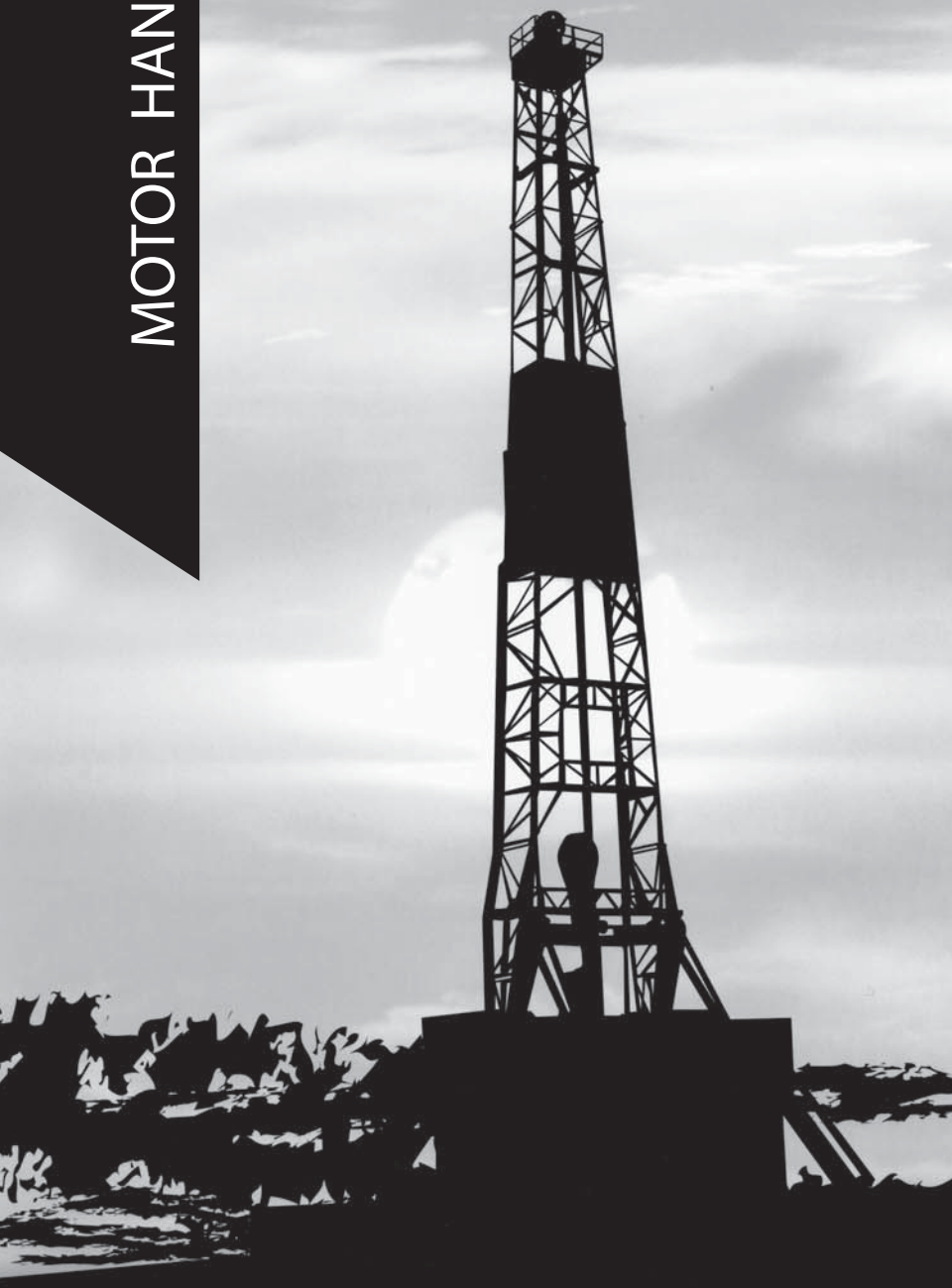
MOTOR HANDBOOK

WZL

"Trendsetters in Downhole Drilling Solutions"



Wenzel Downhole Tools

Motor Handbook

4th Edition Ver. 1.0a

Issue Date; December 23, 2013

The information contained in this manual is provided for informational and illustration purposes only. Wenzel Downhole Tools has made every effort to ensure the accuracy of the information contained within, however, Wenzel does not warrant nor guarantee the contents. The use and interpretation of the information contained in this manual is entirely at the risk of the user. The contents of this handbook are subject to change without notice.

CORPORATE OFFICE /
CALGARY SALES
1000 Elveden House
717 - 7 Avenue SW
Calgary, Alberta
Canada T2P 0Z3
Phone: (403) 262-3050
Fax: (403) 265-8154
info@wenzel-downhole.com

MANUFACTURING /
SALES FACILITIES
3115 - 93 Street
Edmonton, Alberta
Canada T6N 1L7
Phone: (780) 440-4220
Fax: (780) 469-8054
Toll Free: 1-800-306-4046
info@wenzel-downhole.com

US HEADQUARTERS
4205 FM 1485
Conroe, Texas
U.S.A. 77306
Phone: (936) 441-1480
Fax: (936) 756-5335
conroesales@wenzel-downhole.com

WYOMING
5081 Yellowstone Hwy.
Casper, Wyoming
U.S.A. 82604
Phone: (307) 266-1580
Fax: (307) 266-1656
Toll Free: 1-866-522-1144
caspersales@wenzel-downhole.com

OKLAHOMA
100 South Cooley Drive
Oklahoma City, Oklahoma
U.S.A. 73127
Phone: (405) 787-4145
Fax: (405) 470-1968

WEST VIRGINIA
400 Caterpillar Road
Morgantown, West Virginia
U.S.A. 26508
Phone: (304) 777-2534
Fax: (304) 777-2539

WEST TEXAS
1506 South Country Road 1309
Midland, Texas
U.S.A. 79707
Phone: (432) 848-3977

EUROPE
Grafftring 5
29227 Celle, Germany
Phone: 49 (0) 5141 977 65 0
Fax: 49 (0) 5141 977 65 29

www.downhole.com

Table of Contents

Introduction

Introduction

Since their introduction in 1981, Wenzel Downhole Motors have established a 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 performance, directional, horizontal, coiled tubing, work over, and utility applications. Wenzel Motors incorporate numerous exclusive technology improvements in its bearing assemblies, adjustable bent housings, and drive line designs.

Overview

Wenzel positive displacement motors provide superior performance and longer operating life for today's drilling programs. Wenzel offers a versatile array of Downhole motors available for straight, directional, horizontal, workover, coil tubing, and utility applications. Wenzel motors utilize the industry's best technology in sealed bearing assemblies, adjustable bent housings, and drive lines. Wenzel motors will operate effectively with most drilling fluids in a wide range of fluid weights and viscosities including air, mist and foam. Some constraints can be imposed by the use of drilling fluids based on synthetics or low aniline mineral oils and when certain additives are being used. This can be discussed further by contacting your local Wenzel representative.

- Performance
- Reliability
- Service

Tool Description

Dump Sub

This normally open valve allows drilling fluid to fill the drill pipe when running into the hole and drain the drill pipe when pulling out of the hole or making a connection. The valve automatically closes when circulation is established and re-opens when circulation is stopped.

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 performance characteristics of these power sections are determined by the lobe configuration and number of stages.
Typically, torque is a function of the flow rate.
Wenzel Downhole offers a wide range of power section configurations to provide the performance characteristics required by our customers.

Adjustable Bent Housing

Located between the stator and the bearing assembly, the Adjustable Bent Housing is a device which permits an adjustable bend to be set in the motor to provide directional drilling ability and control. The bent housing is adjusted on the rig floor and can provide bend settings from 0 to 3˚ or 0 to 4˚.
The Wenzel Adjustable Bent Housing provides an automatic crown lift feature designed to minimize difficulties encountered with sticking or seized adjusting crowns.
An oversized bore through the Wenzel Adjustable Bent Housing will accept the large diameter drive lines and universal joints necessary to transmit the higher torques developed by today's power sections.

Drive Shaft & 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.
The Wenzel Drive Shaft and sealed Universal Joints incorporate an exclusive patented design, providing greatly increased torsioned strength and life over traditional ball type universal joints.

Bearing Assembly

The Bearing Assembly contains the rotating output shaft and must resist the extreme radial and axial forces applied to the motor when in use.
Wenzel Downhole provides several different bearing assemblies, desiigned to meet the diverse requirements of the drilling industry.
These bearing assemblies utilize components specifically designed to withstand the increased torques developed by current power sections.

Motor Servicing

Motor Servicing

Wenzel Downhole recommends that its downhole motors be serviced at an authorized Wenzel service center.

At the service center, the motors are visually inspected, flushed and if necessary run in the test stand. The motors are then disassembled and all parts are thoroughly cleaned and inspected. All threaded connections and critical areas are magnetic particle inspected by qualified inspectors. All seals and worn parts are replaced, the motor is re-assembled, and all connections torqued to the recommended values.

A detailed service report is prepared; recording the incoming condition, inspection reports, parts replaced, and any other pertinent data.

With the Insite management tool, detailed asset history is maintained. Some of the information maintained in the system includes

- Customer details
- Rig
- Location
- Operator
- Well information
- Drilling parameters
- Outgoing tool configuration
- Incoming tool condition
- Complete service and repair information
- Accumulated operating hours and/or operating days on each component
- Time between component reworks
- Power section details
- Material traceability

Specifications

For Adjustable Motors 0° to 3°

	Degrees per 100 feet																	
	Motor Sizes																	
	3 1/2			4 3/4			6 1/2			6 3/4			8			9 1/2		
Bend Setting	Hole Size			Hole Size			Hole Size			Hole Size			Hole Size			Hole Size		
Degrees	4 1/2	4 3/4	5 1/2	6	6 1/4	6 3/4	7 7/8	8 1/2	8 3/4	8 1/2	8 3/4	9 7/8	9 7/8	10 5/8	12 1/4	12 1/4	14 3/4	17 1/2
0.00																		
0.39	0.9			1.4	0.6		2.1	0.4		1.1	0.6		1.2			1.2		
0.78	6.6	4.2		4.5	3.7	2.1	5.1	3.4	2.8	4.0	3.4	0.9	3.8	2.5		3.4	0.5	
1.15	11.9	9.5	2.3	7.5	6.7	5.1	7.9	6.3	5.6	6.7	6.1	3.6	6.2	4.9	2.3	5.5	2.6	
1.50	17.0	14.6	7.4	10.4	9.6	8.0	10.6	9.0	8.3	9.3	8.7	6.2	8.5	7.2	4.6	7.5	4.6	1.5
1.83	21.8	19.4	12.2	13.1	12.3	10.7	13.2	11.5	10.9	11.7	11.1	8.6	10.7	9.4	6.7	9.4	6.4	3.4
2.12	26.1	23.7	16.4	15.4	14.6	13.0	15.4	13.7	13.1	13.8	13.3	10.7	12.6	11.3	8.6	11.0	8.1	5.0
2.38	29.8	27.4	20.2	17.6	16.7	15.1	17.4	15.7	15.1	15.7	15.2	12.6	14.3	13.0	10.3	12.5	9.6	6.5
2.60	33.0	30.6	23.4	19.3	18.5	16.9	19.1	17.4	16.8	17.3	16.8	14.2	15.8	14.5	11.8	13.8	10.8	7.7
2.77	35.5	33.1	25.9	20.7	19.9	18.3	20.4	18.7	18.1	18.6	18.0	15.5	16.9	15.6	12.9	14.8	11.8	8.7
2.89	37.3	34.9	27.6	21.7	20.9	19.3	21.3	19.7	19.0	19.5	18.9	16.3	17.7	16.4	13.7	15.4	12.5	9.3
3.00	38.9	36.5	29.2	22.6	21.8	20.1	22.2	20.5	19.8	20.3	19.7	17.2	18.4	17.1	14.4	16.1	13.1	10.0

Rates are given for typical slick motor configurations.

Please contact our office for configuration specific predictions.

Notes:

1. Drill string rotation at bend settings above 1.50° is not recommended.
2. Build rate predictions are based on 3 point geometry and are theoretical only. Actual build rates depend on many factors.
3. For performance drilling applications, where the motor is set at 1.15° or less, drill string rotary speed should be kept under 120 rpm.
4. For directional drilling applications, where the motor is set 1.5° or less, drill string rotary speed should be kept under 60 rpm.

For Adjustable Motors 0° to 4°

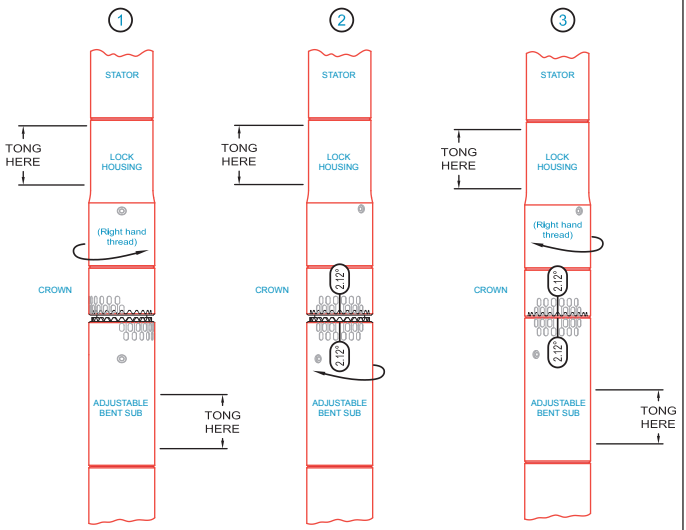
	Degrees per 100 feet					
	Motor Sizes					
	2 7/8		3 1/8		3 1/2	
Bend Setting	Hole Size	Hole Size	Hole Size	Hole Size	Hole Size	Hole Size
Degrees	3 1/2	4 1/2	3 7/8	4 3/4	4 3/4	5 7/8
0.00						
0.35	4.2		3.8		0.6	
0.69	10.6		9.4	1.0	5.8	
1.04	17.1	0.4	15.2	6.7	11.0	1.9
1.37	23.3	6.5	20.6	12.2	16.0	6.9
1.69	29.2	12.5	25.9	17.4	20.8	11.7
2.00	35.0	18.2	31.0	22.5	25.4	16.4
2.29	40.4	23.6	35.8	27.2	29.8	20.7
2.57	45.7	28.8	40.4	31.8	34.0	24.9
2.83	50.5	33.6	44.7	36.1	37.9	28.8
3.06	54.8	37.8	48.5	39.9	41.4	32.3
3.28	58.9	41.9	52.1	43.5	44.7	35.6
3.46	62.3	45.2	55.1	46.4	47.4	38.3
3.63	65.5	48.4	57.9	49.2	49.9	40.8
3.76	67.9	50.8	60.0	51.3	51.9	42.8
3.86	69.8	52.7	61.7	53.0	53.4	44.3
3.94	71.2	54.1	63.0	54.3	54.6	45.5
3.98	72.0	54.9	63.7	54.9	55.2	46.1
4.00	72.4	55.3	64.0	55.3	55.5	46.4

Rates are given for typical slick motor configurations.
Please contact our office for configuration specific predictions.

