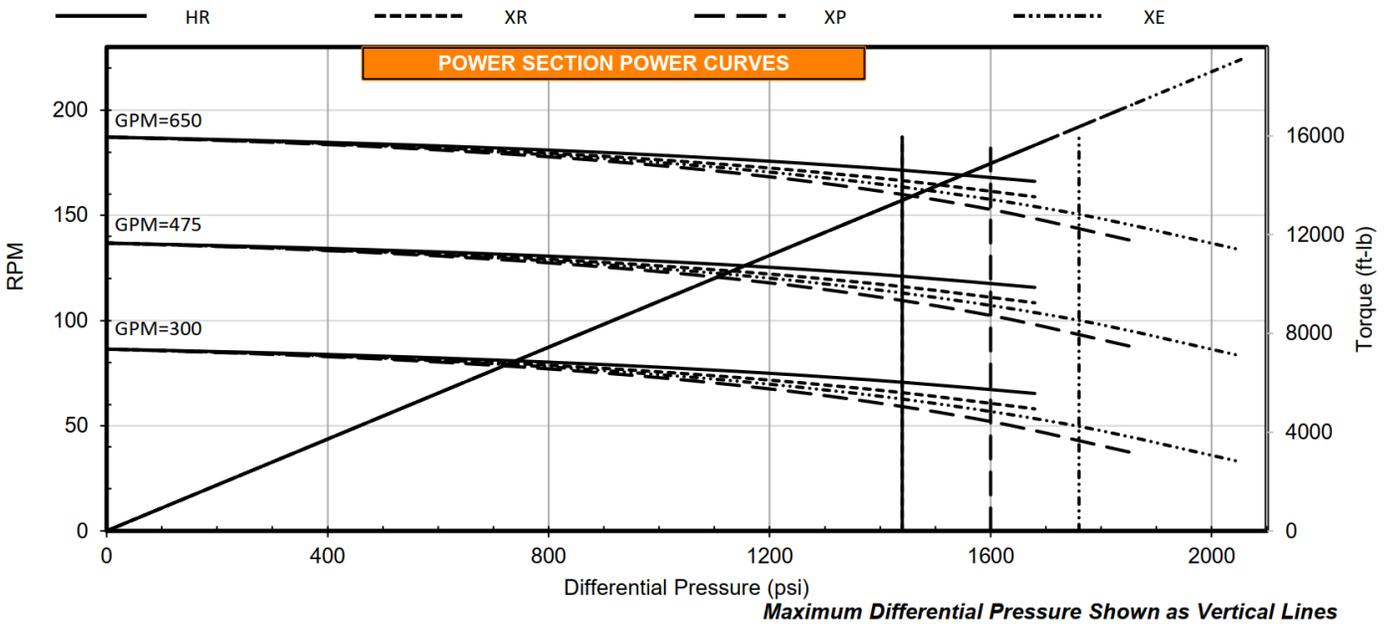
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	51 in.
Bottom End Length	C	101 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	6.50 in.
Crown Pad Radius	H	3.68 in.
Recommended Hole Size		7-7/8 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		2,617 lbs
Operating Capacity	Max. WOB	90,200 lbs
	Max. Bit Overpull	90,200 lbs
	Torsional Limit	17,000 lbf-ft
Static Capacity	Max. WOB to Re-run	358,000 lbs
	Max. Bit Overpull to Re-run	222,000 lbs
	Absolute Body Overpull	539,000 lbs
	Torsional Limit	27,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 6.4 Stages			
Stator Length New (in.)	245.2			
Stator OD (in.)	6.75			
Speed Range (rpm)	86 - 187			
Flow Range (gpm)	300 - 650			
Rotation (rev/gal)	0.288			
Torque Slope (rev/gal)	9.300			
Off Bottom Pressure (psi)	148			
Max Diff Pressure (psi)	1,440	1,440	1,600	1,760
Max Torque (lbf-ft)	13,390	13,390	14,880	16,370
Stall Diff Pressure (psi)	2,160	2,160	2,400	2,640
Stall Torque (lbf-ft)	20,090	20,090	22,320	24,550
Max Power (hp)	437	425	433	469





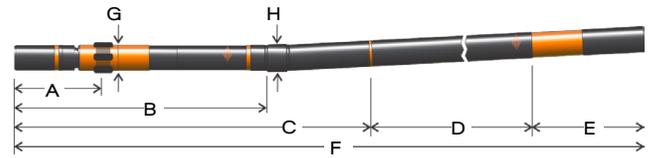
6.75" UltraMotor 7/8 5.7 Stages M40 (6.5)



Motor Specifications

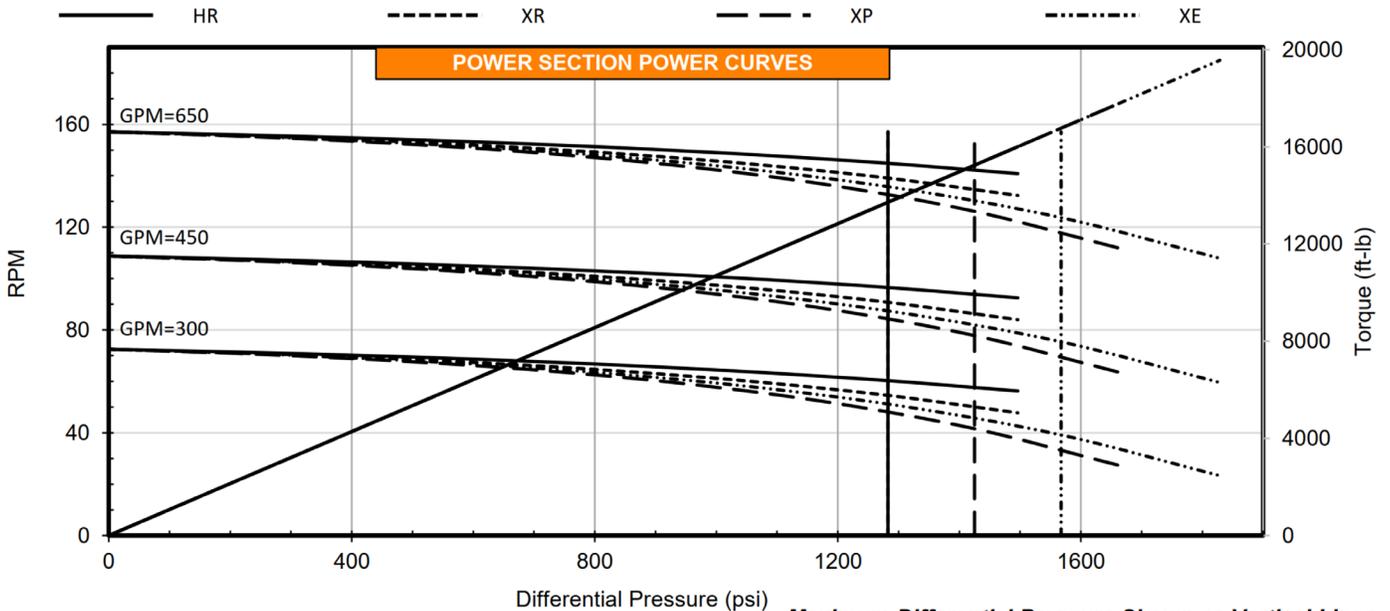
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	51 in.
Bottom End Length	C	101 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	6.50 in.
Crown Pad Radius	H	3.68 in.
Recommended Hole Size		7-7/8 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		2,027 lbs
Operating Capacity	Max. WOB	90,200 lbs
	Max. Bit Overpull	90,200 lbs
	Torsional Limit	17,000 lbf-ft
Static Capacity	Max. WOB to Re-run	358,000 lbs
	Max. Bit Overpull to Re-run	222,000 lbs
	Absolute Body Overpull	539,000 lbs
	Torsional Limit	27,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 5.7 Stages			
Stator Length New (in.)	260			
Stator OD (in.)	6.75			
Speed Range (rpm)	73 - 157			
Flow Range (gpm)	300 - 650			
Rotation (rev/gal)	0.242			
Torque Slope (rev/gal)	10.698			
Off Bottom Pressure (psi)	111			
Max Diff Pressure (psi)	1,280	1,280	1,430	1,570
Max Torque (lbf-ft)	13,720	13,720	15,240	16,770
Stall Diff Pressure (psi)	1,920	1,920	2,140	2,350
Stall Torque (lbf-ft)	20,580	20,580	22,870	25,150
Max Power (hp)	378	363	366	395





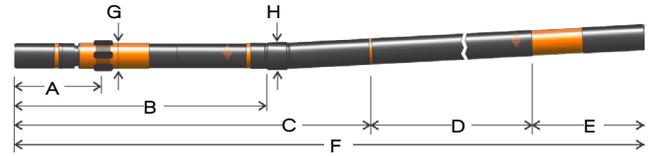
6.75" UltraMotor

7/8 5.7 Stages M40 (7.25)



Motor Specifications

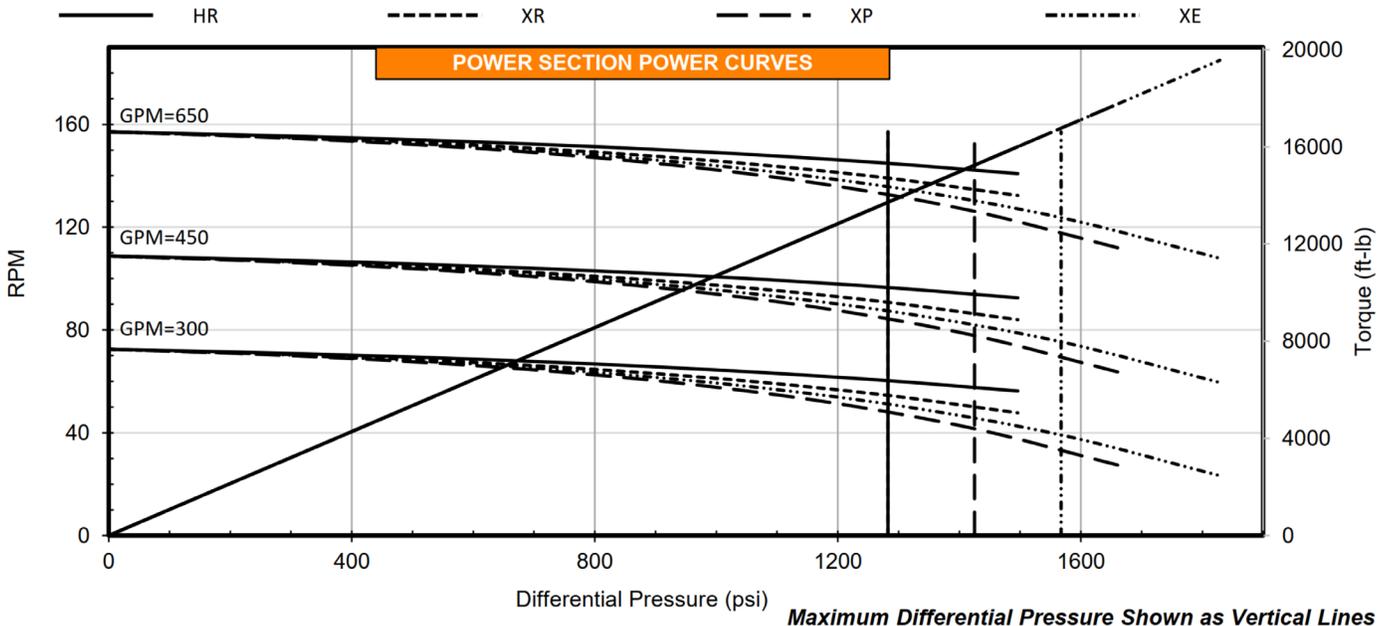
Bit Box to Stabilizer	A	25 in.
Bit Box to Bend (FBH)	B	45 in.
Bit Box to Adj. Bend	B	57 in.
Bottom End Length	C	92 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		3,010 lbs
Operating Capacity	Max. WOB	92,000 lbs
	Max. Bit Overpull	92,000 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	355,000 lbs
	Max. Bit Overpull to Re-run	319,000 lbs
	Absolute Body Overpull	539,000 lbs
	Torsional Limit	34,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 5.7 Stages			
Stator Length New (in.)	260			
Stator OD (in.)	6.75			
Speed Range (rpm)	73 - 157			
Flow Range (gpm)	300 - 650			
Rotation (rev/gal)	0.242			
Torque Slope (rev/gal)	10.698			
Off Bottom Pressure (psi)	111			
Max Diff Pressure (psi)	1,280	1,280	1,430	1,570
Max Torque (lbf-ft)	13,720	13,720	15,240	16,770
Stall Diff Pressure (psi)	1,920	1,920	2,140	2,350
Stall Torque (lbf-ft)	20,580	20,580	22,870	25,150
Max Power (hp)	378	363	366	395