Notes:

1. Drill string rotation at bend settings above 1.50° is not recommended.
2. Build rate predictions are based on 3 point geometry and are theoretical only. Actual build rates depend on many factors.
3. For performance drilling applications, where the motor is set at 1.15° or less, drill string rotary speed should be kept under 120 rpm.
4. For directional drilling applications, where the motor is set 1.5° or less, drill string rotary speed should be kept under 60 rpm.

Wenzel Easy-Set III Adjustable Bent Housings
Series 22 (0° to 3°)
Setting Procedure



Break connection and unscrew using a chain tong to expose teeth

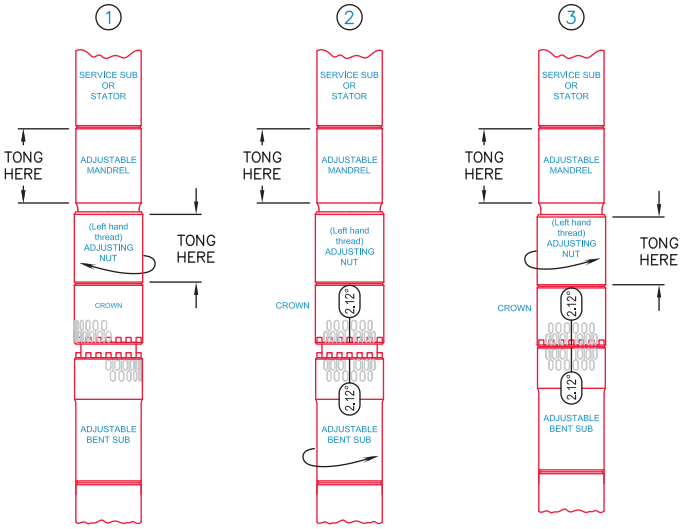
Turn left or right to desired bend setting (Maximum rotation (total) is limited to 1/2 turn by internal stop. The internal stop will prevent rotating past 0° ot 3° setting.)

Turn the Lock Housing, using a chain tong, to lower the Crown to the Adjustable Bent Sub. Maintain alignment of desired setting marks while turning. Torque to recommended value.

Where the numbers are aligned indicates the inside of bend / high side mark of the tool

RECOMMENDED MAKE UP TORQUES		
TOOL SIZE (Inches)	TORQUE (ft.lbs)	TORQUE (Nm)
3 1/2	5500	7500
4 3/4 - 5 1/8	15,000	20 300
6 1/2 - 6 3/4	35,000	47 450
7 3/4	40,000	54 200
8	45,000	61 000
9 1/2	60,000	81 300

Wenzel Easy-Set Adjustable Bent Housings Series 14 (0° to 3°) and Series 15 (0° to 4°) Setting Procedure



Break connection and unscrew using a chain tong to expose teeth

Turn to desired bend setting

Tighten Adjusting Nut using a chain tong and then torque to recommended value

Where the numbers are aligned indicates the inside of bend / high side mark of the tool

RECOMMENDED MAKE UP TORQUES		
TOOL SIZE (Inches)	TORQUE (ft.lbs)	TORQUE (Nm)
2 7/8	1500, Left Hand	2030, Left Hand
3 1/8	2200, Left Hand	2980, Left Hand
3 1/2	3500, Left Hand	4750, Left Hand
4 3/4-5	10,000, Left Hand	13 500, Left Hand
6 1/2	30,000, Left Hand	40 670, Left Hand
7	30,000, Left Hand	40 670, Left Hand
8	40,000, Left Hand	54 200, Left Hand
9 1/2-9 5/8	60,000, Left Hand	81 350, Left Hand

Adjustable Bent Housing

2 DEGREES	3 DEGREES	4 DEGREES
0.00	0.00	0.00
0.26	0.39	0.35
0.52	0.78	0.69
0.77	1.15	1.04
1.00	1.50	1.37
1.22	1.83	1.69
1.41	2.12	2.00
1.59	2.38	2.29
1.73	2.60	2.57
1.85	2.77	2.83
1.93	2.89	3.06
1.98	2.97	3.28
2.00	3.00	3.46
		3.63
		3.76
		3.86
		3.94
		3.98
		4.00

Size		Configuration	Flow Rates		Speed Ratio		Bit Speed	Maxium Torque		Stall Torque		Max. Differential	
Inch	mm		gpm	lpm	Rev / Gal	Rev / l	rpm	ft · lbs.	N · m	ft · lbs.	N · m	PSI	kPa
2 7/8	73	7/8 ml 2 stg. Air	70 - 130	264 - 492	2.154	0.569	150 - 280	360	488	545	739	300	2069
2 7/8	73	7/8 ml 3 stg.	50 - 100	189 - 378	2.700	0.714	135 - 270	440	597	690	936	450	3103
2 7/8	79	7/8 ml 3.7 stg.	60 - 130	227 - 492	2.300	0.608	138 - 299	733	994	1,100	1491	648	4464
3 1/2	89	7/8 ml 3.8 stg.	75 - 150	284 - 568	1.570	0.415	118 - 235	1,103	1495	1,655	2243	665	4585
4 3/4 (5)	121 (127)	5/6 ml 6 stg.	150 - 350	568 - 1325	0.850	0.225	127 - 296	3,214	4358	4,820	6535	1,050	7240
4 3/4 (5)	121 (127)	5/6 ml 8.3 stg.	100 - 275	379 - 1041	1.030	0.270	103 - 283	3,100	4204	4,650	6305	1,130	7797
4 3/4 (5)	121 (127)	5/6 ml 8.3 stg. HR	125 - 275	470 - 1041	1.040	0.275	130 - 280	6,420	8706	9,650	13 085	2,490	17 169
4 3/4 (5)	121 (127)	6/7 ml 8.0 stg, HR	150 - 350	568 - 1325	0.807	0.213	121 - 290	5,720	7756	8,580	11 634	1,800	12 411
4 3/4 (5)	121 (127)	7/8 ml 2.2 stg. Slow	100 - 300	379 - 1136	0.300	0.079	30 - 92	2,729	3701	4,093	5550	385	2655
4 3/4 (5)	121 (127)	7/8 ml 2.2 stg Slo HR	100 - 300	379 - 1136	0.300	0.079	30 - 92	3,900	5290	7,800	10 577	550	3792
4 3/4 (5)	121 (127)	7/8 ml 2.6 stg.	150 - 300	568 - 1136	0.260	0.069	39 - 79	3,500	4746	5,250	7119	390	2689
4 3/4 (5)	121 (127)	7/8 ml 2.6 stg. HR	150 - 300	568 - 1136	0.260	0.069	39 - 79	5,250	7119	7,880	10 685	590	4068
4 3/4 (5)	121 (127)	7/8 ml 3.7 stg.	100 - 275	379 - 1041	0.356	0.094	36 - 98	3,810	5166	5,710	7743	560	3861
4 3/4 (5)	121 (127)	7/8 ml 3.7 stg. HR	100 - 275	379 - 1041	0.356	0.094	36 - 98	5,710	7743	8,560	11 607	840	5792
4 3/4 (5)	121 (127)	7/8 ml 3.8 stg.	100 - 275	379 - 1041	0.510	0.135	51 - 140	2,810	3810	4,215	5715	665	4585
4 3/4 (5)	121 (127)	7/8 ml 3.8 stg. HR	150 - 250	568 - 946	0.520	0.137	78 - 130	4,450	6034	6,670	9 045	860	5930
4 3/4 (5)	121 (127)	7/8 ml 5 stg.	150 - 300	568 - 1136	0.630	0.166	94 - 189	3,193	4330	4,789	6493	875	6033
4 3/4 (5)	121 (127)	7/8 ml 5 stg. HR	150 - 300	568 - 1136	0.630	0.166	94 - 189	4,565	6190	9,130	12 380	1,250	8620
4 3/4 (5)	121 (127)	9/10 2.1 stg	150 - 300	568-1136	0.170	0.037	26 - 51	5,322	7217	7,983	10 825	362	2496

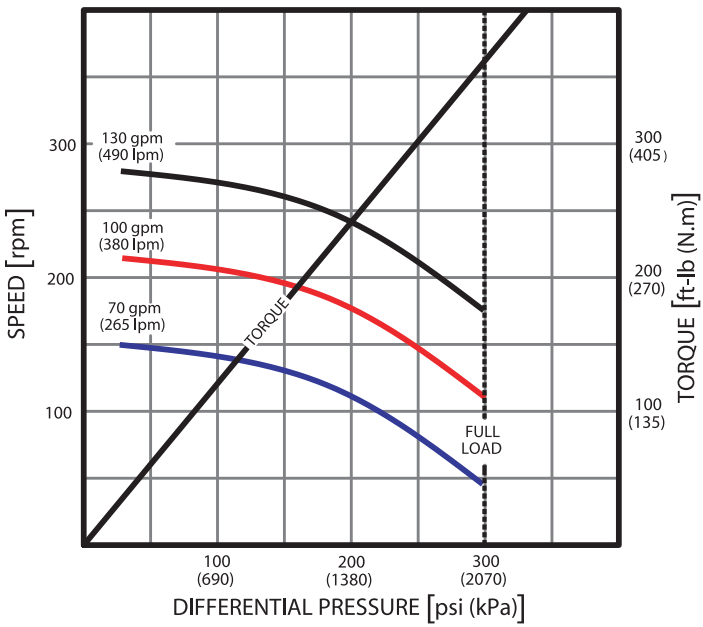
Size		Configuration	Flow Rates		Speed Ratio		Bit Speed	Maxium Torque		Stall Torque		Max. Differential	
Inch	mm		gpm	lpm	Rev / Gal	Rev / l	rpm	ft · lbs.	N · m	ft · lbs.	N · m	PSI	kPa
6 1/2	165	4/5 ml 7 stg.	300 - 600	1136 - 2271	0.497	0.131	149 - 300	6,060	8220	9,090	12 330	1,050	7,240
6 1/2	165	4/5 ml 7 stg. HR	300 - 600	1136 - 2271	0.497	0.131	149 - 300	9,090	12 325	13,635	18 490	1,580	10 895
6 1/2 (6 1/4)	165 (159)	6/7 ml 5 stg.	200 - 500	757 - 1893	0.350	0.090	68 - 169	6,652	9018	9,978	13 528	875	6033
6 1/2 (6 1/4)	165 (159)	6/7 ml 5 stg. HR	200 - 500	757 - 1893	0.350	0.090	68 - 169	9,510	12 895	19,020	25 791	1,250	8620
6 1/2 (6 3/4)	165 (171)	6/7 ml 5 stg.	300 - 600	1136 - 2271	0.290	0.077	87 - 174	7,280	9870	10,920	14 806	875	6033
6 1/2 (6 3/4)	165 (171)	6/7 ml 5 stg. HR	300 - 600	1136 - 2271	0.290	0.077	87 - 174	10,400	14 100	20,800	28 200	1,250	8620
6 1/2	165	7/8 ml 2.1 stg.	300 - 600	1135 - 2271	0.110	0.029	34 - 69	6,745	9145	10,117	13 717	368	2537
6 1/2	165	7/8 ml 2.1 stg. HR	300 - 600	1136 - 2271	0.110	0.029	34 - 69	9,645	13 077	19,290	26 150	525	3620
6 1/2 (6 1/4)	165 (159)	7/8 ml 3 stg. Slow	300 - 600	1136 - 2271	0.200	0.053	59 - 118	6,531	8855	9,797	13 282	525	3620
6 1/2 (6 1/4)	165 (159)	7/8 ml 3 stg. Slo HR	300 - 600	1136 - 2271	0.200	0.053	59 - 118	9,143	12 398	18,286	24 796	735	5068
6 1/2 (6 3/4)	165 (171)	7/8 ml 3 stg. Slow	300 - 600	1136 - 2271	0.150	0.040	45 - 90	8,937	12 117	13,406	18 175	525	3620
6 1/2 (6 3/4)	165 (171)	7/8 ml 3 stg. Slo HR	300 - 600	1136 - 2271	0.150	0.040	45 - 90	12,780	17 327	25,560	34 654	750	5171
6 1/2	165	7/8 ml 4 stg.	150 - 500	568 - 1893	0.350	0.092	53 - 176	5,170	7010	7,756	10 515	700	4826
6 1/2	165	7/8 ml 4 stg. HR	200 - 600	757 - 2271	0.350	0.092	70 - 211	7,400	10034	14,800	20 069	1,000	6895
6 1/2	165	7/8 ml 4.8 stg.	200 - 500	757 - 1893	0.320	0.085	64 - 161	6,810	9233	10,215	13 850	840	5792
6 1/2	165	7/8 ml 4.8 stg. HR	200 - 500	757 - 1893	0.320	0.085	64 - 161	9,738	13 205	14,607	19 807	1,200	8274
6 1/2	165	7/8 ml 5 stg. HR	300 - 600	1136 - 2271	0.287	0.076	86 - 180	10,460	14 184	15,690	21 276	1,130	7790
6 1/2 (6 3/4)	165 (171)	7/8 6 stg.	300 - 600	1136 - 2271	0.260	0.069	78 - 157	9,525	12 915	14,288	19 375	1,050	7239
6 1/2 (6 3/4)	165 (171)	7/8 6 stg. HR	300 - 600	1136 - 2271	0.260	0.069	78 - 157	13,600	18 450	20,410	27 670	1,500	10 340
6 1/2 (6 3/4)	165 (171)	9/10 3.5 stg.	350 - 625	1325 - 2366	0.150	0.040	53 - 94	10,752	14 577	16,128	21 866	619	4268

Size		Configuration	Flow Rates		Speed Ratio		Bit Speed	Maxium Torque		Stall Torque		Max. Differential	
Inch	mm		gpm	lpm	Rev / Gal	Rev / l	rpm	ft · lbs.	N · m	ft · lbs.	N · m	PSI	kPa
8	203	6/7 ml 6 stg.	300 - 900	1136 - 3407	0.263	0.069	79 - 237	10,427	14,139	15,641	21 206	1,050	7,240
7 3/4 (8)	197 (203)	7/8 ml 2.5 stg. Slow	300 - 900	1136 - 3407	0.070	0.018	22 - 66	12,816	17 376	19,224	26 064	438	3020
7 3/4 (8)	197 (203)	7/8 ml 2.5 stg. Slo HR	300 - 900	1136 - 3407	0.070	0.018	22 - 66	18,314	24 830	36,628	49 660	625	4309
7 3/4 (8)	197 (203)	7/8 ml 3 stg.	300 - 900	1136 - 3407	0.170	0.045	51 - 153	7,550	10 236	11,325	15 354	525	3620
7 3/4 (8)	197 (203)	7/8 ml 4 stg.	300 - 900	1136 - 3407	0.160	0.042	48 - 143	11,469	15 549	17,203	23 324	700	4826
7 3/4 (8)	197 (203)	7/8 ml 4 stg. HR	400 - 900	1515 - 3407	0.066	0.044	66 - 149	14,940	20 259	22,400	30 374	900	6206
7 3/4 (8)	197 (203)	8/9 ml 6 stg.	300 - 900	1136 - 3407	0.220	0.058	65 - 196	12,548	17 012	18,821	25 518	1,050	7239
9 1/2	241	5/6 ml 3 stg.	600 - 1200	2271 - 4542	0.112	0.030	67 - 135	10,685	14 489	30,400	41 222	450	3103
9 1/2	241	5/6 ml 4 stg.	600 - 1200	2271 - 4542	0.110	0.029	65 - 130	16,792	22 766	25,188	34 149	700	4826
9 1/2	241	5/6 ml 5 stg.	700 - 1300	2650 - 4920	0.140	0.036	96 - 180	16,120	21 850	24,170	32 770	750	5170
9 1/2	241	5/6 5 ml stg. HR	700 - 1300	2650 - 4920	0.140	0.036	96 - 180	24,170	32 770	36,260	49 160	1,130	7760
9 1/2	241	6/7 ml 5 stg.	600 - 1200	2271 - 4542	0.120	0.032	76 - 148	18,449	25 013	27,674	37 520	875	6033
9 1/2	241	7/8 ml 2.5 stg. Slow	300 - 900	1136 - 3407	0.070	0.018	22 - 66	12,816	17 376	19,224	26 064	438	3020
11 1/4	286	6/7 ml 3.5 stg. ERT	600 - 1200	2271 - 4542	0.107	0.028	65 - 125	32,275	43 760	54,000	73 225	1,300	8965

2 7/8” 73 mm 7/8 - 2 Stage Air

Performance Specifications	Imperial	Metric
Flow Range	70 - 130 gpm	264 - 492 lpm
Speed Range	150 - 280 rpm	150 - 280 rpm
Speed Ratio	2.15 rev/gal	0.57 rev/l
Recommended Max Differential Pressure	300 psi	2,069 kPa
Torque Ratio	1.20 ft lbs/ psi	0.236 Nm/ kPa
Torque at Recommended Max Differential	360 ft lbs	488 Nm
Stall Torque	545 ft lbs	739 Nm

2.88 (73 mm) 7-8 2 Stg. AIR

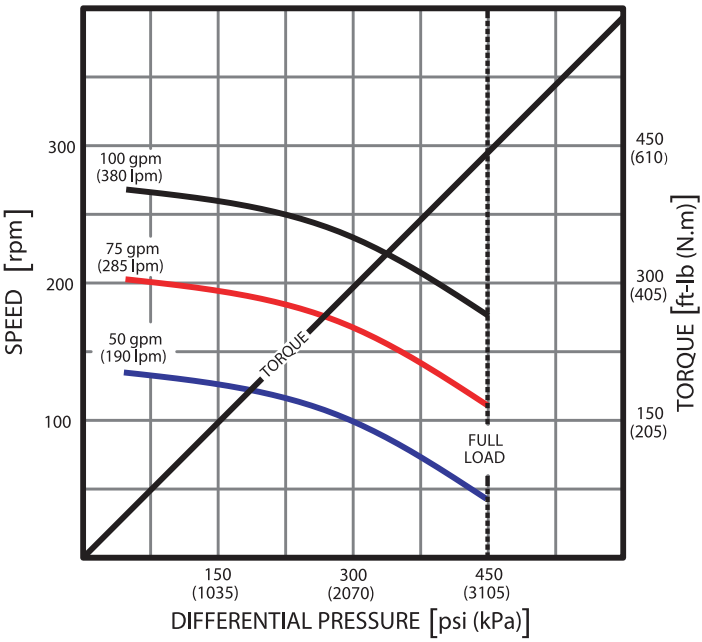


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend	2.73 ft	0.83 m
Hole Size	3 ½” - 4½”	89 - 114 mm
Standard Bit Box Thread	2 3/8 Reg	2 3/8 Reg
Max WOB	11,400 lbs	5,100 daN
Max Pull while back Reaming	19,000 lbs	8,500 daN
Absolute Overpull	157,000 lbs	69,800 daN
Tool Weight	210 lbs	95 kg
Length	13.22 ft	4.03 m
Adjustable Torque (S15)	1,500 ft lbs Left	2,032 Nm Left
Stabilizer Torque	600 ft lbs	814 Nm

2 7/8” 73 mm 7/8 - 3 Stage

Performance Specifications	Imperial	Metric
Flow Range	50 - 100 gal	189 - 378 lpm
Speed Range	135 - 270 rpm	135 - 270 rpm
Speed Ratio	2.70 rev/gal	0.714 rev/l
Recommended Max Differential Pressure	450 psi	3,103 kPa
Torque Ratio	0.977 ft lbs/ psi	0.192 Nm/ kPa
Torque at Recommended Max Differential	440 ft lbs	597 Nm
Stall Torque	690 ft lbs	936 Nm

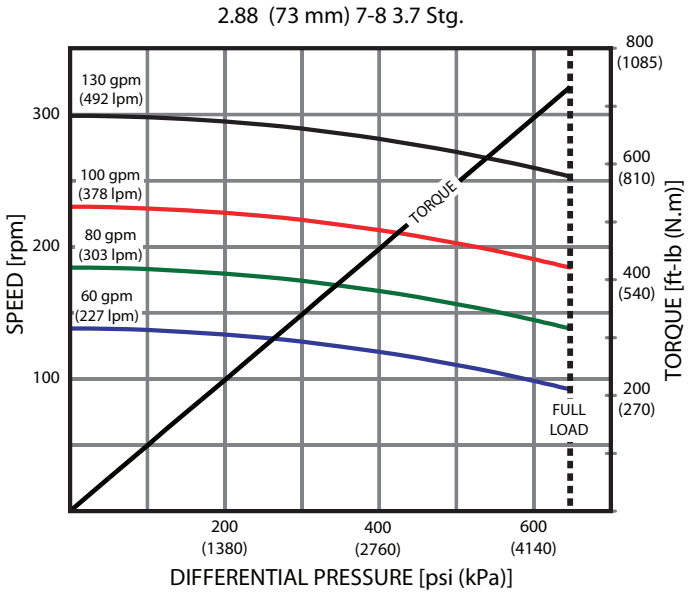
2.88 (73 mm) 7-8 3 Stg.



M6 Motor Specifications	Imperial	Metric
Bit Box to Bend	2.73 ft	0.83 m
Hole Size	3 ½” - 4 ½”	89 - 114 mm
Standard Bit Box Thread	2 3/8 Reg	2 3/8 Reg
Max WOB	11,400 lbs	5,100 daN
Max Pull while back Reaming	19,000 lbs	8,500 daN
Absolute Overpull	157,000 lbs	69,800 daN
Tool Weight	225 lbs	102 kg
Length	14.22 ft	4.33 m
Adjustable Torque (S15)	1,500 ft lbs Left	2,032 Nm Left
Stabilizer Torque	600 ft lbs	814 Nm

2 7/8” 73 mm 7/8 - 3.7 Stage

Performance Specifications	Imperial	Metric
Flow Range	60 - 130 gal	227 - 492 lpm
Speed Range	138 - 229 rpm	138 - 229 rpm
Speed Ratio	2.30 rev/gal	0.608 rev/l
Recommended Max Differential Pressure	648 psi	4,464 kPa
Torque Ratio	1.13 ft lbs/ psi	0.223 Nm/ kPa
Torque at Recommended Max Differential	733 ft lbs	994 Nm
Stall Torque	1100 ft lbs	1491 Nm

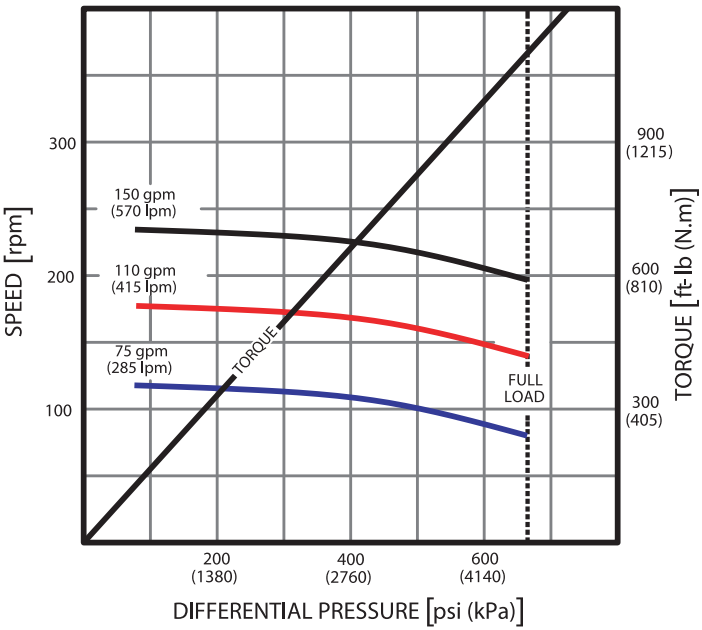


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend	2.73 ft	0.83 m
Hole Size	3 ½” - 4 ½”	89 - 114 mm
Standard Bit Box Thread	2 3/8 Reg	2 3/8 Reg
Max WOB	11,400 lbs	5,100 daN
Max Pull while back Reaming	19,000 lbs	8,500 daN
Absolute Overpull	157,000 lbs	69,800 daN
Tool Weight	240 lbs	110 kg
Length (Fixed Bend)	15.3 ft	4.66 m
Adjustable Torque (S15)	1,500 ft lbs Left	2,032 Nm Left
Stabilizer Torque	600 ft lbs	814 Nm

3 1/2” 89 mm 7/8 - 3.8 Stage

Performance Specifications	Imperial	Metric
Flow Range	75 - 150 gpm	284 - 568 lpm
Speed Range	118 - 235 rpm	118 - 235 rpm
Speed Ratio	1.57 rev/gal	0.41 rev/l
Recommended Max Differential Pressure	660 psi	4,550 kPa
Torque Ratio	1.67 ft lbs/ psi	0.33 Nm/ kPa
Torque at Recommended Max Differential	1,100 ft lbs	1,490 Nm
Stall Torque	1,655 ft lbs	2,243 Nm

3.50 (89 mm) 7-8 3.8 Stg.



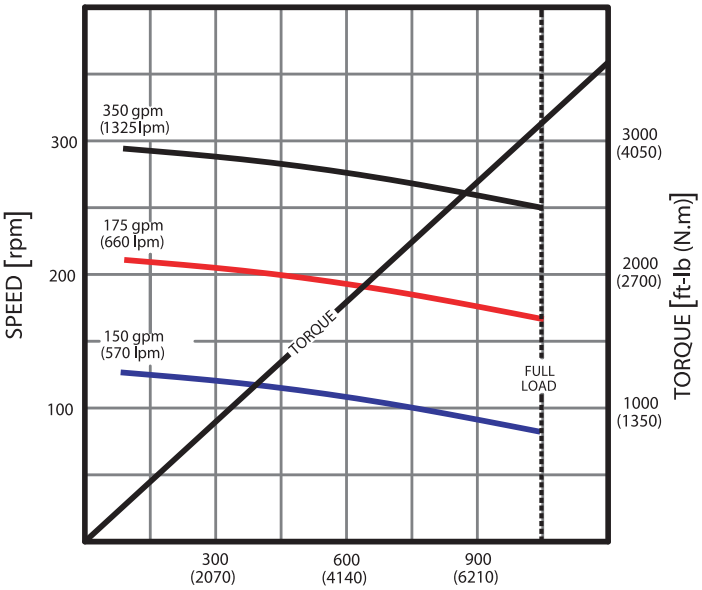
M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	3.11 ft	.95 m
Bit box to Bend - FBH	2.5 ft	.77 m
Hole Size	4 ¼” - 5 7/8”	108 - 149 mm
Standard Bit Box Thread	2 7/8 Reg	2 7/8 Reg
Max WOB	18,500 lbs	8,200 daN
Max Pull while back Reaming	30,900 lbs	13,750 daN
Absolute Overpull	226,000 lbs	100,500 daN
Tool Weight	415 lbs	188 kg
Length	18.07 ft	5.51 m
Adjustable Torque (S22)	5,500 ft lbs	7,500 Nm
Stabilizer Torque	2,200 ft lbs	2,983 Nm

4 3/4"* 121 mm 5/6 - 6 Stage

Performance Specifications	Imperial	Metric
Flow Range	150 - 350 gpm	568 - 1,325 lpm
Speed Range	127 - 296 rpm	127 - 296 rpm
Speed Ratio	0.85 rev/gal	0.225 rev/l
Recommended Max Differential Pressure	1,050 psi	7,240 kPa
Torque Ratio	3.06 ft lbs/ psi	0.60 Nm/ kPa
Torque at Recommended Max Differential	3,214 ft lbs	4,358 Nm
Stall Torque	4,820 ft lbs	6,536 Nm

*Supplied with 5"(127mm) O.D. power section in some regions.

4.75/5.00 (121/127) 5-6 6 Stg.



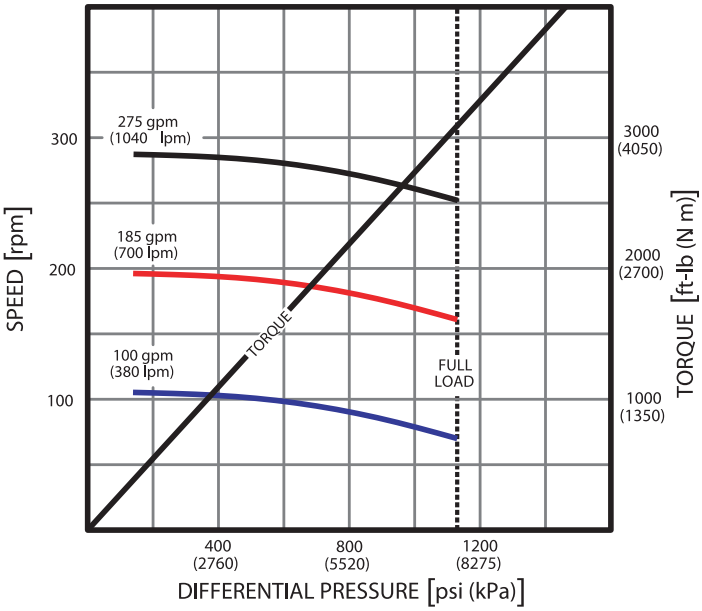
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8" - 7 7/8"	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1210 lbs	550 kg
Length	27.1 ft	8.27 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121 mm 5/6 - 8.3 Stage

Performance Specifications	Imperial	Metric
Flow Range	100 - 275 gpm	379 - 1,041 lpm
Speed Range	103 - 283 rpm	103 - 283 rpm
Speed Ratio	1.03 rev/gal	0.27 rev/l
Recommended Max Differential Pressure	1,130 psi	7,793 kPa
Torque Ratio	2.74 ft lbs/ psi	0.539 Nm/ kPa
Torque at Recommended Max Differential	3,100 ft lbs	4,204 Nm
Stall Torque	4,650 ft lbs	6,305 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

4.75/5.00 (121/127mm) 5-6 8.3 Stg.