¹other options available on request





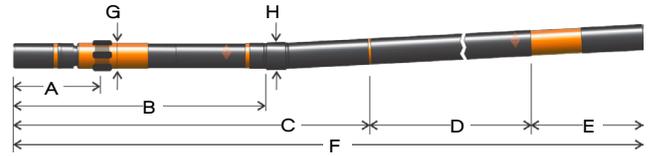
6.75" UltraMotor

7/8 5.7 Stages M41



Motor Specifications

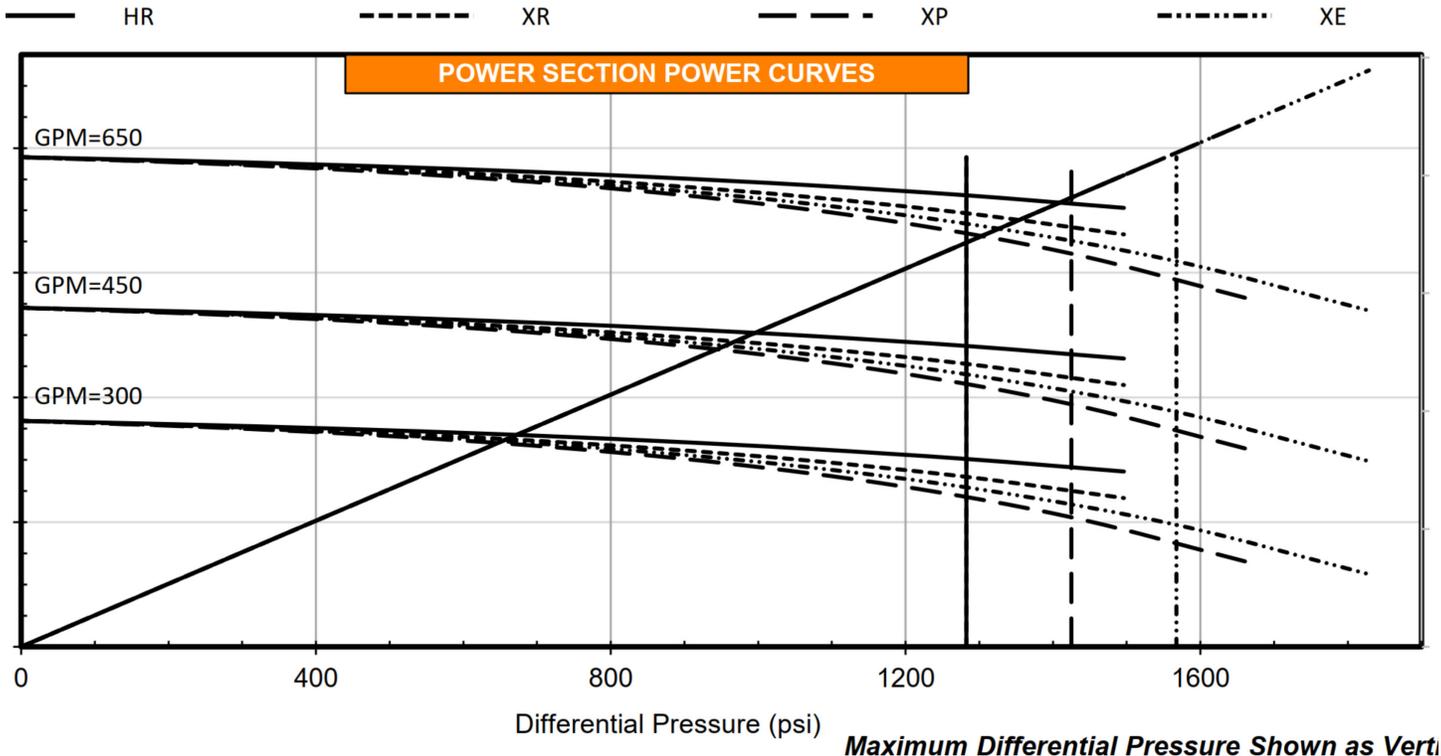
Bit Box to Stabilizer	A	30 in.
Bit Box to Bend (FBH)	B	60 in.
Bit Box to Adj. Bend	B	72 in.
Bottom End Length	C	116 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		4,210 lbs
Operating Capacity	Max. WOB	95,100 lbs
	Max. Bit Overpull	95,100 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	487,500 lbs
	Max. Bit Overpull to Re-run	131,500 lbs
	Absolute Body Overpull	539,000 lbs
	Torsional Limit	34,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 5.7 Stages			
Stator Length New (in.)	260			
Stator OD (in.)	6.75			
Speed Range (rpm)	73 - 157			
Flow Range (gpm)	300 - 650			
Rotation (rev/gal)	0.242			
Torque Slope (rev/gal)	10.698			
Off Bottom Pressure (psi)	111			
Max Diff Pressure (psi)	1,280	1,280	1,430	1,570
Max Torque (lbf-ft)	13,720	13,720	15,240	16,770
Stall Diff Pressure (psi)	1,920	1,920	2,140	2,350
Stall Torque (lbf-ft)	20,580	20,580	22,870	25,150
Max Power (hp)	378	363	366	395

¹other options available on request



BLACK DIAMOND





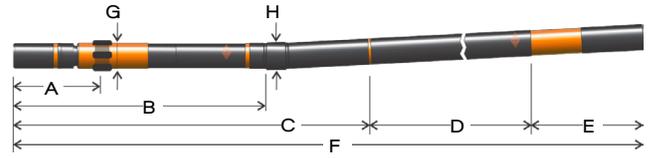
7.0" UltraMotor

5/6 8.3 Stages M40



Motor Specifications

Bit Box to Stabilizer	A	25 in.
Bit Box to Bend (FBH)	B	45 in.
Bit Box to Adj. Bend	B	57 in.
Bottom End Length	C	85 in.
Power Section Length	D	see Power Section
Top End Length	E	47 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size	8-1/2 - 9-7/8 in.	
Standard Bit Box Connection ¹	4-1/2 REG	
Standard Pin Down Connection ¹	4-1/2 IF	
Standard Top Box Connection ¹	NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)	
Total Weight	3,018 lbs	
Operating Capacity	Max. WOB	92,000 lbs
	Max. Bit Overpull	92,000 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	355,000 lbs
	Max. Bit Overpull to Re-run	319,000 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft

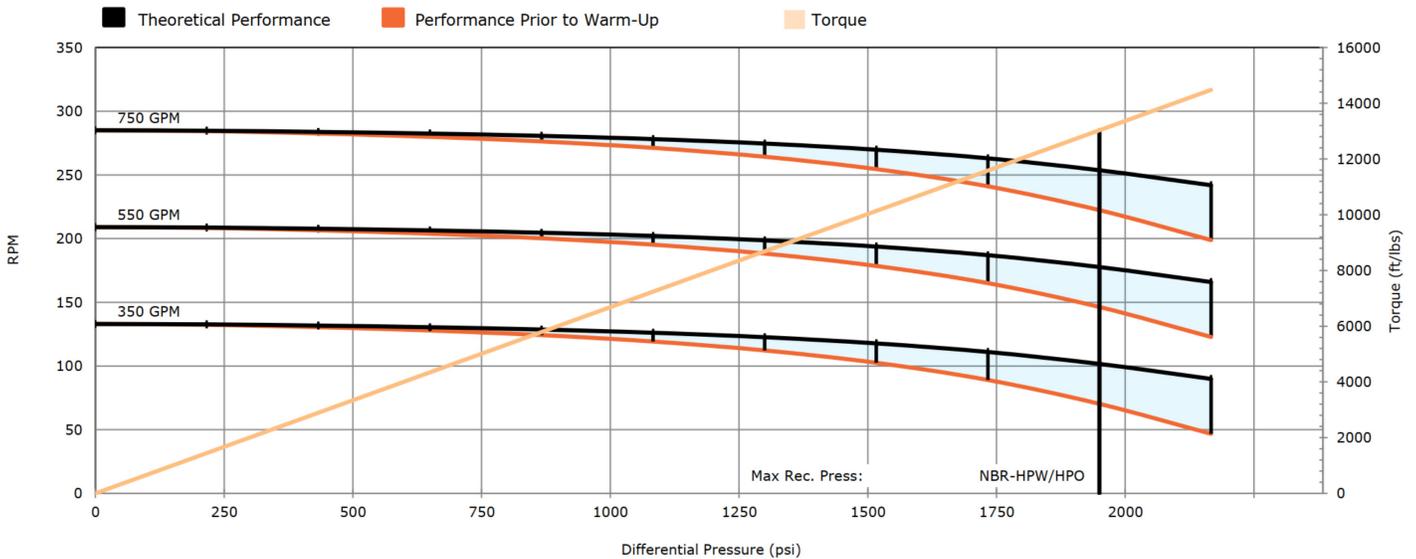


Power Section

Elastomer	NBR-HPW/ NBR-HPO
Configuration	5/6 Lobes 8.3 Stages
Stator Length New (in.)	260
Stator OD (in.)	7.00
Speed Range (rpm)	130-290
Flow Range (gpm)	350-750
Rotation (rev/gal)	0.380
Torque Slope (rev/gal)	6.68
Off Bottom Pressure (psi)	180
Max Diff Pressure (psi)	1,960
Max Torque (lbf-ft)	13,030
Stall Diff Pressure (psi)	3,080
Stall Torque (lbf-ft)	20,530
Max Power (hp)	720