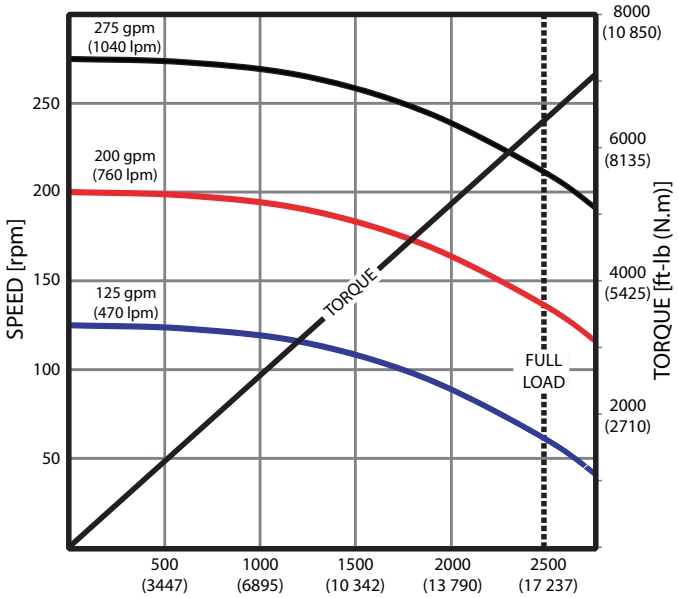
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1400 lbs	640 kg
Length	31.54 ft	9.61 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121 mm 5/6-8.3 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	125 - 275 gpm	473 - 1041 lpm
Speed Range	130 - 280 rpm	130 - 280 rpm
Speed Ratio	1.040 rev/gal	0.275 rev/l
Recommended Max Differential Pressure	2490 psi	17,169 kPa
Torque Ratio	2.58 ft lbs/ psi	0.51 Nm/ kPa
Torque at Recommended Max Differential	6420 ft lbs	8706 Nm
Stall Torque	9650 ft lbs	13,085 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

5.00 (127 mm) 5-6 8.3 Stg. D



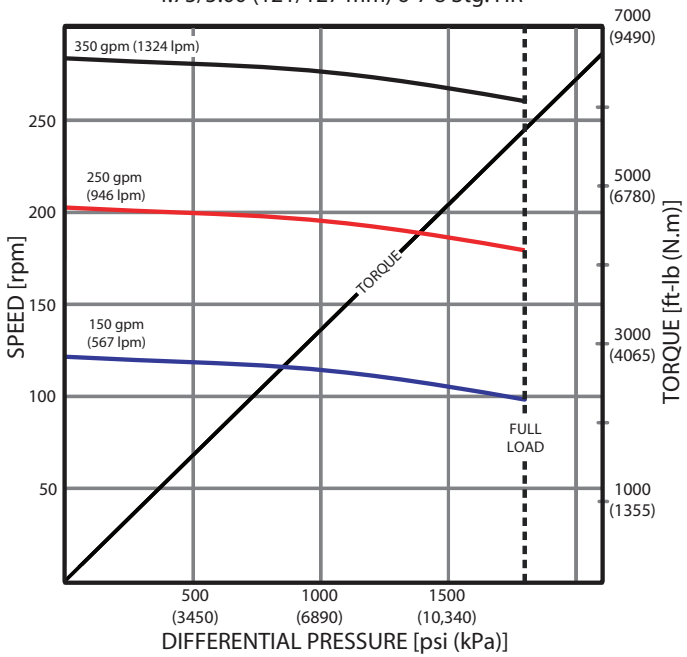
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1400 lbs	640 kg
Length	31.54 ft	9.61 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121 mm 6/7 - 8 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	150 - 350 gpm	568 - 1325 lpm
Speed Range	121 - 290 rpm	121 - 290 rpm
Speed Ratio	0.807 rev/gal	0.213 rev/l
Recommended Max Differential Pressure	1800 psi	12,411 kPa
Torque Ratio	3.18 ft lbs/ psi	0.62 Nm/ kPa
Torque at Recommended Max Differential	5720 ft lbs	7756Nm
Stall Torque	8580 ft lbs	11,634 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm) 6-7 8 Stg. HR



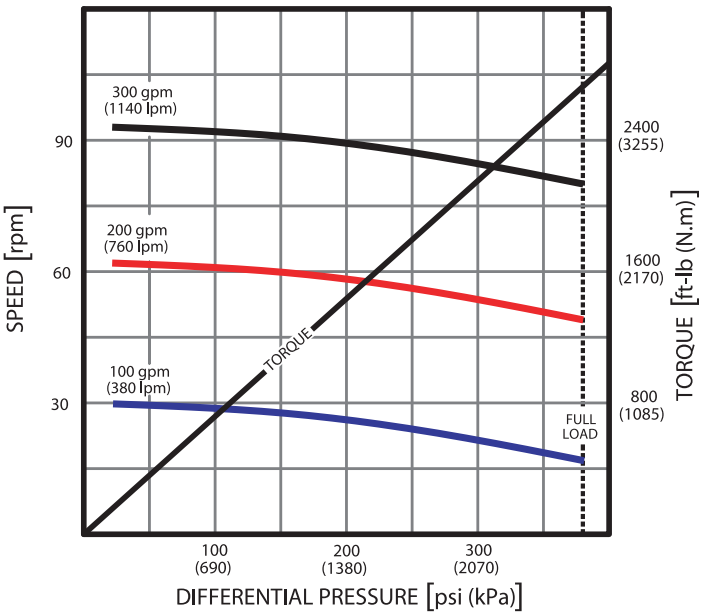
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1415 lbs	640 kg
Length	31.75 ft	9.68 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4"* 121 mm 7/8 -2.2 Stg.Slow

Performance Specifications	Imperial	Metric
Flow Range	100 - 300 gpm	379 - 1,136 lpm
Speed Range	30 - 92 rpm	30 - 92 rpm
Speed Ratio	0.30 rev/gal	0.079 rev/l
Recommended Max Differential Pressure	385 psi	2,655 kPa
Torque Ratio	7.09 ft lbs/ psi	1,394 Nm/ kPa
Torque at Recommended Max Differential	2,729 ft lbs	3,700 Nm
Stall Torque	4,093 ft lbs	5,550 Nm

*Supplied with 5"(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm) 7-8 2.2 Stg. True Slow



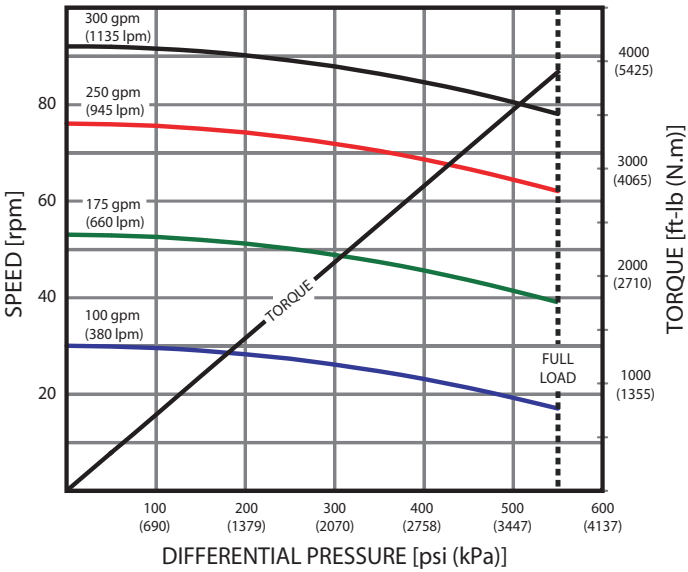
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8" - 7 7/8"	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1240 lbs	560 kg
Length	27.80 ft	8.47 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4"* 121mm 7/8-2.2 Stg. H.R.

Performance Specifications	Imperial	Metric
Flow Range	100 - 300 gpm	379 - 1136 lpm
Speed Range	30 - 92 rpm	30 - 92 rpm
Speed Ratio	0.30 rev/gal	0.079 rev/l
Recommended Max Differential Pressure	550 psi	3,792 kPa
Torque Ratio	7.09 ft lbs/ psi	1.395 Nm/ kPa
Torque at Recommended Max Differential	3,900 ft lbs	5,290 Nm
Stall Torque	7,800 ft lbs	10,580 Nm

*Supplied with 5"(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm) 7-8 2.2 Stg. Slo HR



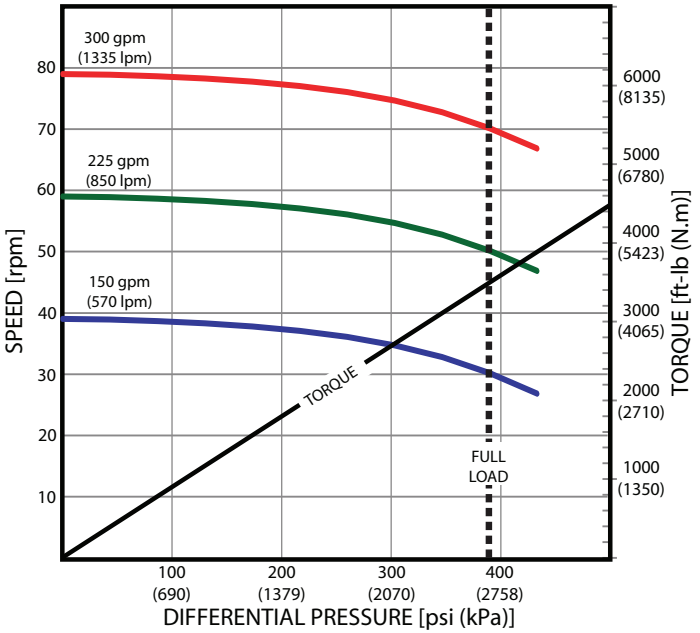
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8" - 7 7/8"	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1240 lbs	560 kg
Length	27.80 ft	8.47 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121 mm 7/8 - 2.6 Stage

Performance Specifications	Imperial	Metric
Flow Range	150 - 300 gpm	568 - 1,136 lpm
Speed Range	39 - 79 rpm	39 - 79 rpm
Speed Ratio	0.26 rev/gal	0.069 rev/l
Recommended Max Differential Pressure	390 psi	2689 kPa
Torque Ratio	8.97 ft lbs/ psi	1.76 Nm/ kPa
Torque at Recommended Max Differential	3500 ft lbs	4746 Nm
Stall Torque	5250 ft lbs	7120 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm 7-8 2.6 Stg.



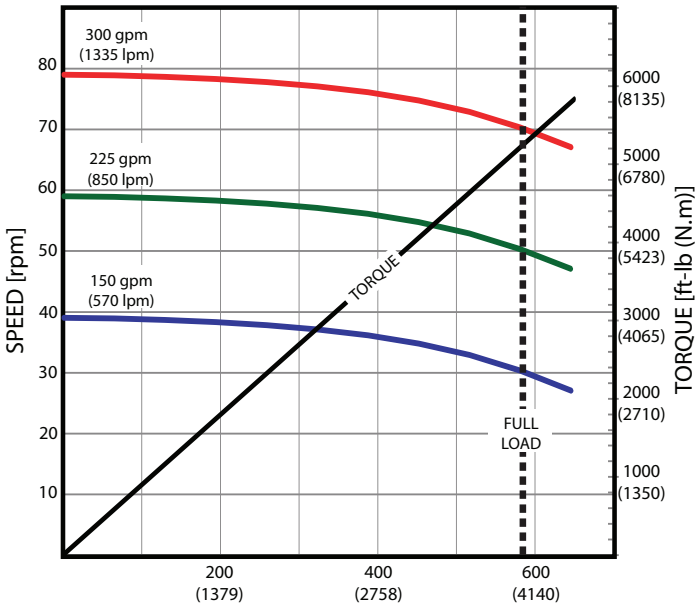
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1350 lbs	610 kg
Length	30.62 ft	9.33 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121 mm 7/8 - 2.6 Stg.HR

Performance Specifications	Imperial	Metric
Flow Range	150 - 300 gpm	568 - 1,136 lpm
Speed Range	39 - 79 rpm	39 - 79 rpm
Speed Ratio	0.26 rev/gal	0.069 rev/l
Recommended Max Differential Pressure	590 psi	4068 kPa
Torque Ratio	8.97 ft lbs/ psi	1.76 Nm/ kPa
Torque at Recommended Max Differential	5250 ft lbs	7118 Nm
Stall Torque	7880 ft lbs	10 683 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm 7-8 2.6 Stg. H.R.



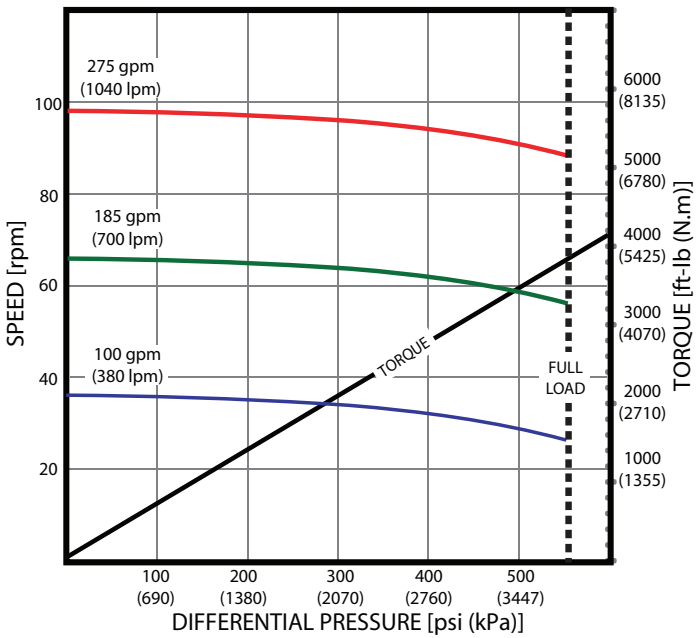
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1350 lbs	610 kg
Length	30.62 ft	9.33 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121mm 7/8 - 3.7 Stage

Performance Specifications	Imperial	Metric
Flow Range	100 - 275 gpm	379 - 1041 lpm
Speed Range	36 - 98 rpm	36 - 98 rpm
Speed Ratio	0.356 rev/gal	0.094 rev/l
Recommended Max Differential Pressure	560 psi	3861 kPa
Torque Ratio	6.85 ft lbs/ psi	1.34 Nm/ kPa
Torque at Recommended Max Differential	3810 ft lbs	5166 Nm
Stall Torque	5710 ft lbs	7743 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm) 7-8 3.7 Stg.

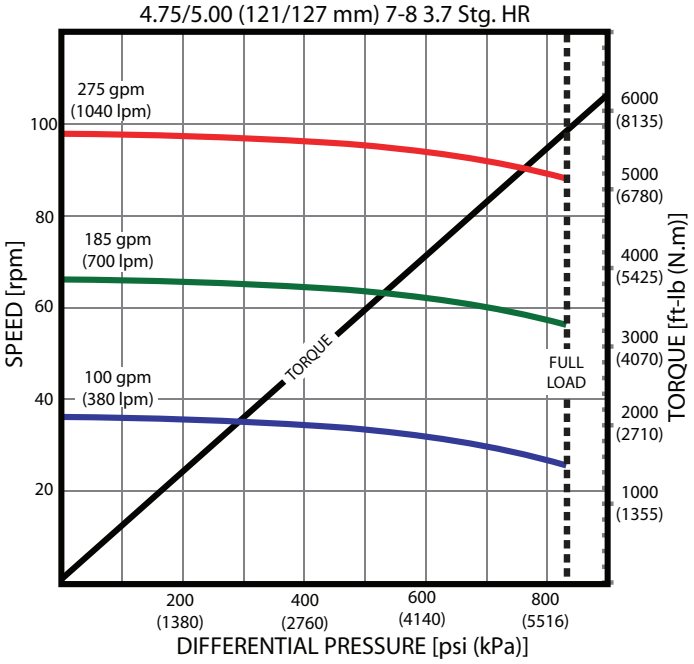


M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,000 daN
Tool Weight	1350 lbs	610 kg
Length	30.21 ft	9.21 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121mm 7/8-3.7 Stg. HR

Performance Specifications	Imperial	Metric
Flow Range	100 - 275 gpm	379 - 1041 lpm
Speed Range	36 - 98 rpm	36 - 98 rpm
Speed Ratio	0.356 rev/gal	0.094 rev/l
Recommended Max Differential Pressure	560 psi	3861 kPa
Torque Ratio	6.85 ft lbs/ psi	1.34 Nm/ kPa
Torque at Recommended Max Differential	5710 ft lbs	7743 Nm
Stall Torque	8560 ft lbs	11,607 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.



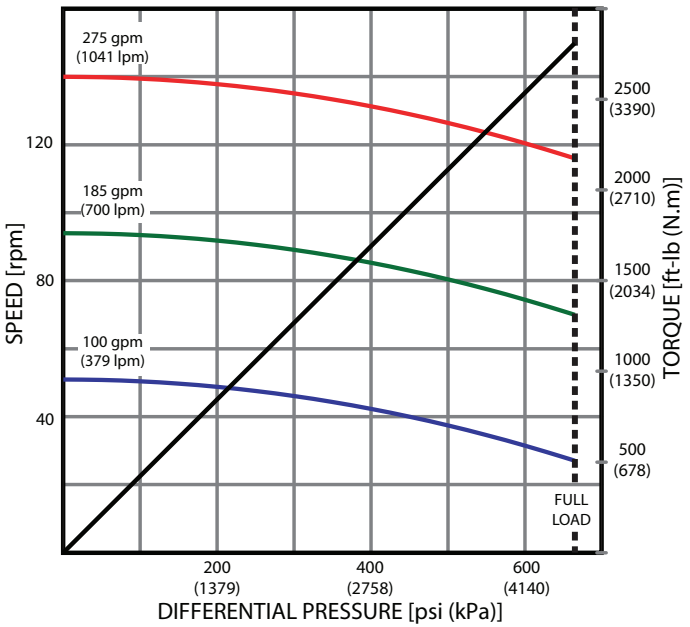
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,000 daN
Tool Weight	1350 lbs	610 kg
Length	30.21 ft	9.21 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121 mm 7/8 - 3.8 Stage

Performance Specifications	Imperial	Metric
Flow Range	100 - 275 gpm	379 - 1041 lpm
Speed Range	51 - 140 rpm	51 - 140 rpm
Speed Ratio	0.51 rev/gal	0.135 rev/l
Recommended Max Differential Pressure	665 psi	4,585 kPa
Torque Ratio	4.23 ft lbs/ psi	0.831 Nm/ kPa
Torque at Recommended Max Differential	2810 ft lbs	3810 Nm
Stall Torque	4215 ft lbs	5715 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm 7-8 3.8 Stg.



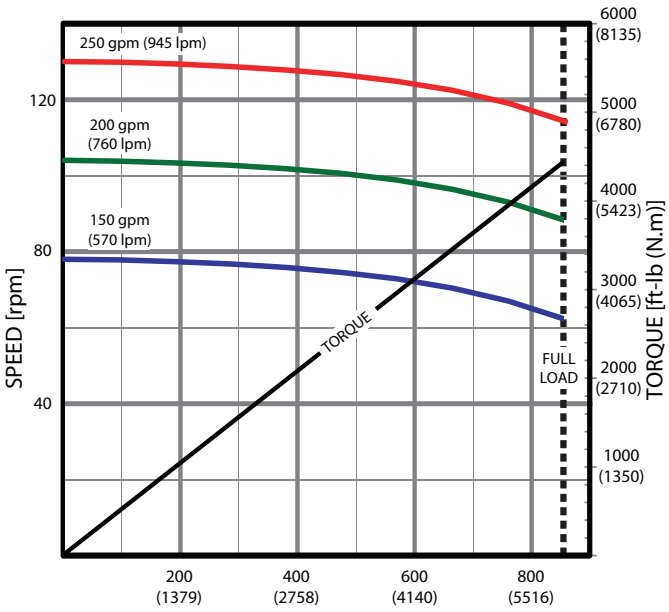
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1210 lbs	550 kg
Length	27.13 ft	8.27 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4"* 121 mm 7/8-3.8 Stg. HR

Performance Specifications	Imperial	Metric
Flow Range	150 - 250 gpm	568 - lpm
Speed Range	78 - 130 rpm	78 - 130 rpm
Speed Ratio	0.521 rev/gal	0.137 rev/l
Recommended Max Differential Pressure	860 psi	5930 kPa
Torque Ratio	5.17 ft lbs/ psi	1.02 Nm/ kPa
Torque at Recommended Max Differential	4450 ft lbs	6034 Nm
Stall Torque	6670 ft lbs	9045 Nm

*Supplied with 5"(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm 7-8 3.8 Stg. HR



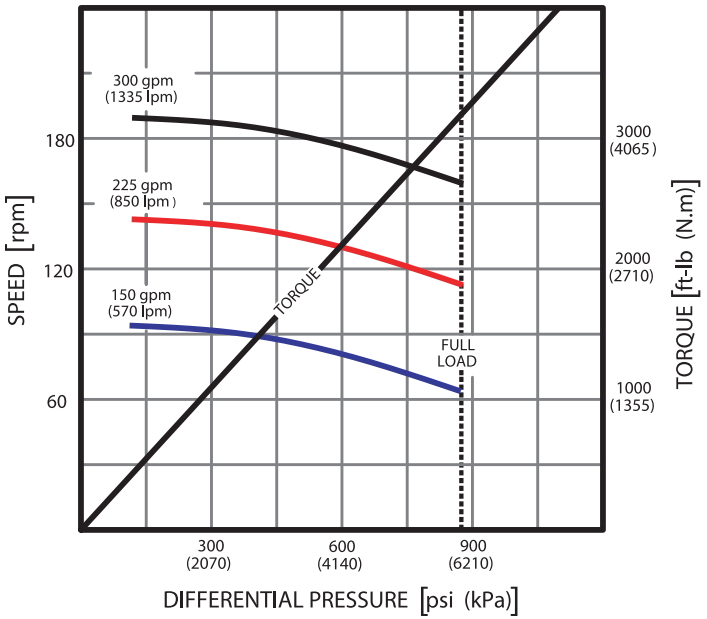
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8" - 7 7/8"	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1210 lbs	550 kg
Length	27.13 ft	8.27 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4"* 121 mm 7/8 - 5 Stage

Performance Specifications	Imperial	Metric
Flow Range	150 - 300 gpm	568 - 1,136 lpm
Speed Range	94 - 189 rpm	94 - 189 rpm
Speed Ratio	0.63 rev/gal	0.166 rev/l
Recommended Max Differential Pressure	875 psi	6,033 kPa
Torque Ratio	3.65 ft lbs/ psi	0.718 Nm/ kPa
Torque at Recommended Max Differential	3,193 ft lbs	4,329 Nm
Stall Torque	4,789 ft lbs	6,493 Nm

*Supplied with 5"(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm) 7-8 5 Stg.



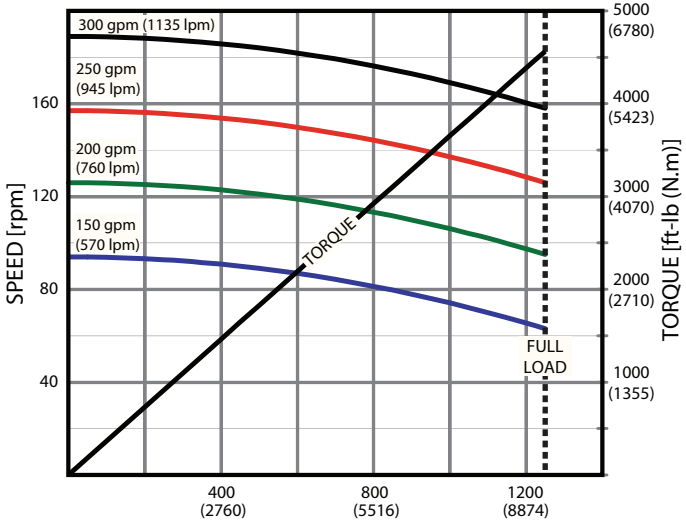
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8" - 7 7/8"	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1240 lbs	560 kg
Length	27.80 ft	8.47 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4”* 121 mm 7/8-5 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	150 - 300 gpm	568 - 1,136 lpm
Speed Range	94 - 189 rpm	94 - 189 rpm
Speed Ratio	0.63 rev/gal	0.166 rev/l
Recommended Max Differential Pressure	1,250 psi	8,618 kPa
Torque Ratio	3.65 ft lbs/ psi	0.718 Nm/ kPa
Torque at Recommended Max Differential	4,565 ft lbs	6,189 Nm
Stall Torque	9,130 ft lbs	12,378 Nm

*Supplied with 5”(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm) 7-8 5.0 Stg. HR



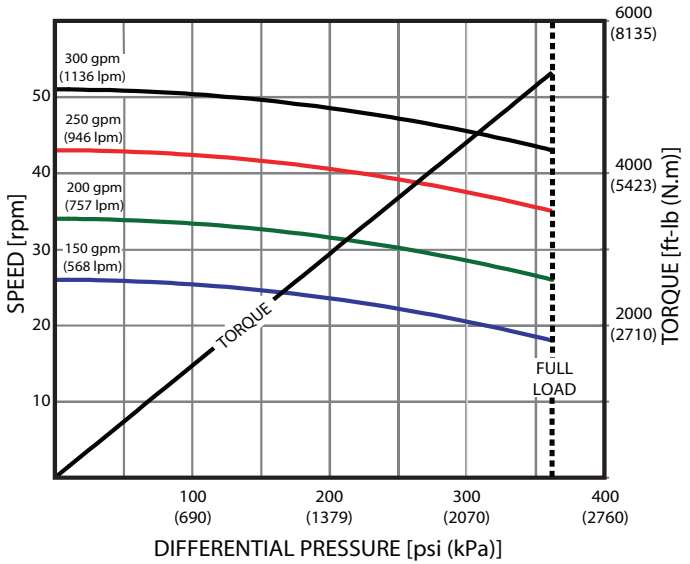
M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8” - 7 7/8”	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,100 daN
Tool Weight	1240 lbs	560 kg
Length	27.80 ft	8.47 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

4 3/4"* 121 mm 9/10 - 2.1 Stage

Performance Specifications	Imperial	Metric
Flow Range	150 - 300 gpm	568 - 1,136 lpm
Speed Range	26 - 51 rpm	26 - 51 rpm
Speed Ratio	0.17 rev/gal	0.037 rev/l
Recommended Max Differential Pressure	362 psi	2500 kPa
Torque Ratio	14.70 ft lbs/ psi	2.89 Nm/ kPa
Torque at Recommended Max Differential	5,322 ft lbs	7,220 Nm
Stall Torque	7,980 ft lbs	10,825 Nm

*Supplied with 5"(127mm) O.D. power section in some regions.

4.75/5.00 (121/127 mm) 9-10 2.1 Stg.

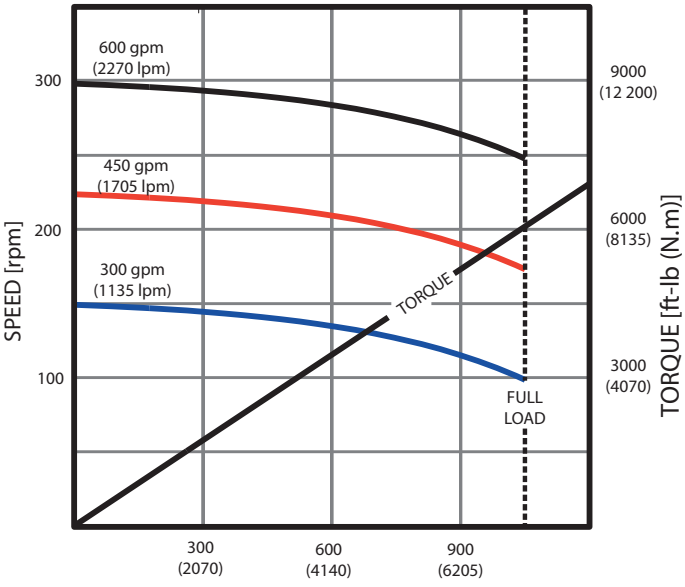


M5 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.13 ft	1.56 m
Bit Box to Bend - FBH	4.22 ft	1.29 m
Hole Size	5 7/8" - 7 7/8"	149 - 200 mm
Standard Bit Box Thread	3 ½ Reg	3 ½ Reg
Max WOB	53,300 lbs	23,700 daN
Max Pull while back Reaming	52,400 lbs	23,300 daN
Absolute Overpull	515,000 lbs	229,000 daN
Tool Weight	1350 lbs	610 kg
Length	30.25 ft	9.22 m
Adjustable Torque (S22)	15,000 ft lbs	20,300 Nm
Adjustable Torque (S14)	10,000 ft lbs Left	13,500 Nm Left
Stabilizer Torque	6,000 ft lbs	8,000 Nm

6 1/2” 165 mm 4/5 - 7 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	149 - 300 rpm	149 - 300 rpm
Speed Ratio	0.497 rev/gal	0.131 rev/l
Recommended Max Differential Pressure	1,050 psi	7,240 kPa
Torque Ratio	5.77 ft lbs/ psi	1.135 Nm/ kPa
Torque at Recommended Max Differential	6,060 ft lbs	8,220 Nm
Stall Torque	9,090 ft lbs	12,330 Nm

6.50/6.75 (165/171 mm 4-5 7 Stg.)