¹other options available on request

POWER SECTION POWER CURVES





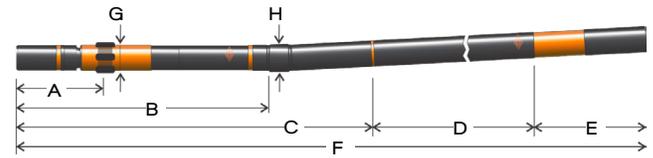
7.0" UltraMotor

6/7 4.6 Stages M40



Motor Specifications

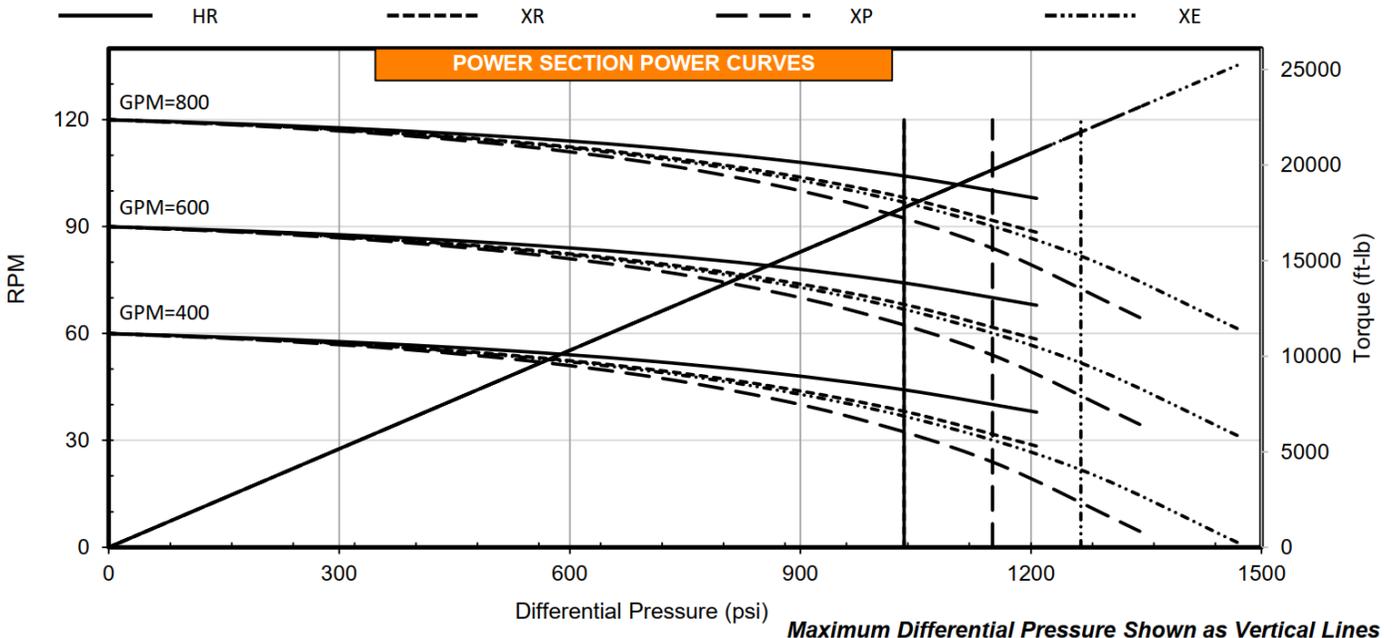
Bit Box to Stabilizer	A	25 in.
Bit Box to Bend (FBH)	B	45 in.
Bit Box to Adj. Bend	B	57 in.
Bottom End Length	C	92 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		3,488 lbs
Operating Capacity	Max. WOB	92,000 lbs
	Max. Bit Overpull	92,000 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	355,000 lbs
	Max. Bit Overpull to Re-run	319,000 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	6/7 Lobes 4.6 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	7.0			
Speed Range (rpm)	60 - 120			
Flow Range (gpm)	400 - 800			
Rotation (rev/gal)	0.150			
Torque Slope (rev/gal)	17.173			
Off Bottom Pressure (psi)	102			
Max Diff Pressure (psi)	1,040	1,040	1,150	1,270
Max Torque (lbf-ft)	17,770	17,770	19,750	21,720
Stall Diff Pressure (psi)	1,550	1,550	1,730	1,900
Stall Torque (lbf-ft)	26,660	26,660	29,620	32,590
Max Power (hp)	353	332	316	338

¹other options available on request





7.0" UltraMotor

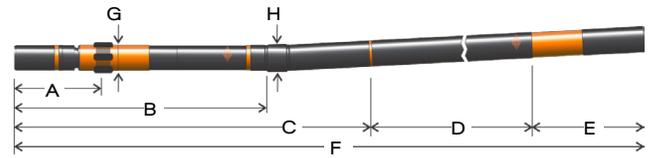
7/8 8.5 Stages M40



Motor Specifications

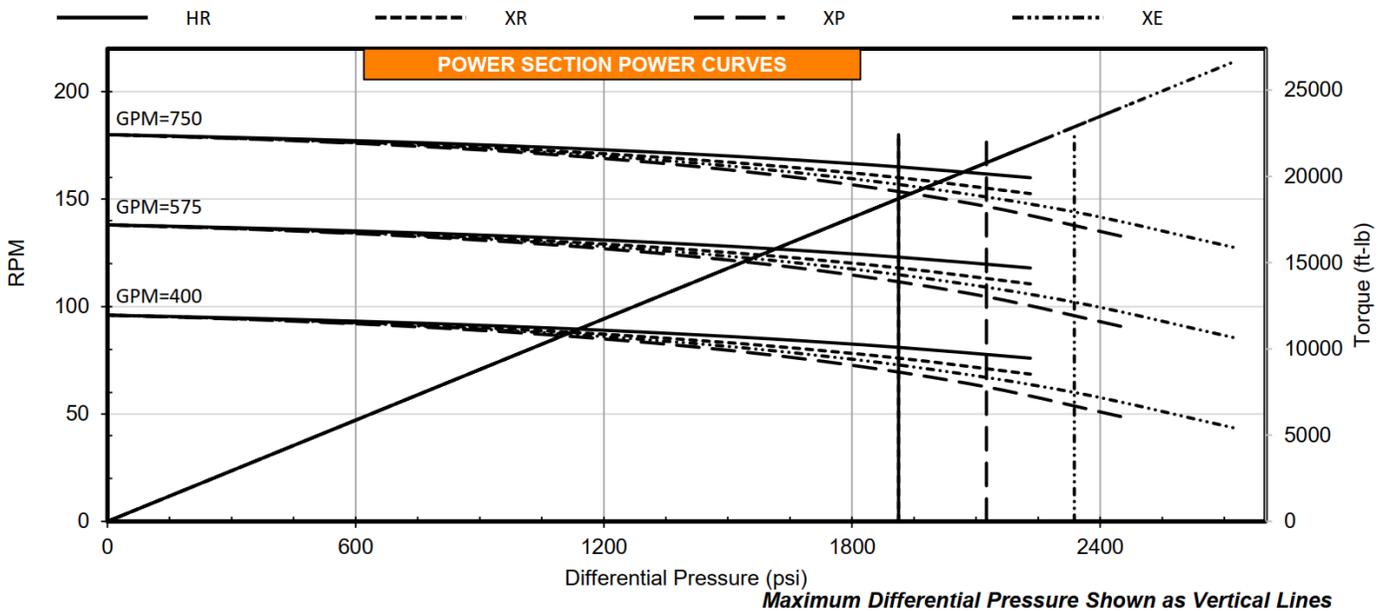
Bit Box to Stabilizer	A	25 in.
Bit Box to Bend (FBH)	B	45 in.
Bit Box to Adj. Bend	B	57 in.
Bottom End Length	C	92 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		3,953 lbs
Operating Capacity	Max. WOB	92,000 lbs
	Max. Bit Overpull	92,000 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	355,000 lbs
	Max. Bit Overpull to Re-run	319,000 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 8.5 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	7.0			
Speed Range (rpm)	96 - 180			
Flow Range (gpm)	400 - 750			
Rotation (rev/gal)	0.240			
Torque Slope (rev/gal)	9.783			
Off Bottom Pressure (psi)	164			
Max Diff Pressure (psi)	1,910	1,910	2,130	2,340
Max Torque (lbf-ft)	18,710	18,710	20,790	22,870
Stall Diff Pressure (psi)	2,870	2,870	3,190	3,510
Stall Torque (lbf-ft)	28,060	28,060	31,180	34,300
Max Power (hp)	588	570	580	627





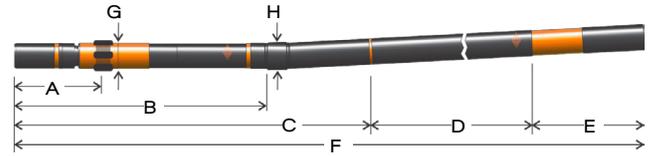
7.0" UltraMotor

6/7 4.6 Stages M41



Motor Specifications

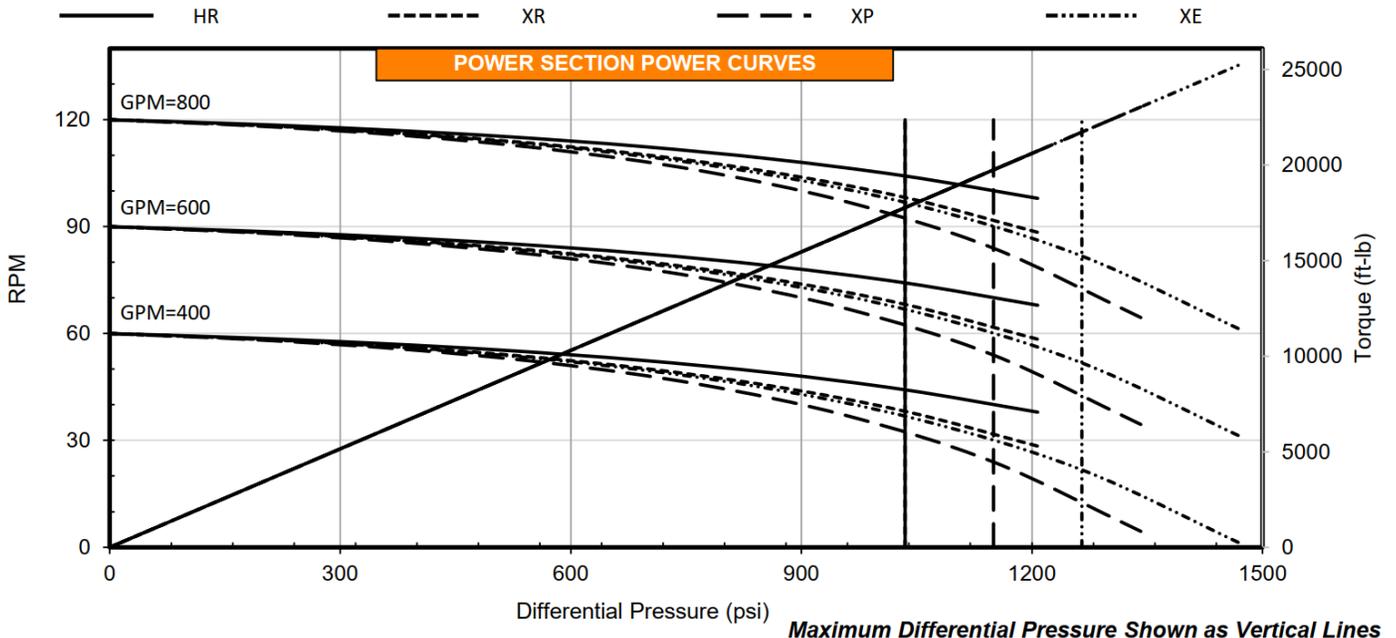
Bit Box to Stabilizer	A	30 in.
Bit Box to Bend (FBH)	B	60 in.
Bit Box to Adj. Bend	B	72 in.
Bottom End Length	C	116 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		3,488 lbs
Operating Capacity	Max. WOB	95,100 lbs
	Max. Bit Overpull	95,100 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	487,500 lbs
	Max. Bit Overpull to Re-run	131,500 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	6/7 Lobes 4.6 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	7.0			
Speed Range (rpm)	60 - 120			
Flow Range (gpm)	400 - 800			
Rotation (rev/gal)	0.150			
Torque Slope (rev/gal)	17.173			
Off Bottom Pressure (psi)	102			
Max Diff Pressure (psi)	1,040	1,040	1,150	1,270
Max Torque (lbf-ft)	17,770	17,770	19,750	21,720
Stall Diff Pressure (psi)	1,550	1,550	1,730	1,900
Stall Torque (lbf-ft)	26,660	26,660	29,620	32,590
Max Power (hp)	353	332	316	338