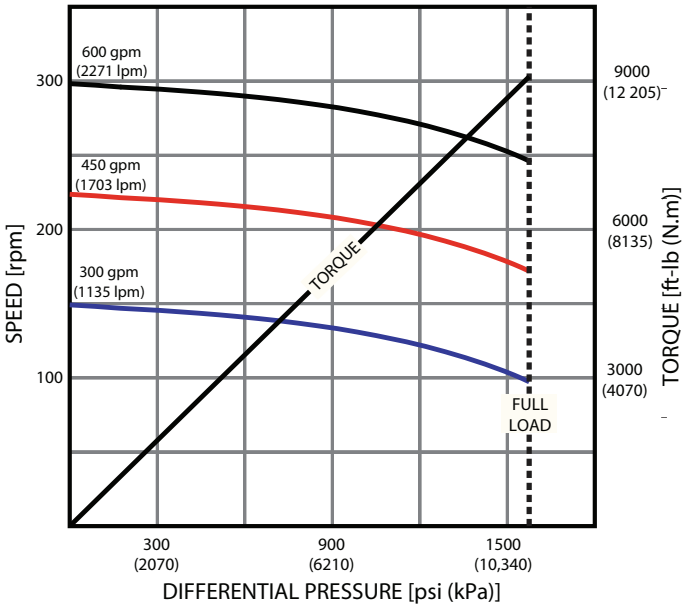


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2450 lbs	1110 kg
Length	30.58 ft	9.32 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300

6 1/2” 165 mm 4/5 - 7 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	149 - 300 rpm	149 - 300 rpm
Speed Ratio	0.497 rev/gal	0.131 rev/l
Recommended Max Differential Pressure	1,580 psi	10,860 kPa
Torque Ratio	5.77 ft lbs/ psi	1.135 Nm/ kPa
Torque at Recommended Max Differential	9,090 ft lbs	12,330 Nm
Stall Torque	13,630 ft lbs	18,490 Nm

6.50 (165mm) 4-5 7.0 Stg. HR

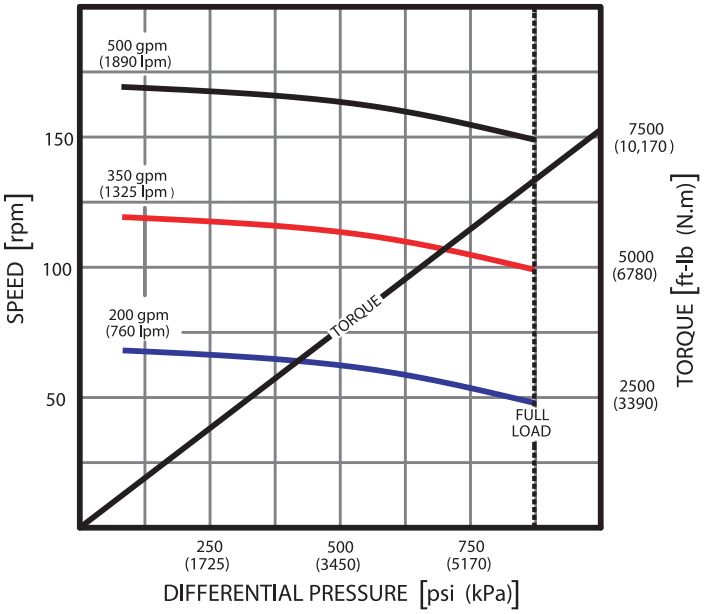


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2450 lbs	1110 kg
Length	30.58 ft	9.32 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 6/7 - 5 Stage

Performance Specifications	Imperial	Metric
Flow Range	200 - 500 gpm	757 - 1,893 lpm
Speed Range	68 - 169 rpm	68 - 169 rpm
Speed Ratio	0.35 rev/gal	0.090 rev/l
Recommended Max Differential Pressure	875 psi	6,033 kPa
Torque Ratio	7.60 ft lbs/ psi	1,495 Nm/ kPa
Torque at Recommended Max Differential	6,652 ft lbs	9,018 Nm
Stall Torque	9,978 ft lbs	13,528 Nm

6.50/6.25 (165/159mm) 6-7 5.0 Stg.

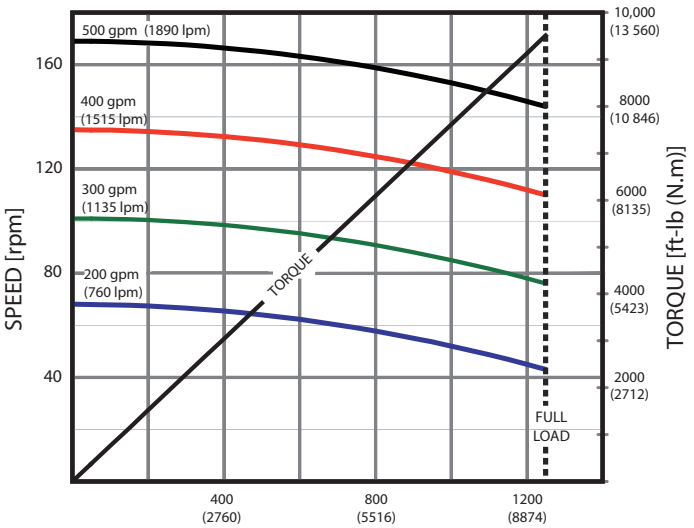


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2400 lbs	1090 kg
Length	29.92 ft	9.12 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 6/7-5 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	200 - 500 gpm	757 - 1,893 lpm
Speed Range	68 - 169 rpm	68 - 169 rpm
Speed Ratio	0.34 rev/gal	0.090 rev/l
Recommended Max Differential Pressure	1250 psi	8,618 kPa
Torque Ratio	7.61 ft lbs/ psi	1.497 Nm/ kPa
Torque at Recommended Max Differential	9,510 ft lbs	12,896 Nm
Stall Torque	19,020 ft lbs	25,790 Nm

650/625 (165/159mm) 6-7 5.0 Stg. HR

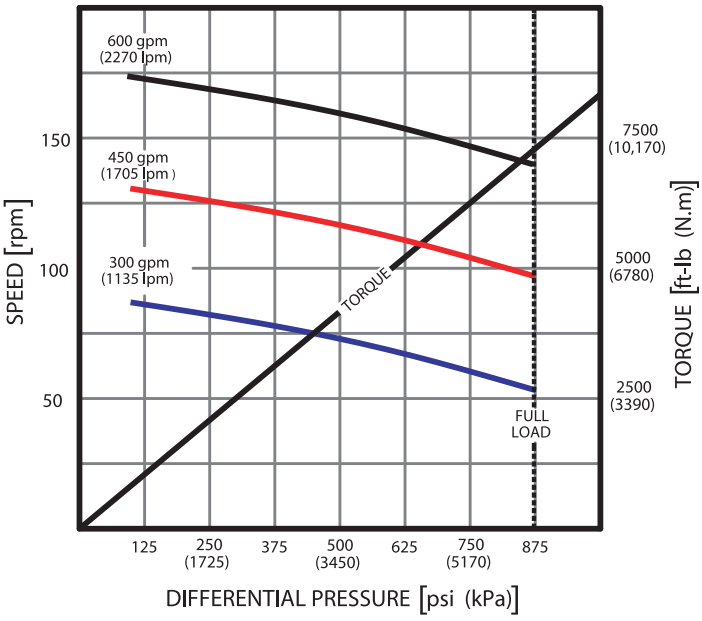


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2400 lbs	1090 kg
Length	29.92 ft	9.12 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 6/7 - 5 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	87 - 174 rpm	87 - 174 rpm
Speed Ratio	0.29 rev/gal	0.077 rev/l
Recommended Max Differential Pressure	875 psi	6,033 kPa
Torque Ratio	8.32 ft lbs/ psi	1.636 Nm/ kPa
Torque at Recommended Max Differential	7,280 ft lbs	9,870 Nm
Stall Torque	10,920 ft lbs	14,808 Nm

6.50/6.75 (165/171 mm) 6-7 5 Stg.

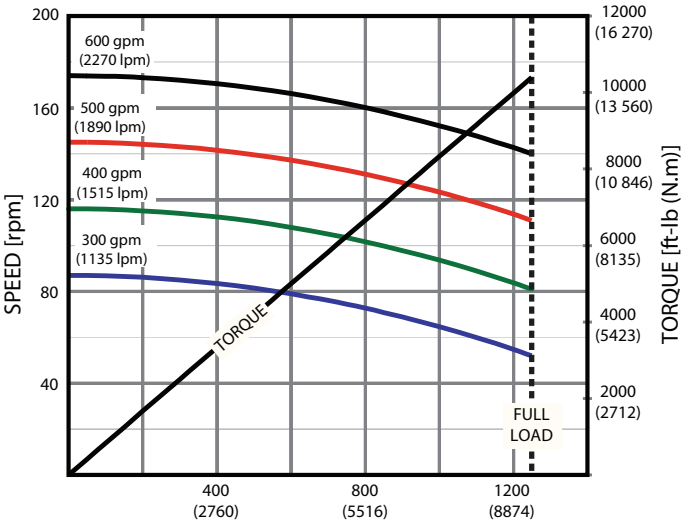


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2390 lbs	1080 kg
Length	29.75 ft	9.07 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 6/7 - 5 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	87 - 174 rpm	87 - 174 rpm
Speed Ratio	0.29 rev/gal	0.077 rev/l
Recommended Max Differential Pressure	1250 psi	8,618 kPa
Torque Ratio	8.32 ft lbs/ psi	1.636 Nm/ kPa
Torque at Recommended Max Differential	10,400 ft lbs	14.100 Nm
Stall Torque	20,800 ft lbs	28,200 Nm

6.50/6.75 (165/171mm) 6-7 5.0 Stg. HR

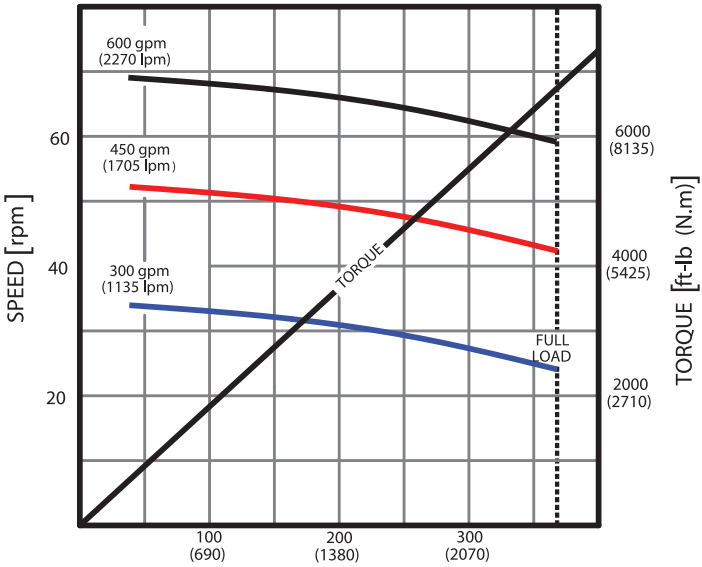


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2390 lbs	1080 kg
Length	29.75 ft	9.07 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 2.1 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	34 - 69 rpm	34 - 69 rpm
Speed Ratio	0.11 rev/gal	0.029 rev/l
Recommended Max Differential Pressure	368 psi	2,537 kPa
Torque Ratio	18.33 ft lbs/ psi	3.605 Nm/ kPa
Torque at Recommended Max Differential	6,745 ft lbs	9,145 Nm
Stall Torque	10,117 ft lbs	13,717 Nm

6.50/6.75 (165/171 mm 7-8 2.1 Stg.

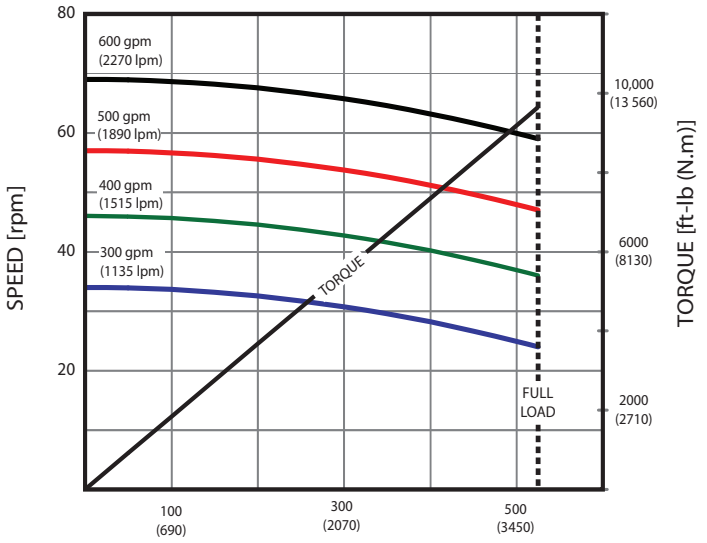


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 251 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2570 lbs	1170 kg
Length	32.08 ft	9.78 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 2.1 Stg. HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,140 - 2,270 lpm
Speed Range	34 - 69 rpm	34 - 69 rpm
Speed Ratio	0.11 rev/gal	0.029 rev/l
Recommended Max Differential Pressure	525 psi	3,620 kPa
Torque Ratio	18.37 ft lbs/ psi	3.61 Nm/ kPa
Torque at Recommended Max Differential	9,645 ft lbs	13,077 Nm
Stall Torque	19,290 ft lbs	26,150 Nm

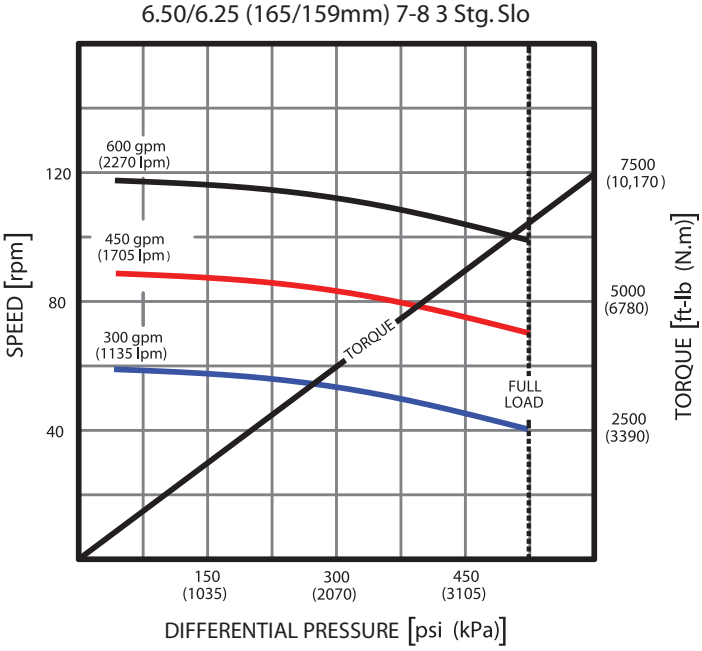
650/675 (165/171mm) 7-8 2.1 Stg. HR



M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 251 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2570 lbs	1170 kg
Length	32.08 ft	9.78 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 3 Stg. Slow

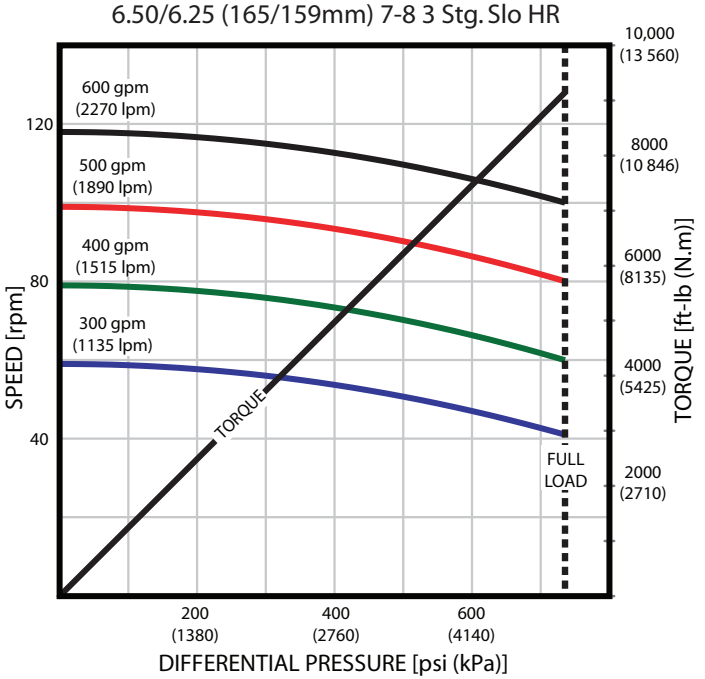
Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	59 - 118 rpm	59 - 118 rpm
Speed Ratio	0.20 rev/gal	0.053 rev/l
Recommended Max Differential Pressure	525 psi	3,620 kPa
Torque Ratio	12.44 ft lbs/ psi	2.446 Nm/ kPa
Torque at Recommended Max Differential	6,531 ft lbs	8,855 Nm
Stall Torque	9,797 ft lbs	13,282 Nm