¹other options available on request





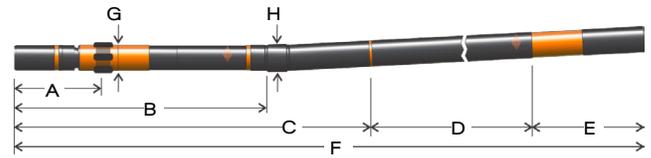
7.0" UltraMotor

7/8 8.5 Stages M41



Motor Specifications

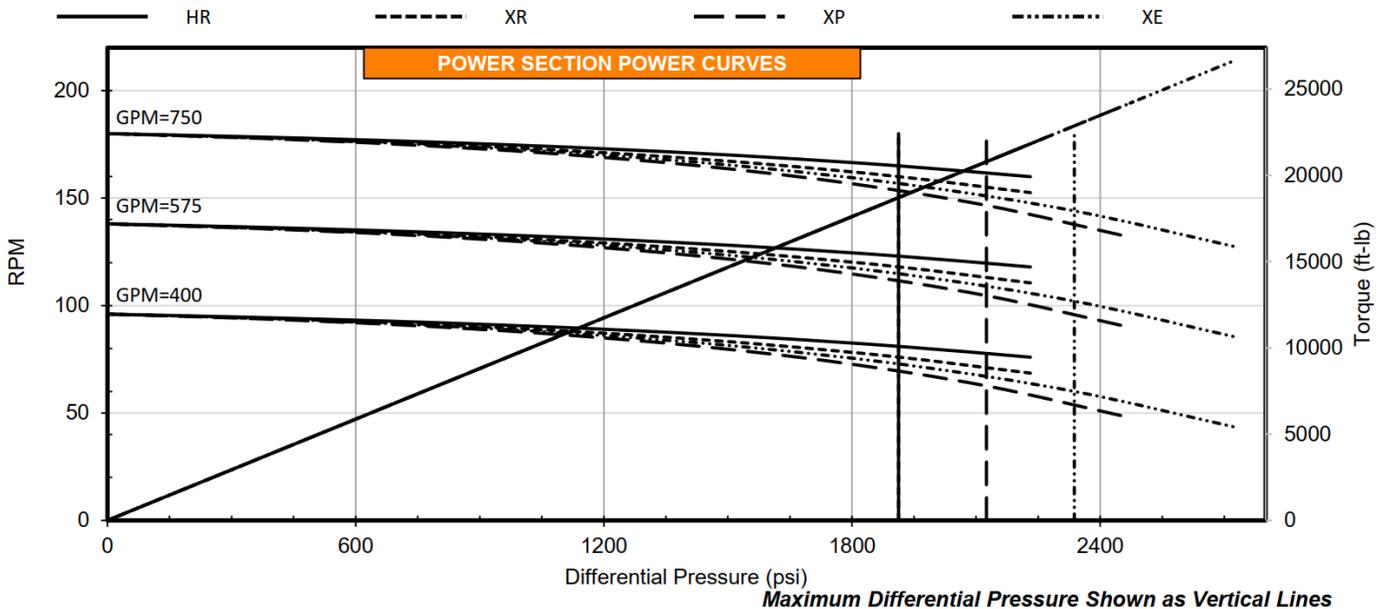
Bit Box to Stabilizer	A	30 in.
Bit Box to Bend (FBH)	B	60 in.
Bit Box to Adj. Bend	B	72 in.
Bottom End Length	C	116 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		4,996 lbs
Operating Capacity	Max. WOB	95,100 lbs
	Max. Bit Overpull	95,100 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	487,500 lbs
	Max. Bit Overpull to Re-run	131,500 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 8.5 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	7.0			
Speed Range (rpm)	96 - 180			
Flow Range (gpm)	400 - 750			
Rotation (rev/gal)	0.240			
Torque Slope (rev/gal)	9.783			
Off Bottom Pressure (psi)	164			
Max Diff Pressure (psi)	1,910	1,910	2,130	2,340
Max Torque (lbf-ft)	18,710	18,710	20,790	22,870
Stall Diff Pressure (psi)	2,870	2,870	3,190	3,510
Stall Torque (lbf-ft)	28,060	28,060	31,180	34,300
Max Power (hp)	588	570	580	627

¹other options available on request



BLACK DIAMOND





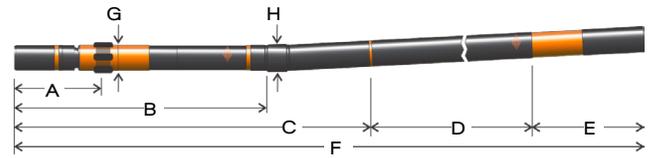
7.25" UltraMotor

5/6 9.6 Stages M40



Motor Specifications

Bit Box to Stabilizer	A	25 in.
Bit Box to Bend (FBH)	B	45 in.
Bit Box to Adj. Bend	B	57 in.
Bottom End Length	C	85 in.
Power Section Length	D	see Power Section
Top End Length	E	47 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size	8-1/2 - 9-7/8 in.	
Standard Bit Box Connection ¹	4-1/2 REG	
Standard Pin Down Connection ¹	4-1/2 IF	
Standard Top Box Connection ¹	NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)	
Total Weight	3,440 lbs	
Operating Capacity	Max. WOB	92,000 lbs
	Max. Bit Overpull	92,000 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	355,000 lbs
	Max. Bit Overpull to Re-run	319,000 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft

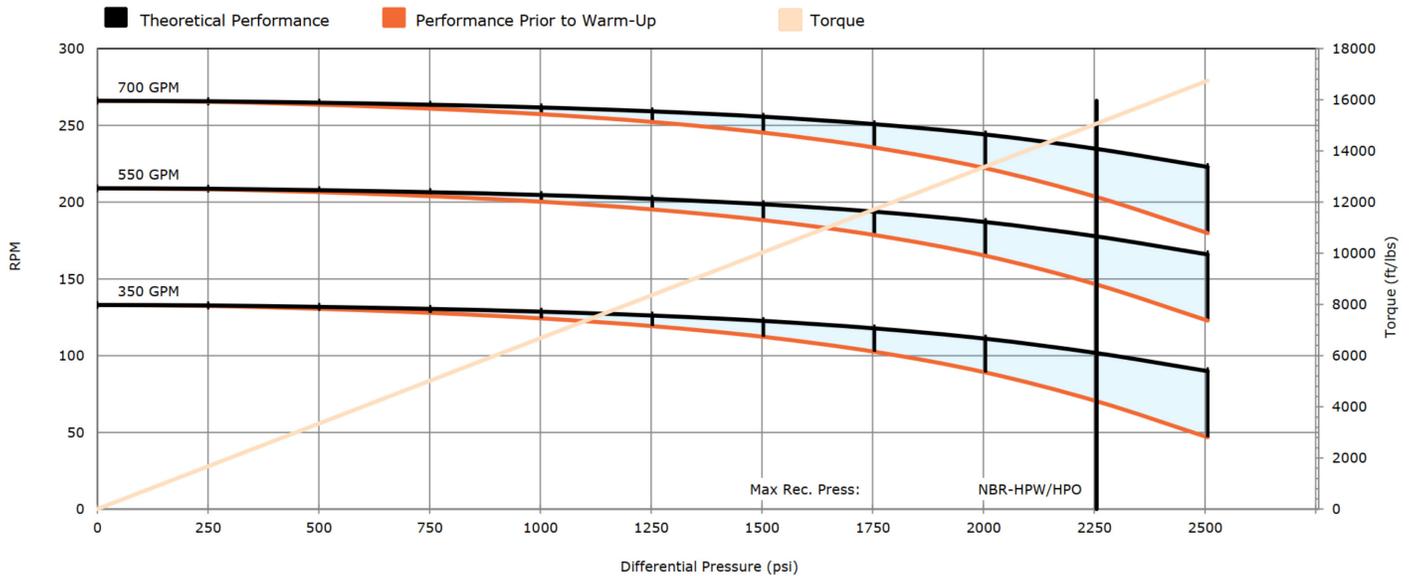


Power Section

Elastomer	NBR-HPW/ NBR-HPO
Configuration	5/6 Lobes 9.6 Stages
Stator Length New (in.)	300
Stator OD (in.)	7.25
Speed Range (rpm)	130-270
Flow Range (gpm)	350-700
Rotation (rev/gal)	0.380
Torque Slope (rev/gal)	6.68
Off Bottom Pressure (psi)	190
Max Diff Pressure (psi)	2,260
Max Torque (lbf-ft)	15,080
Stall Diff Pressure (psi)	3,560
Stall Torque (lbf-ft)	23,740
Max Power (hp)	730

¹other options available on request

POWER SECTION POWER CURVES



BLACK DIAMOND





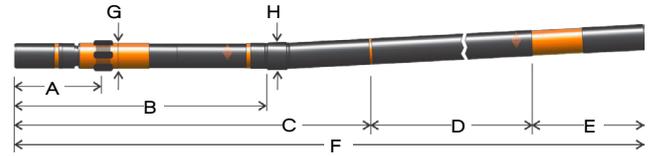
7.25" UltraMotor

6/7 12.1 Stages M40



Motor Specifications

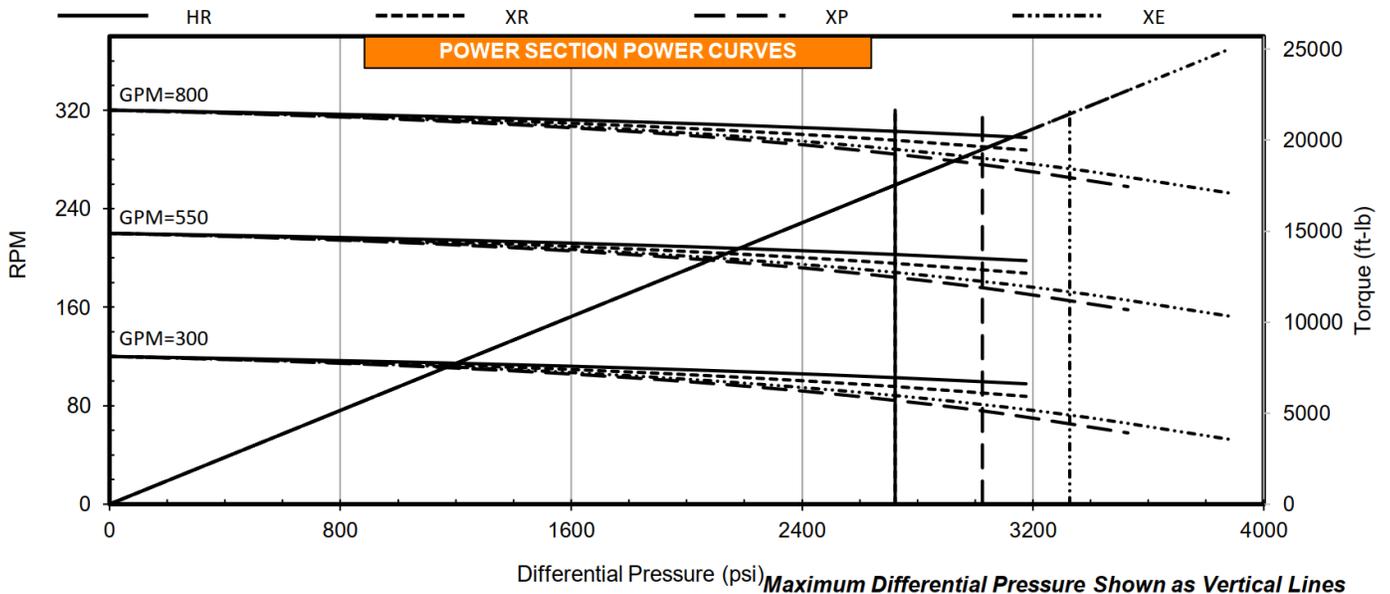
Bit Box to Stabilizer	A	25 in.
Bit Box to Bend (FBH)	B	45 in.
Bit Box to Adj. Bend	B	57 in.
Bottom End Length	C	92 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		3,712 lbs
Operating Capacity	Max. WOB	92,000 lbs
	Max. Bit Overpull	92,000 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	355,000 lbs
	Max. Bit Overpull to Re-run	319,000 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	6/7 Lobes 12.1 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	7.25			
Speed Range (rpm)	120 - 320			
Flow Range (gpm)	300 - 800			
Rotation (rev/gal)	0.400			
Torque Slope (rev/gal)	6.440			
Off Bottom Pressure (psi)	233			
Max Diff Pressure (psi)	2,720	2,720	3,030	3,330
Max Torque (lbf-ft)	17,530	17,530	19,480	21,430
Stall Diff Pressure (psi)	4,080	4,080	4,540	4,990
Stall Torque (lbf-ft)	26,300	26,300	29,220	32,140
Max Power (hp)	1,011	987	1,023	1,112

¹ other options available on request





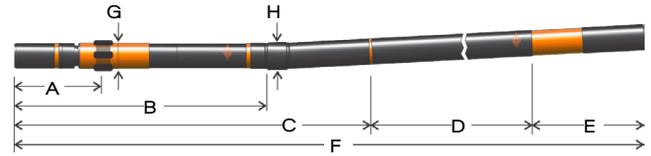
7.25" UltraMotor

6/7 12.1 Stages M41



Motor Specifications

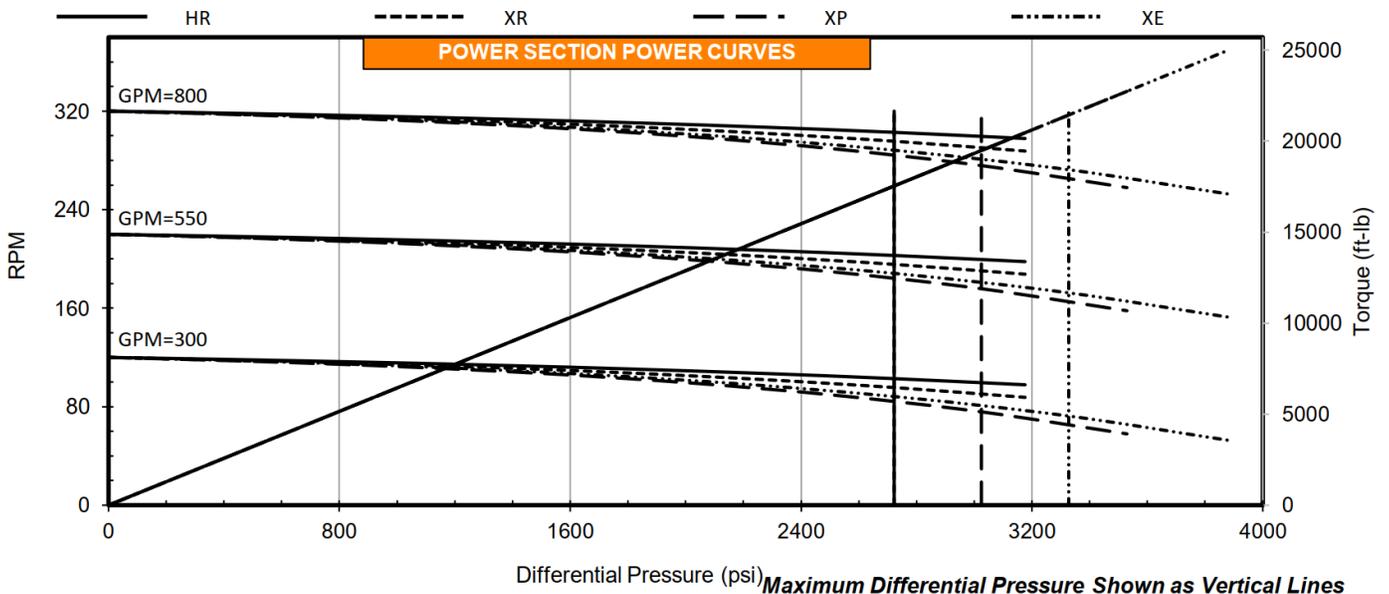
Bit Box to Stabilizer	A	30 in.
Bit Box to Bend (FBH)	B	60 in.
Bit Box to Adj. Bend	B	72 in.
Bottom End Length	C	116 in.
Power Section Length	D	see Power Section
Top End Length	E	31 in.
Total Length	F	C + D + E
Body Outer Diameter	G	7.25 in.
Crown Pad Radius	H	3.98 in.
Recommended Hole Size		8-1/2 - 9-7/8 in.
Standard Bit Box Connection ¹		4-1/2 REG
Standard Pin Down Connection ¹		4-1/2 IF
Standard Top Box Connection ¹		NC50 (5 XH, 4-1/2 IF) NC46 (4 IF, 4-1/2 XH)
Total Weight		4,912 lbs
Operating Capacity	Max. WOB	95,100 lbs
	Max. Bit Overpull	95,100 lbs
	Torsional Limit	21,000 lbf-ft
Static Capacity	Max. WOB to Re-run	487,500 lbs
	Max. Bit Overpull to Re-run	131,500 lbs
	Absolute Body Overpull	659,000 lbs
	Torsional Limit	34,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	6/7 Lobes 12.1 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	7.25			
Speed Range (rpm)	120 - 320			
Flow Range (gpm)	300 - 800			
Rotation (rev/gal)	0.400			
Torque Slope (rev/gal)	6.440			
Off Bottom Pressure (psi)	233			
Max Diff Pressure (psi)	2,720	2,720	3,030	3,330
Max Torque (lbf-ft)	17,530	17,530	19,480	21,430
Stall Diff Pressure (psi)	4,080	4,080	4,540	4,990
Stall Torque (lbf-ft)	26,300	26,300	29,220	32,140
Max Power (hp)	1,011	987	1,023	1,112

¹other options available on request





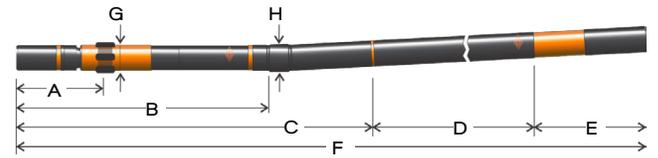
8.0" UltraMotor

7/8 3.4 Stages M40



Motor Specifications

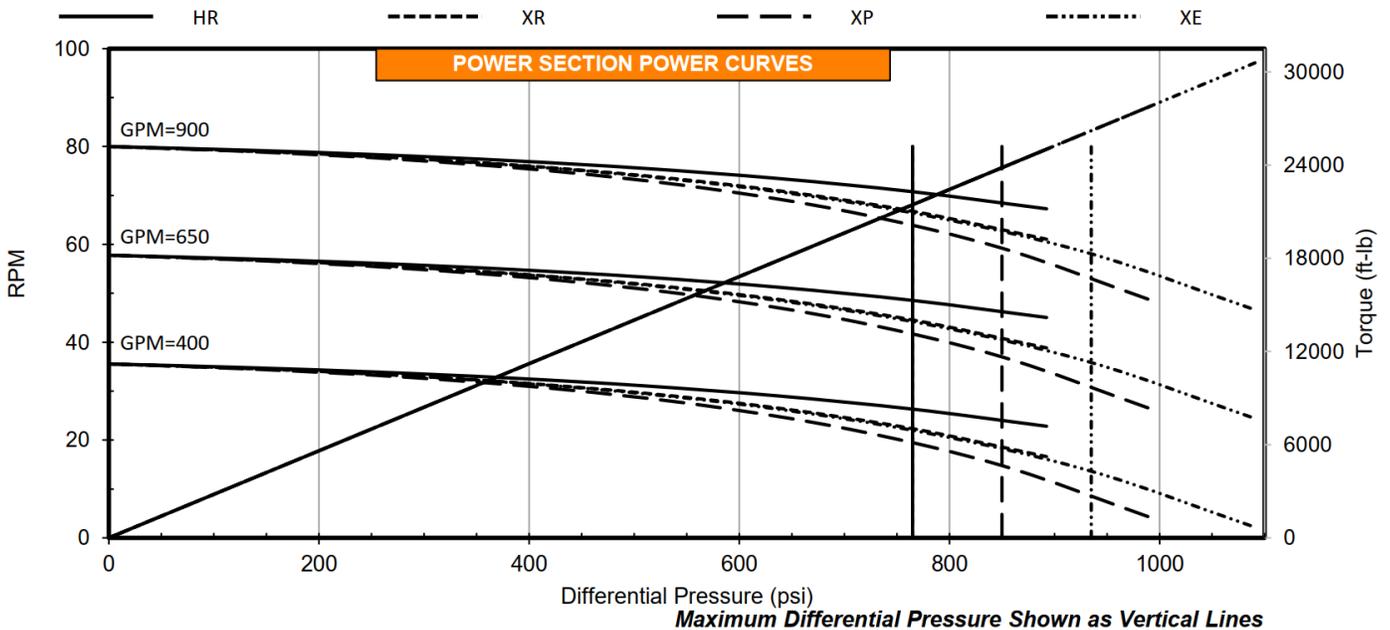
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	52 in.
Bit Box to Adj. Bend	B	66 in.
Bottom End Length	C	114 in.
Power Section Length	D	see Power Section
Top End Length	E	39.5 in.
Total Length	F	C + D + E
Body Outer Diameter	G	8.25 in.
Crown Pad Radius	H	4.55 in.
Recommended Hole Size	9-7/8 - 12-1/4 in.	
Standard Bit Box Connection ¹	6-5/8 REG, 7-5/8 REG	
Standard Pin Down Connection ¹	6-5/8 REG	
Standard Top Box Connection ¹	6-5/8 IF	
Total Weight	4,567 lbs	
Operating Capacity	Max. WOB	97,250 lbs
	Max. Bit Overpull	97,250 lbs
	Torsional Limit	28,000 lbf-ft
Static Capacity	Max. WOB to Re-run	463,000 lbs
	Max. Bit Overpull to Re-run	326,000 lbs
	Absolute Body Overpull	783,000 lbs
	Torsional Limit	45,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 3.4 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	8.0			
Speed Range (rpm)	36 - 80			
Flow Range (gpm)	400 - 900			
Rotation (rev/gal)	0.089			
Torque Slope (rev/gal)	28.040			
Off Bottom Pressure (psi)	150			
Max Diff Pressure (psi)	770	770	850	940
Max Torque (lbf-ft)	21,450	21,450	23,830	26,220
Stall Diff Pressure (psi)	1,150	1,150	1,280	1,400
Stall Torque (lbf-ft)	32,180	32,180	35,750	39,330
Max Power (hp)	289	273	269	290