M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2360 lbs	1070 kg
Length	29.50 ft	8.99 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8-3 Stg. Slo HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	59 - 118 rpm	59 - 118 rpm
Speed Ratio	0.20 rev/gal	0.053 rev/l
Recommended Max Differential Pressure	735 psi	5068 kPa
Torque Ratio	12.44 ft lbs/ psi	2.446 Nm/ kPa
Torque at Recommended Max Differential	9143 ft lbs	12,398 Nm
Stall Torque	18,286 ft lbs	24,796 Nm

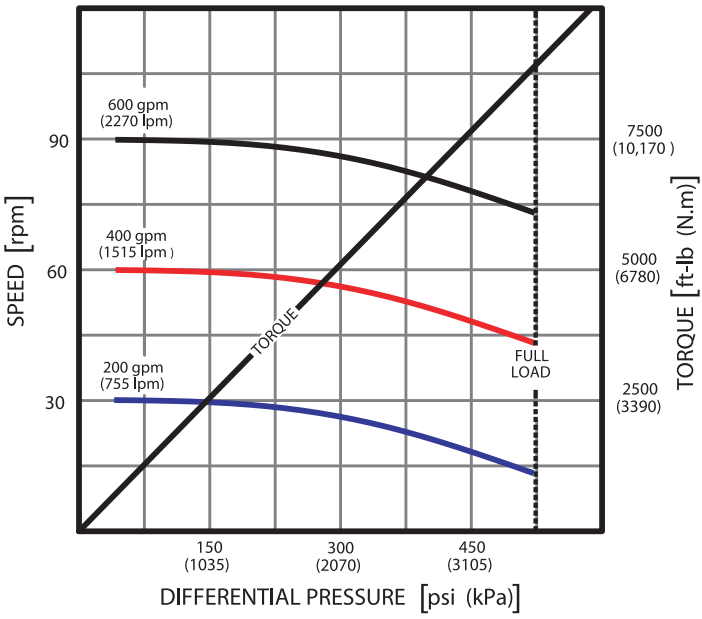


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2360 lbs	1070 kg
Length	29.50 ft	8.99 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 3 Stage Slow

Performance Specifications	Imperial	Metric
Flow Range	200 - 600 gpm	757 - 2,271 lpm
Speed Range	30 - 90 rpm	30 - 90 rpm
Speed Ratio	0.15 rev/gal	0.040 rev/l
Recommended Max Differential Pressure	525 psi	3,620 kPa
Torque Ratio	17.02 ft lbs/ psi	3.348 Nm/ kPa
Torque at Recommended Max Differential	8,937 ft lbs	12,117 Nm
Stall Torque	13,406 ft lbs	18,175 Nm

6.50/6.75 (165/171mm) 7-8 3 Stg. Slow

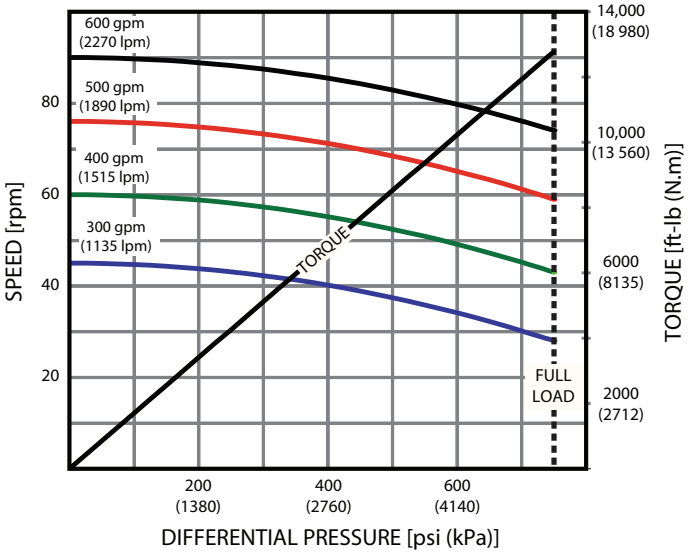


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2400 lbs	1090 kg
Length	29.92 ft	9.12 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	106,300 Nm

6 1/2” 165 mm 7/8-3 Stage Slo HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1136 - 2271 lpm
Speed Range	40 - 90 rpm	40 - 90 rpm
Speed Ratio	0.15 rev/gal	0.040 rev/l
Recommended Max Differential Pressure	750 psi	5,171 kPa
Torque Ratio	17.04 ft lbs/ psi	3.351 Nm/ kPa
Torque at Recommended Max Differential	12,780 ft lbs	17,327 Nm
Stall Torque	25,560 ft lbs	34,654 Nm

6.50/6.75 (165/171mm) 7-8 3 Slo HR

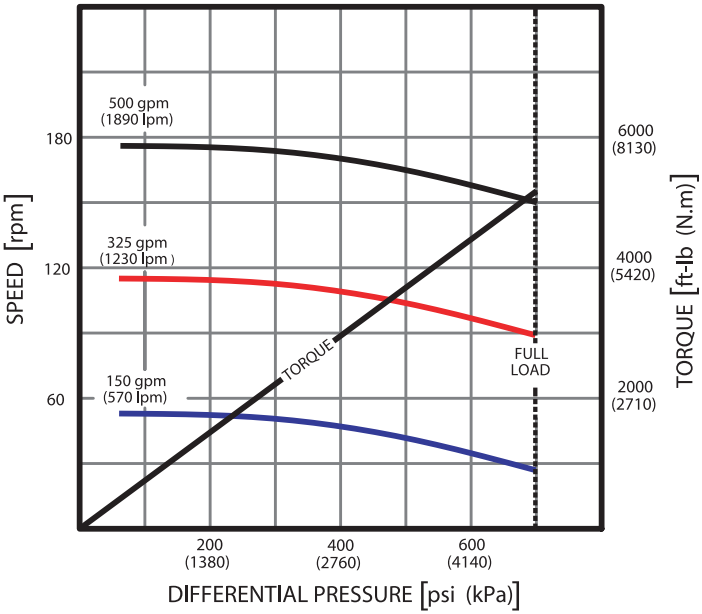


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2400 lbs	1090 kg
Length	29.92 ft	9.12 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	106,300 Nm

6 1/2” 165 mm 7/8 - 4 Stage

Performance Specifications	Imperial	Metric
Flow Range	150 - 500 gpm	568 - 1,893 lpm
Speed Range	53 - 176 rpm	53 - 176 rpm
Speed Ratio	0.35 rev/gal	0.092 rev/l
Recommended Max Differential Pressure	700 psi	4,826 kPa
Torque Ratio	7.39 ft lbs/ psi	1.453 Nm/ kPa
Torque at Recommended Max Differential	5,170 ft lbs	7,010 Nm
Stall Torque	7,756 ft lbs	10,515 Nm

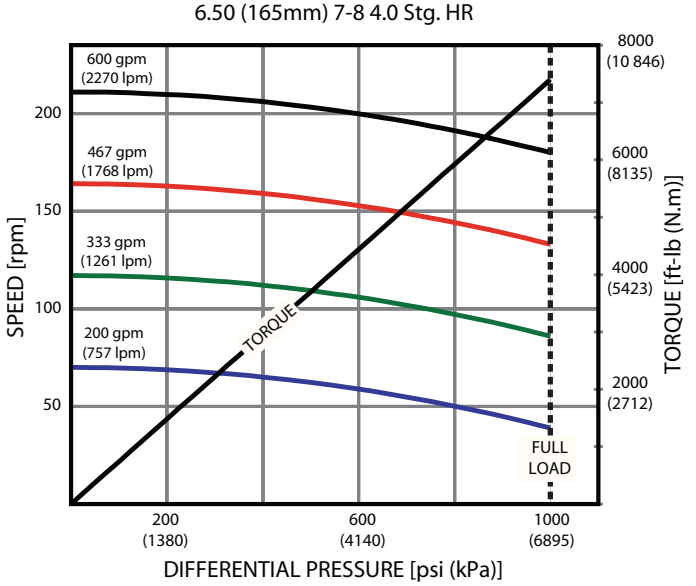
6.5 (165 mm) 7-8 4 Stg.



M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2090 lbs	950 kg
Length	26.08 ft	7.95 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 4 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	200 - 600 gpm	757 - 2271 lpm
Speed Range	70 - 211 rpm	70 - 211 rpm
Speed Ratio	0.35 rev/gal	0.092 rev/l
Recommended Max Differential Pressure	1,000 psi	6,895 kPa
Torque Ratio	7.40 ft lbs/ psi	1.455 Nm/ kPa
Torque at Recommended Max Differential	7,400 ft lbs	10,233 Nm
Stall Torque	11,100 ft lbs	15,049 Nm

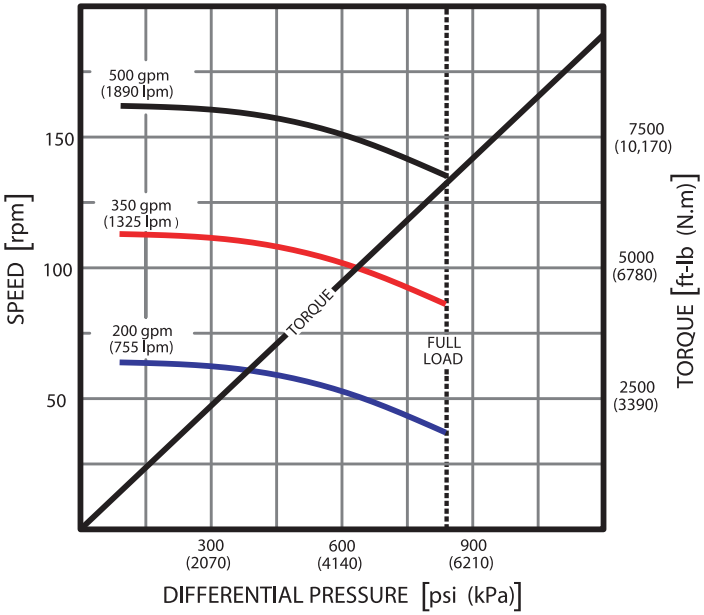


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2090 lbs	950 kg
Length	26.08 ft	7.95 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 4.8 Stage

Performance Specifications	Imperial	Metric
Flow Range	200 - 500 gpm	757 - 1,893 lpm
Speed Range	64 - 161 rpm	64 - 161 rpm
Speed Ratio	0.320 rev/gal	0.085 rev/l
Recommended Max Differential Pressure	840 psi	5,792 kPa
Torque Ratio	8.11 ft lbs/ psi	1.595 Nm/ kPa
Torque at Recommended Max Differential	6,810 ft lbs	9,233 Nm
Stall Torque	10,215 ft lbs	13,850 Nm

6.5 (165 mm) 7-8 4.8 Stg.

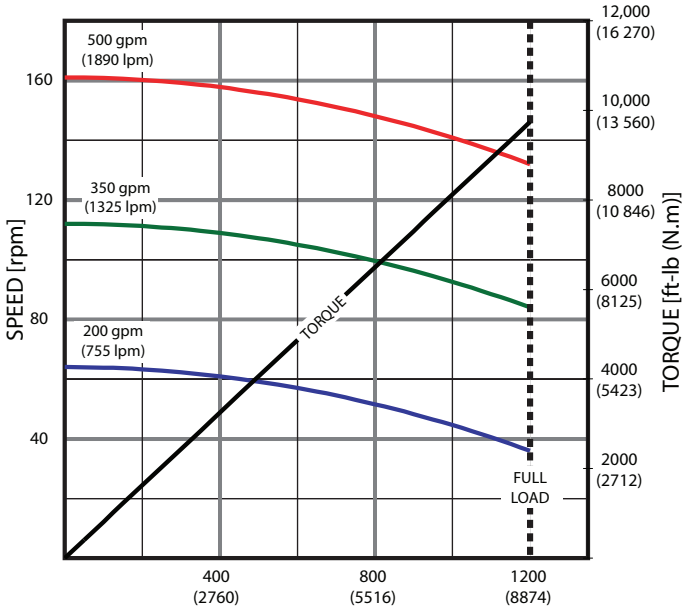


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2390 lbs	1080 kg
Length	29.75 ft	9.07 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 -4.8 Stg. HR

Performance Specifications	Imperial	Metric
Flow Range	200 - 500 gpm	757 - 1,893 lpm
Speed Range	64 - 161 rpm	64 - 161 rpm
Speed Ratio	0.320 rev/gal	0.085 rev/l
Recommended Max Differential Pressure	1,200 psi	8,274 kPa
Torque Ratio	8.11 ft lbs/ psi	1.595 Nm/ kPa
Torque at Recommended Max Differential	9,738 ft lbs	13 203 Nm
Stall Torque	14,607 ft lbs	19,804 Nm

6.50 (165 mm) 7-8 4.8 Stg. HR

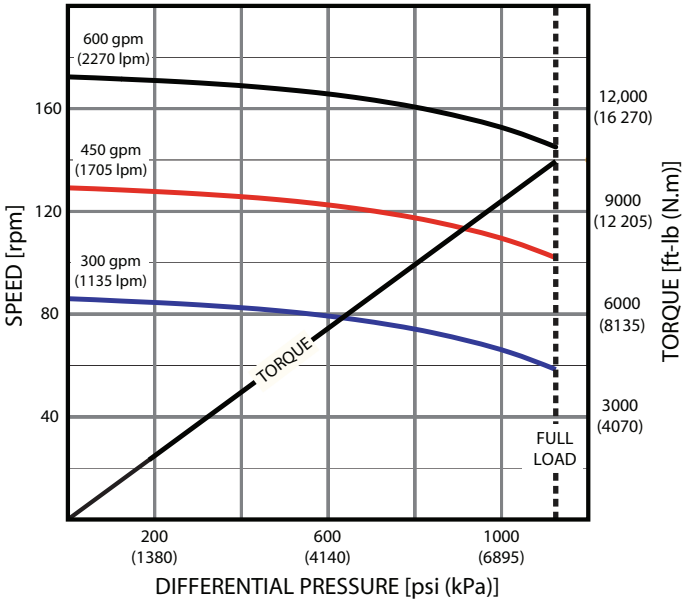


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2390 lbs	1080 kg
Length	29.75 ft	9.07 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8-5 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1140 - 2270 lpm
Speed Range	86 - 180 rpm	86 - 180 rpm
Speed Ratio	0.288 rev/gal	0.076 rev/l
Recommended Max Differential Pressure	1,130 psi	7,760 kPa
Torque Ratio	9.30 ft lbs/ psi	1.829 Nm/ kPa
Torque at Recommended Max Differential	10,460 ft lbs	14,190 Nm
Stall Torque	15,690 ft lbs	21,280 Nm

6.50 (165mm) 7-8 5.0 Stg. HR

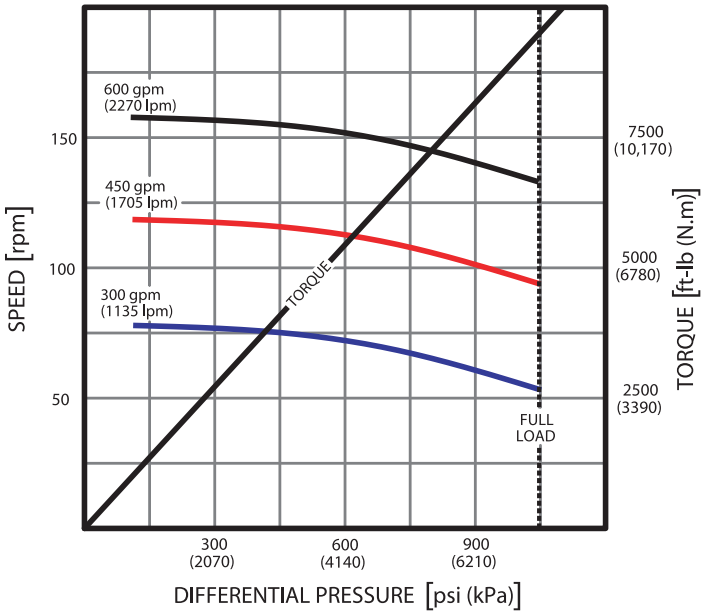


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2340 lbs	1065 kg
Length	29.25 ft	8.92 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 6 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,136 - 2,271 lpm
Speed Range	78 - 157 rpm	78 - 157 rpm
Speed Ratio	0.26 rev/gal	0.069 rev/l
Recommended Max Differential Pressure	1,050 psi	7,239 kPa
Torque Ratio	9.07 ft lbs/ psi	1.784 Nm/ kPa
Torque at Recommended Max Differential	9,525 ft lbs	12,915 Nm
Stall Torque	14,288 ft lbs	19,375 Nm

6.50/6.75 (165/171 mm) 7-8 6 Stg.