¹other options available on request





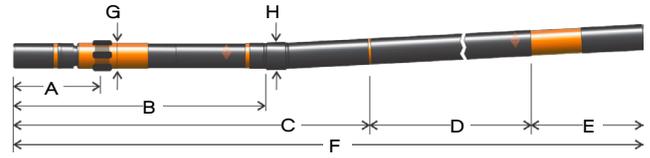
8.0" UltraMotor

7/8 4.0 Stages M40



Motor Specifications

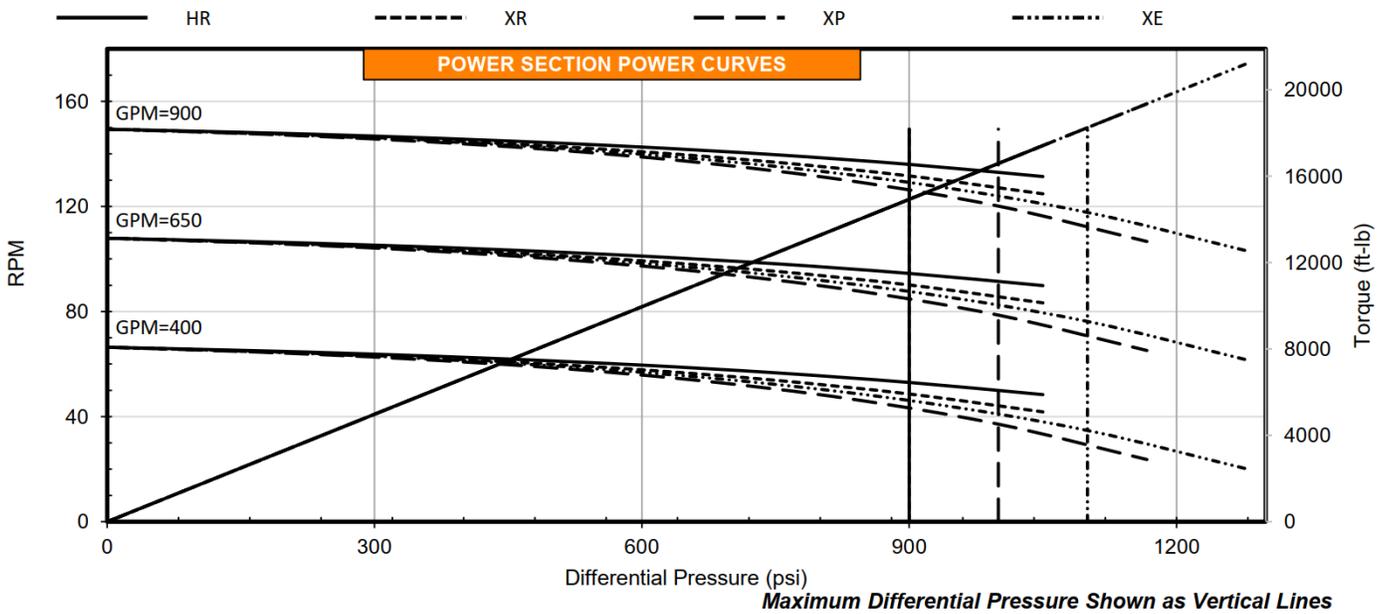
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	52 in.
Bit Box to Adj. Bend	B	66 in.
Bottom End Length	C	114 in.
Power Section Length	D	see Power Section
Top End Length	E	39.5 in.
Total Length	F	C + D + E
Body Outer Diameter	G	8.25 in.
Crown Pad Radius	H	4.55 in.
Recommended Hole Size	9-7/8 - 12-1/4 in.	
Standard Bit Box Connection ¹	6-5/8 REG, 7-5/8 REG	
Standard Pin Down Connection ¹	6-5/8 REG	
Standard Top Box Connection ¹	6-5/8 IF	
Total Weight	3,699 lbs	
Operating Capacity	Max. WOB	97,250 lbs
	Max. Bit Overpull	97,250 lbs
	Torsional Limit	28,000 lbf-ft
Static Capacity	Max. WOB to Re-run	463,000 lbs
	Max. Bit Overpull to Re-run	326,000 lbs
	Absolute Body Overpull	783,000 lbs
	Torsional Limit	45,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 4.0 Stages			
Stator Length New (in.)	203.2			
Stator OD (in.)	8.0			
Speed Range (rpm)	66 - 149			
Flow Range (gpm)	400 - 900			
Rotation (rev/gal)	0.166			
Torque Slope (rev/gal)	16.589			
Off Bottom Pressure (psi)	138			
Max Diff Pressure (psi)	900	900	1,000	1,100
Max Torque (lbf-ft)	14,930	14,930	16,590	18,250
Stall Diff Pressure (psi)	1,350	1,350	1,500	1,650
Stall Torque (lbf-ft)	22,400	22,400	24,880	27,370
Max Power (hp)	387	374	379	409

¹other options available on request





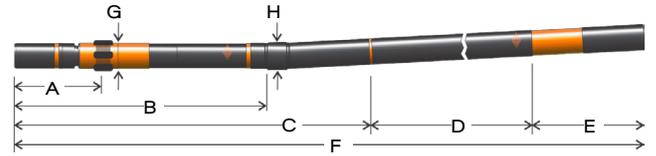
8.25" UltraMotor 7/8 7.0 Stages M40



Motor Specifications

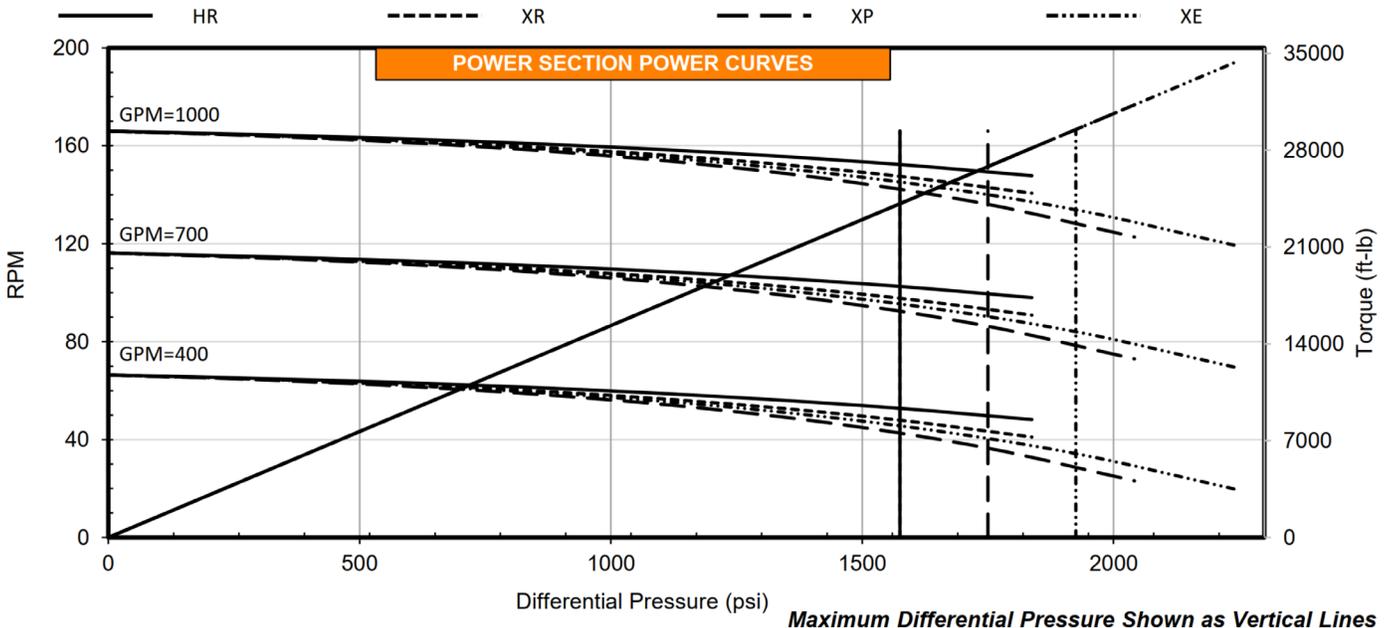
Bit Box to Stabilizer	A	29 in.
Bit Box to Bend (FBH)	B	52 in.
Bit Box to Adj. Bend	B	66 in.
Bottom End Length	C	114 in.
Power Section Length	D	see Power Section
Top End Length	E	39.5 in.
Total Length	F	C + D + E
Body Outer Diameter	G	8.25 in.
Crown Pad Radius	H	4.55 in.
Recommended Hole Size	9-7/8 - 12-1/4 in.	
Standard Bit Box Connection ¹	6-5/8 REG, 7-5/8 REG	
Standard Pin Down Connection ¹	6-5/8 REG	
Standard Top Box Connection ¹	6-5/8 IF	
Total Weight	3,699 lbs	
Operating Capacity	Max. WOB	97,250 lbs
	Max. Bit Overpull	97,250 lbs
	Torsional Limit	28,000 lbf-ft
Static Capacity	Max. WOB to Re-run	463,000 lbs
	Max. Bit Overpull to Re-run	326,000 lbs
	Absolute Body Overpull	783,000 lbs
	Torsional Limit	45,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 7.0 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	8.25			
Speed Range (rpm)	66 - 166			
Flow Range (gpm)	400 - 1,000			
Rotation (rev/gal)	0.166			
Torque Slope (rev/gal)	15,323			
Off Bottom Pressure (psi)	157			
Max Diff Pressure (psi)	1,580	1,580	1,750	1,930
Max Torque (lbf-ft)	24,130	24,130	26,820	29,500
Stall Diff Pressure (psi)	2,360	2,360	2,630	2,890
Stall Torque (lbf-ft)	36,200	36,200	40,220	44,250
Max Power (hp)	700	678	695	752



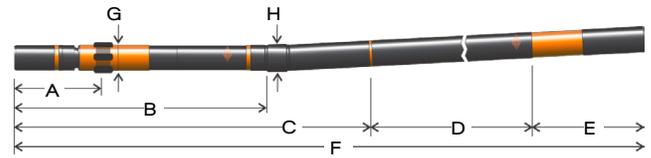


9.625" UltraMotor 5/6 4.0 Stages M40



Motor Specifications

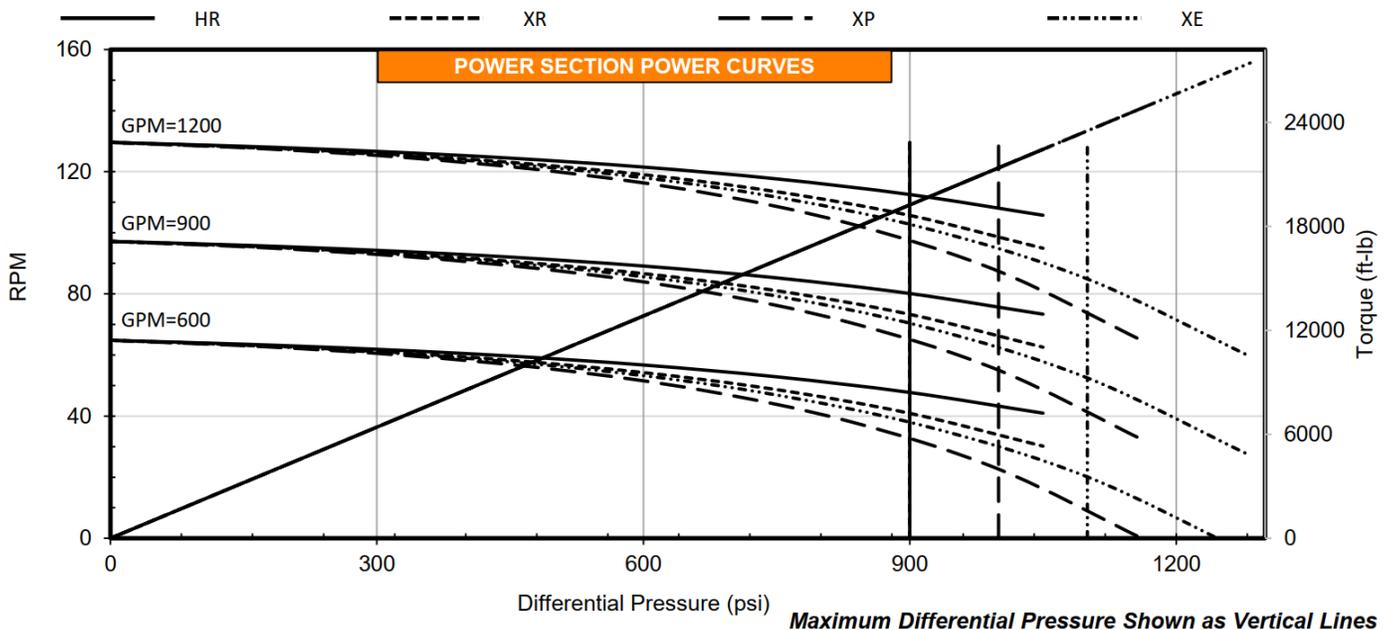
Bit Box to Stabilizer	A	46 in.
Bit Box to Bend (FBH)	B	78 in.
Bit Box to Adj. Bend	B	94 in.
Bottom End Length	C	129 in.
Power Section Length	D	see Power Section
Top End Length	E	60 in.
Total Length	F	C + D + E
Body Outer Diameter	G	9.60 in.
Crown Pad Radius	H	5.26 in.
Recommended Hole Size	12-1/4 - 17-1/2 in.	
Standard Bit Box Connection ¹	6-5/8 REG, 7-5/8 REG	
Standard Top Box Connection ¹	6-5/8 IF	
Total Weight	6,293 lbs	
Operating Capacity	Max. WOB	132,000 lbs
	Max. Bit Overpull	132,000 lbs
	Torsional Limit	41,500 lbf-ft
Static Capacity	Max. WOB to Re-run	772,000 lbs
	Max. Bit Overpull to Re-run	485,000 lbs
	Absolute Body Overpull	1,177,000 lbs
	Torsional Limit	66,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	5/6 Lobes 4.0 Stages			
Stator Length New (in.)	228			
Stator OD (in.)	9.63			
Speed Range (rpm)	65 - 130			
Flow Range (gpm)	600 - 1,200			
Rotation (rev/gal)	0.108			
Torque Slope (rev/gal)	21,373			
Off Bottom Pressure (psi)	233			
Max Diff Pressure (psi)	900	900	1,000	1,100
Max Torque (lbf-ft)	19,240	19,240	21,370	23,510
Stall Diff Pressure (psi)	1,350	1,350	1,500	1,650
Stall Torque (lbf-ft)	28,850	28,850	32,060	35,270
Max Power (hp)	412	387	356	380

¹other options available on request



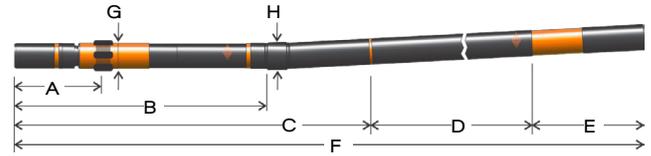


9.625" x 8.0" UltraMotor 7/8 3.4 Stages M40



Motor Specifications

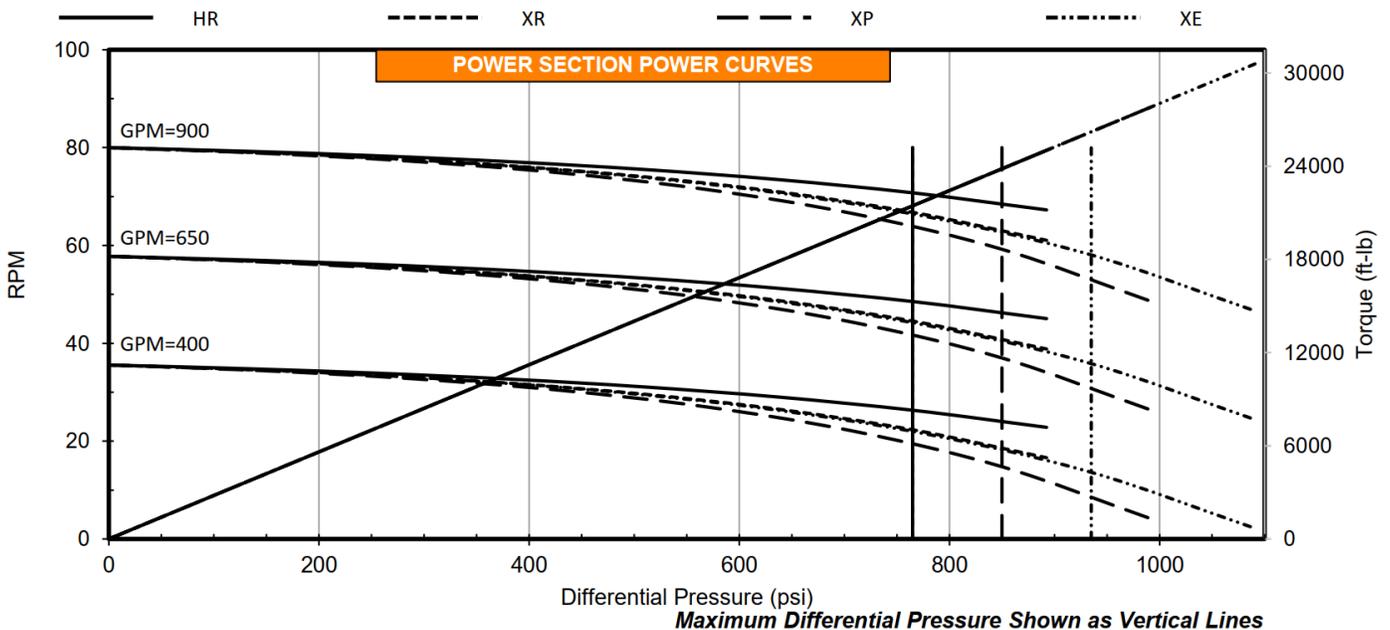
Bit Box to Stabilizer	A	46 in.
Bit Box to Bend (FBH)	B	78 in.
Bit Box to Adj. Bend	B	94 in.
Bottom End Length	C	129 in.
Power Section Length	D	see Power Section
Top End Length	E	60 in.
Total Length	F	C + D + E
Body Outer Diameter	G	9.60 in.
Crown Pad Radius	H	5.26 in.
Recommended Hole Size	12-1/4 - 17-1/2 in.	
Standard Bit Box Connection ¹	6-5/8 REG, 7-5/8 REG	
Standard Top Box Connection ¹	6-5/8 IF	
Total Weight	6,377 lbs	
Operating Capacity	Max. WOB	132,000 lbs
	Max. Bit Overpull	132,000 lbs
	Torsional Limit	41,500 lbf-ft
Static Capacity	Max. WOB to Re-run	772,000 lbs
	Max. Bit Overpull to Re-run	485,000 lbs
	Absolute Body Overpull	1,177,000 lbs
	Torsional Limit	66,000 lbf-ft



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 3.4 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	8.0			
Speed Range (rpm)	36-80			
Flow Range (gpm)	400-900			
Rotation (rev/gal)	0.089			
Torque Slope (rev/gal)	28.040			
Off Bottom Pressure (psi)	150			
Max Diff Pressure (psi)	770	770	850	940
Max Torque (lbf-ft)	21,450	21,450	23,830	26,220
Stall Diff Pressure (psi)	1,150	1,150	1,280	1,400
Stall Torque (lbf-ft)	32,180	32,180	35,750	39,330
Max Power (hp)	289	273	269	290

¹other options available on request



BLACK DIAMOND





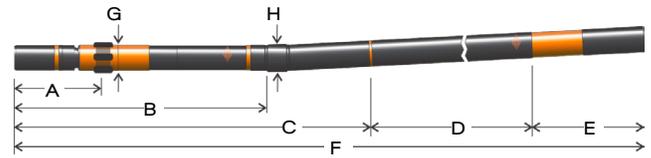
9.625" x 8.0" UltraMotor 7/8 4.0 Stages M40



Motor Specifications

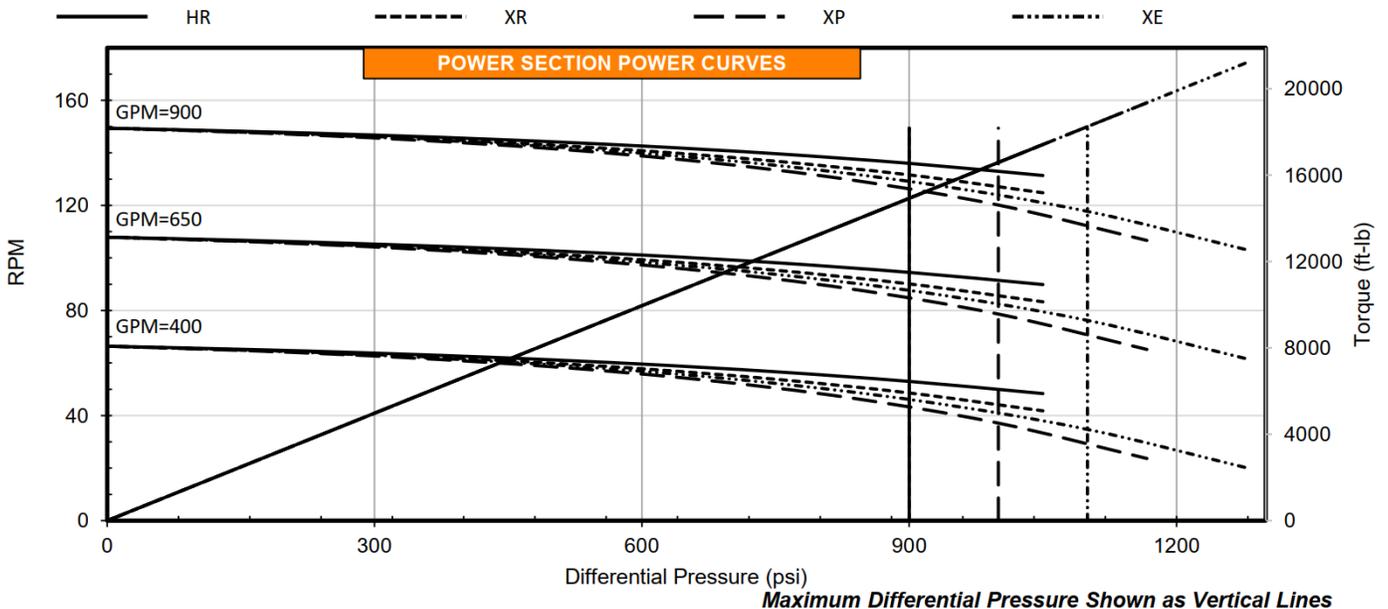
Bit Box to Stabilizer	A	46 in.
Bit Box to Bend (FBH)	B	78 in.
Bit Box to Adj. Bend	B	94 in.
Bottom End Length	C	129 in.
Power Section Length	D	see Power Section
Top End Length	E	39.5 in.
Total Length	F	C + D + E
Body Outer Diameter	G	9.60 in.
Crown Pad Radius	H	5.26 in.
Recommended Hole Size	12-1/4 - 17-1/2 in.	
Standard Bit Box Connection ¹	6-5/8 REG, 7-5/8 REG	
Standard Top Box Connection ¹	6-5/8 IF	
Total Weight	5,509 lbs	
Operating Capacity	Max. WOB	132,000 lbs
	Max. Bit Overpull	132,000 lbs
	Torsional Limit	41,500 lbf-ft
Static Capacity	Max. WOB to Re-run	772,000 lbs
	Max. Bit Overpull to Re-run	485,000 lbs
	Absolute Body Overpull	1,177,000 lbs
	Torsional Limit	66,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 4.0 Stages			
Stator Length New (in.)	203.2			
Stator OD (in.)	8.0			
Speed Range (rpm)	66 - 149			
Flow Range (gpm)	400 - 900			
Rotation (rev/gal)	0.166			
Torque Slope (rev/gal)	16.589			
Off Bottom Pressure (psi)	138			
Max Diff Pressure (psi)	900	900	1,000	1,100
Max Torque (lbf-ft)	14,930	14,930	16,590	18,250
Stall Diff Pressure (psi)	1,350	1,350	1,500	1,650
Stall Torque (lbf-ft)	22,400	22,400	24,880	27,370
Max Power (hp)	387	374	379	409



BLACK DIAMOND





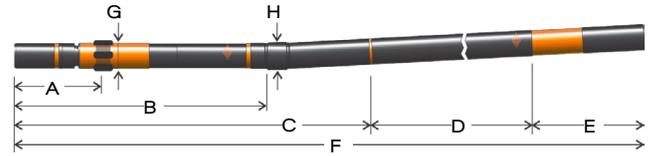
9.625" x 8.25" UltraMotor 7/8 7.0 Stages M40



Motor Specifications

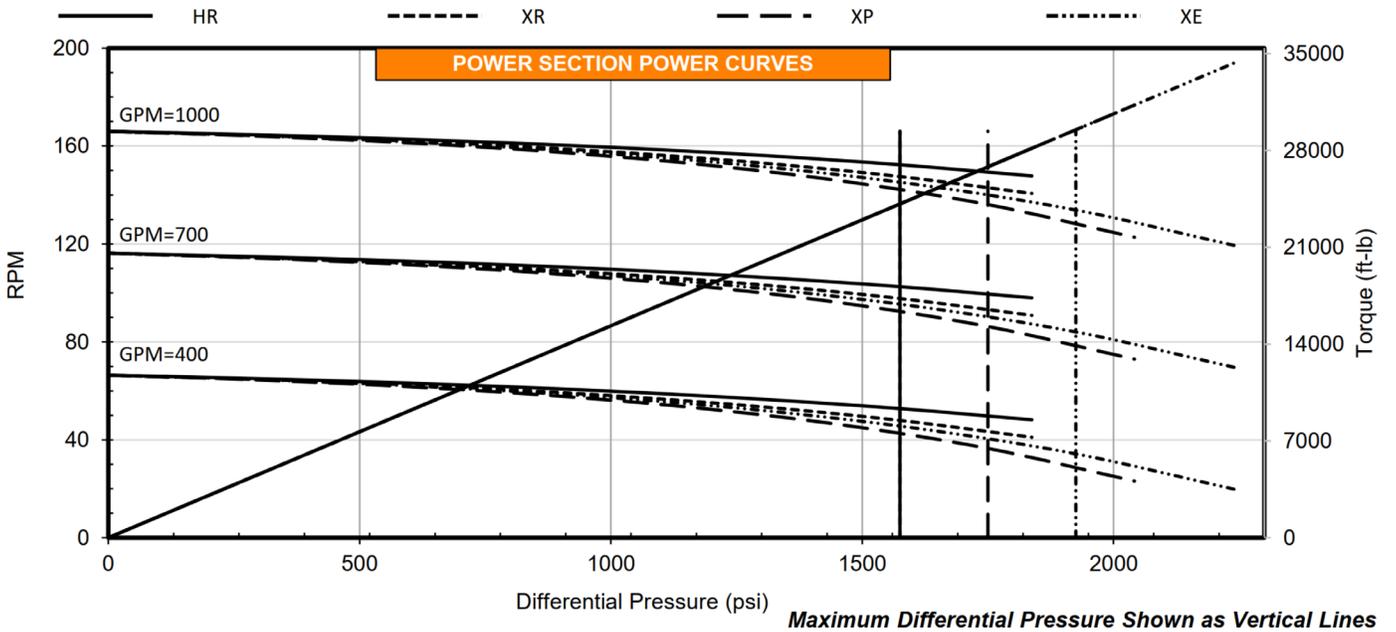
Bit Box to Stabilizer	A	46 in.
Bit Box to Bend (FBH)	B	78 in.
Bit Box to Adj. Bend	B	94 in.
Bottom End Length	C	129 in.
Power Section Length	D	see Power Section
Top End Length	E	39.5 in.
Total Length	F	C + D + E
Body Outer Diameter	G	9.60 in.
Crown Pad Radius	H	5.26 in.
Recommended Hole Size	12-1/4 - 17-1/2 in.	
Standard Bit Box Connection ¹	6-5/8 REG, 7-5/8 REG	
Standard Top Box Connection ¹	6-5/8 IF	
Total Weight	6,703 lbs	
Operating Capacity	Max. WOB	132,000 lbs
	Max. Bit Overpull	132,000 lbs
	Torsional Limit	41,500 lbf-ft
Static Capacity	Max. WOB to Re-run	772,000 lbs
	Max. Bit Overpull to Re-run	485,000 lbs
	Absolute Body Overpull	1,177,000 lbs
	Torsional Limit	66,000 lbf-ft

¹other options available on request



Power Section

Elastomer	HR	XR	XP	XE
Configuration	7/8 Lobes 7.0 Stages			
Stator Length New (in.)	300			
Stator OD (in.)	8.25			
Speed Range (rpm)	66 - 166			
Flow Range (gpm)	400 - 1,000			
Rotation (rev/gal)	0.166			
Torque Slope (rev/gal)	15.323			
Off Bottom Pressure (psi)	157			
Max Diff Pressure (psi)	1,580	1,580	1,750	1,930
Max Torque (lbf-ft)	24,130	24,130	26,820	29,500
Stall Diff Pressure (psi)	2,360	2,360	2,630	2,890
Stall Torque (lbf-ft)	36,200	36,200	40,220	44,250
Max Power (hp)	700	678	695	752





TABLES & FORMULAS



Formulas

Power

$$\text{Bit Hydraulic Horsepower (HP)} = \frac{P_b \times Q}{1714}$$

P_b = Pressure Drop at Bit (psi)

Q = Flow rate (gpm)

$$\text{Mechanical Horsepower (HP)} = \frac{T \times N}{5252}$$

T = Torque (lbf-ft)

N = Speed (rpm)

Pressure

$$\text{Pressure Drop at Bit (psi)} = \frac{Q^2 \times W}{10858 \times A^2}$$

Q = Flow rate (gpm)

W = Mud Weight (ppg)

A = Total Flow Area of Bit Nozzles (in.²)

$$\text{Total Flow Area (in.²)} = \frac{j_1^2 + j_2^2 + j_3^2 + j_n^2}{1303.8}$$

$j_1, j_2, j_3 \dots j_n$ = diameter of each jet (1/32 in.)

$$\text{Hydrostatic Pressure (psi)} = \frac{TVD \times 0.052}{W}$$

T = Total Vertical Depth (ft)

W = Mud Weight (ppg)

$$\text{New Circulating Pressure (psi)} = \frac{P_{\text{Orig}} \times W_{\text{New}}}{W_{\text{Orig}}}$$

P_{Orig} = Original Circulating Pressure (psi)

W_{Orig} = Original Mud Weight (ppg)

W_{New} = New Mud Weight (ppg)





TABLES & FORMULAS



Conversion Factors

Units	Multiply by	Obtain
Length		
inch	25.4	millimeter
inch	2.54	centimeter
feet	0.3048	meter
mile	1.609	kilometer
millimeter	0.03937	inch
centimeter	.039370	inch
meter	3.28084	feet
kilometer	0.62150	mile
Mass		
pound	0.4536	kilogram
kilogram	2.2046	pound
Pressure		
pounds/ square inch	6.8948	kiloPascal
pounds/ square inch	0.006895	megaPascal
pounds/ square inch	0.0703067	kilogram/ cm ²
pounds/ square inch	0.0680462	atmosphere
pounds/ square inch	0.06895	bar
kiloPascal	0.14504	pounds/ square inch
megaPascal	145.033	pounds/ square inch
kilogram/ cm ²	14.2234	pounds/ square inch
atmosphere	14.6959	pounds/ square inch
bar	14.503	pounds/ square inch
Flow		
gallons/ minute	3.785	liters/ minute
gallons/ minute	0.003785	meter ³ / minute
barrels/ minute	0.1589	meter ³ / minute
liters/ minute	0.2642	gallons/ minute
meter ³ / minute	264.2	gallons/ minute
meter ³ / minute	6.2933	barrels/ minute
Force		
pound	0.4536	kilogram
pound	4.4482	newton
pound	0.4448	decanewton
pound	0.004448	kilonewton
kilogram	2.20459	pound
newton	0.2248	pound
decanewton	2.2482	pound
kilonewton	224.82	pound
Area		
inch ²	6.4516	centimeter ²
inch ²	645.16	millimeter ²
foot ²	0.0929	meter ²
centimeter ²	0.15500	inch ²
millimeter ²	0.00155	inch ²
meter ²	10.76426	foot ²

Units	Multiply by	Obtain
Volume		
gallon (US)	3.785	liter
gallon (US)	0.003785	meter ³
foot ³	0.02831	meter ³
barrel (US)	0.1589	meter ³
liter	0.2642	gallon (US)
meter ³	264.20	gallon (US)
meter ³	35.323	foot ³
meter ³	6.2933	barrel (US)
Torque		
foot pound	1.356	newton meter
foot pound	0.00136	kilonewton meter
foot pound	0.1382	kilogram meter
newton meter	0.73746	foot pound
kilonewton meter	735.294	foot pound
kilogram meter	7.2359	foot pound
Power		
Horsepower	0.7457	Kilowatt
Kilowatt	1.34102	Horsepower
Density		
pounds/ gallon	119.82	kilograms/ meter ³
pounds/ gallon	0.11982	grams/ centimeter ³
pounds/ inch ³	27679.7	kilograms/ meter ³
pounds/ inch ³	27.6797	grams/ centimeter ³
kilograms/ meter ³	0.00835	pounds/ gallon
grams/ centimeter ³	8.34585	pounds/ gallon
kilograms/ meter ³	0.0000361	pounds/ inch ³
grams/ centimeter ³	0.03613	pounds/ inch ³
Temperature		
° Fahrenheit	(°F-32) / 1.8	° Celcius
° Celcius	(°C x 1.8) + 32	° Fahrenheit