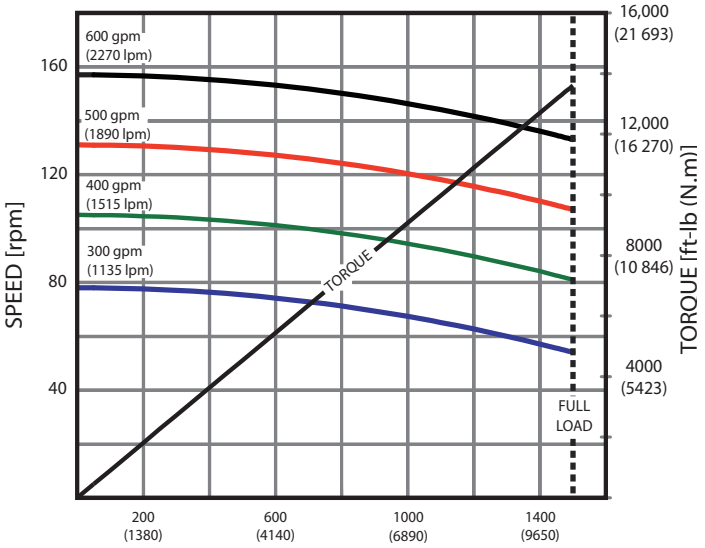


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2570 lbs	1170 kg
Length	32.08 ft	9.78 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 7/8 - 6.0 Stg. HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 600 gpm	1,140 - 2,270 lpm
Speed Range	78 - 157 rpm	78 - 157 rpm
Speed Ratio	0.26 rev/gal	0.069 rev/l
Recommended Max Differential Pressure	1500 psi	10,340 kPa
Torque Ratio	9.07 ft lbs/ psi	1.78 Nm/ kPa
Torque at Recommended Max Differential	13,600 ft lbs	18,450 Nm
Stall Torque	27,200 ft lbs	36,900 Nm

650/675 (165/171mm) 7-8 6.0 Stage HR

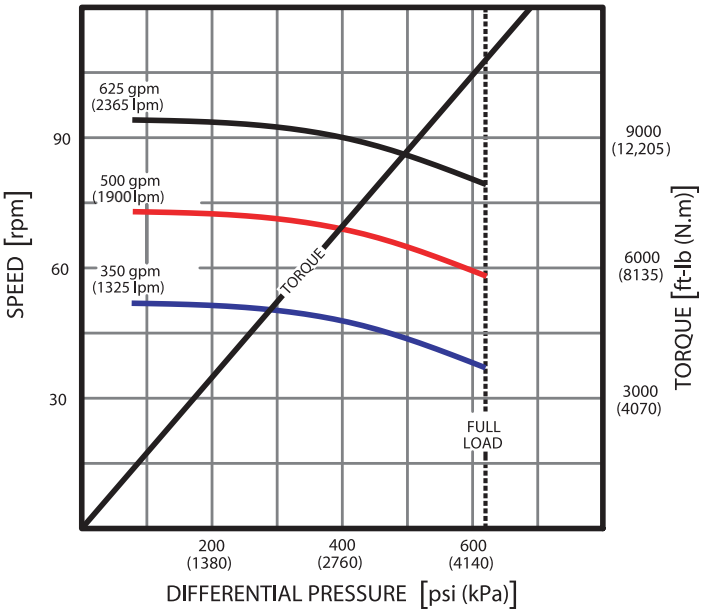


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 251 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2570 lbs	1170 kg
Length	32.08 ft	9.78 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

6 1/2” 165 mm 9/10 - 3.5 Stage

Performance Specifications	Imperial	Metric
Flow Range	350 - 625 gpm	1,325 - 2,366 lpm
Speed Range	53 - 94 rpm	53 - 94 rpm
Speed Ratio	0.15 rev/gal	0.040 rev/l
Recommended Max Differential Pressure	619 psi	4,268 kPa
Torque Ratio	17.36 ft lbs/ psi	3.414 Nm/ kPa
Torque at Recommended Max Differential	10,752 ft lbs	14,577 Nm
Stall Torque	16,128 ft lbs	21,866 Nm

6.50/6.75 (165/171mm) 9-10 3.5 Stg.

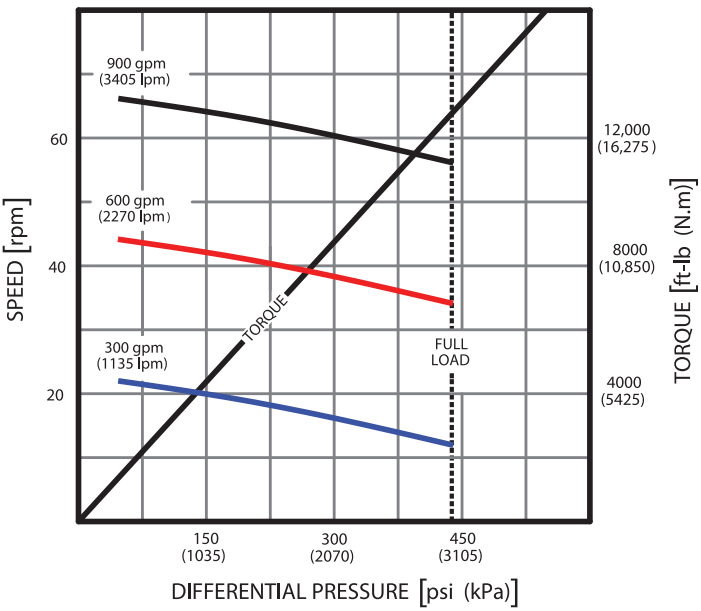


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	5.64 ft	1.72 m
Bit Box to Bend - FBH	4.71 ft	1.43 m
Hole Size	7 7/8” - 9 7/8”	200 - 250 mm
Standard Bit Box Thread	4 1/2 Reg	4 1/2 Reg
Max WOB	90,200 lbs	40,120 daN
Max Pull while back Reaming	85,600 lbs	38,075 daN
Absolute Overpull	780,000 lbs	347,000 daN
Tool Weight	2570 lbs	1170 kg
Length	32.08 ft	9.78 m
Adjustable Torque (S22)	35,000 ft lbs	47,450 Nm
Adjustable Torque (S14)	30,000 ft lbs Left	40,670 Nm Left
Stabilizer Torque	12,000 ft lbs	16,300 Nm

7 3/4” 197mm 7/8-2.5 Stg. Slow

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	22 - 66 rpm	22 - 66 rpm
Speed Ratio	0.07 rev/gal	0.018 rev/l
Recommended Max Differential Pressure	438 psi	3,020 kPa
Torque Ratio	29.26 ft lbs/ psi	5.754 Nm/ kPa
Torque at Recommended Max Differential	12,816 ft lbs	17,376 Nm
Stall Torque	19,224 ft lbs	26,064 Nm

7.75/8.00 (197/203mm) 7-8 2.5 Stg.

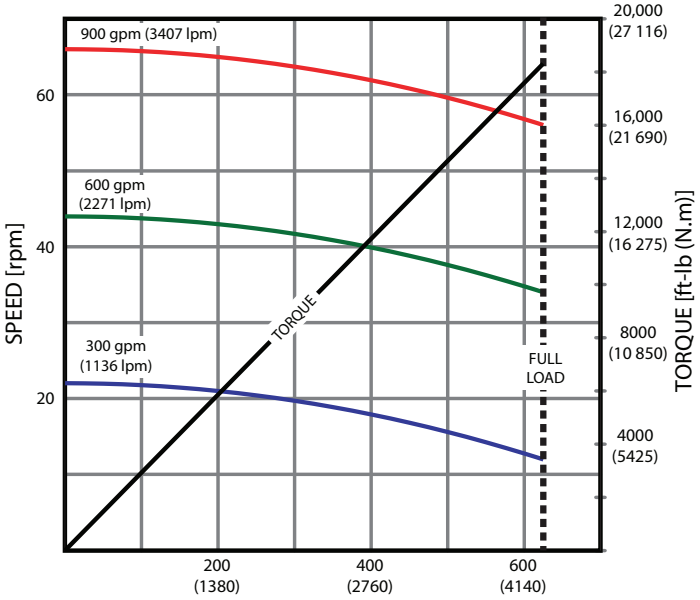


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.65 ft	2.03 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	87,360 lbs	38,860 daN
Max Pull while back Reaming	145,600 lbs	64,760 daN
Absolute Overpull	908,350 lbs	404,030 daN
Tool Weight	3990 lbs	1810 kg
Length	35.56 ft	10.84 m
Adjustable Torque (S22)	40,000 ft lbs	54,200 Nm
Stabilizer Torque	35,000 ft lbs	47,400 Nm

7 3/4” 197mm 7/8-2.5 Slow HR

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	22 - 66 rpm	22 - 66 rpm
Speed Ratio	0.07 rev/gal	0.018 rev/l
Recommended Max Differential Pressure	625 psi	4,309 kPa
Torque Ratio	29.30 ft lbs/ psi	5.763 Nm/ kPa
Torque at Recommended Max Differential	18,314 ft lbs	24,830 Nm
Stall Torque	36,628 ft lbs	49,660 Nm

7.75/8.00 (197/203mm) 7-8 2.5 Slo HR

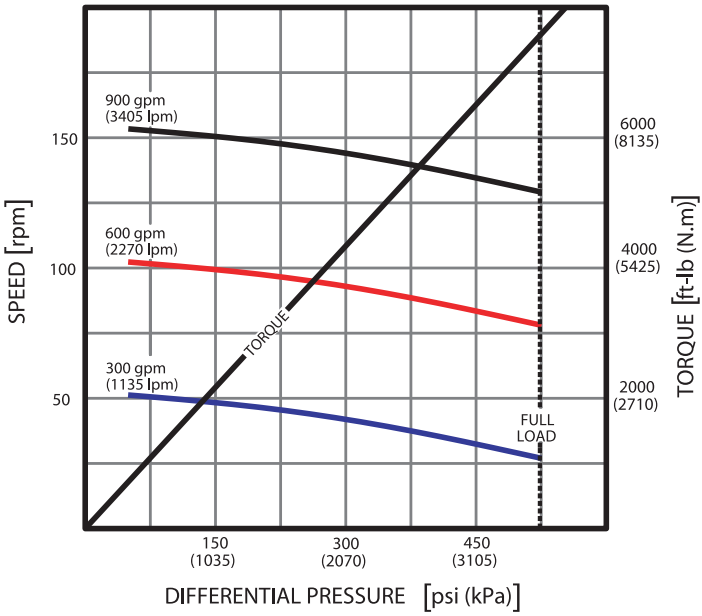


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.65 ft	2.03 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	87,360 lbs	38,860 daN
Max Pull while back Reaming	145,600 lbs	64,760 daN
Absolute Overpull	908,350 lbs	404,030 daN
Tool Weight	3990 lbs	1810 kg
Length	35.56 ft	10.84 m
Adjustable Torque (S22)	40,000 ft lbs	54,200 Nm
Stabilizer Torque	35,000 ft lbs	47,400 Nm

7 3/4” 197 mm 7/8 - 3 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	51 - 153 rpm	51 - 153 rpm
Speed Ratio	0.17 rev/gal	0.045 rev/l
Recommended Max Differential Pressure	525 psi	3,620 kPa
Torque Ratio	14.38 ft lbs/ psi	2.828 Nm/ kPa
Torque at Recommended Max Differential	7,550 ft lbs	10,236 Nm
Stall Torque	11,325 ft lbs	15,354 Nm

7.75/8.00 (197/203mm) 7-8 3 Stg.

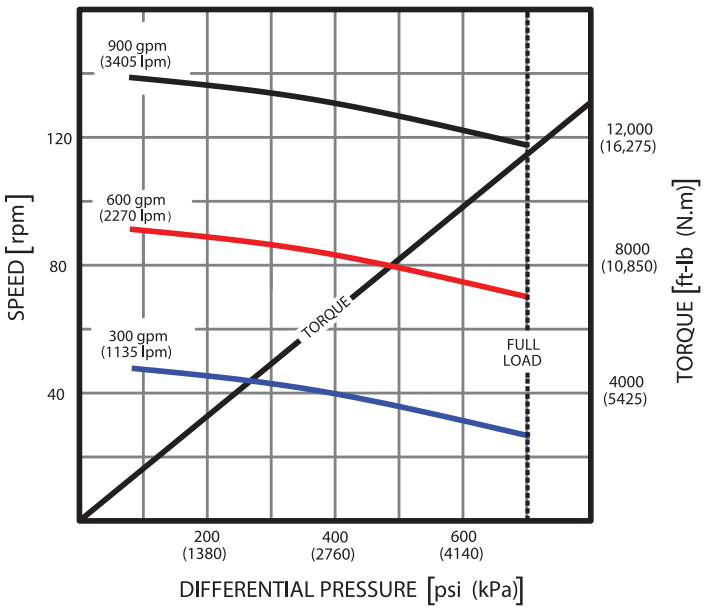


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.65 ft	2.03 m
Hole Size	9 5/8” - 12 ¼”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	87,360 lbs	38,860 daN
Max Pull while back Reaming	145,600 lbs	64,760 daN
Absolute Overpull	908,350 lbs	404,030 daN
Tool Weight	3115 lbs	1410 kg
Length	27.73 ft	8.45 m
Adjustable Torque (S22)	40,000 ft lbs	54,200 Nm
Stabilizer Torque	35,000 ft lbs	47,400 Nm

7 3/4” 197 mm 7/8 - 4 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	48 - 143 rpm	48 - 143 rpm
Speed Ratio	0.16 rev/gal	0.042 rev/l
Recommended Max Differential Pressure	700 psi	4,826 kPa
Torque Ratio	16.38 ft lbs/ psi	3.222 Nm/ kPa
Torque at Recommended Max Differential	11,469 ft lbs	15,549 Nm
Stall Torque	17,203 ft lbs	23,324 Nm

7.75/8.00 (197/203mm) 7-8 4 Stg.

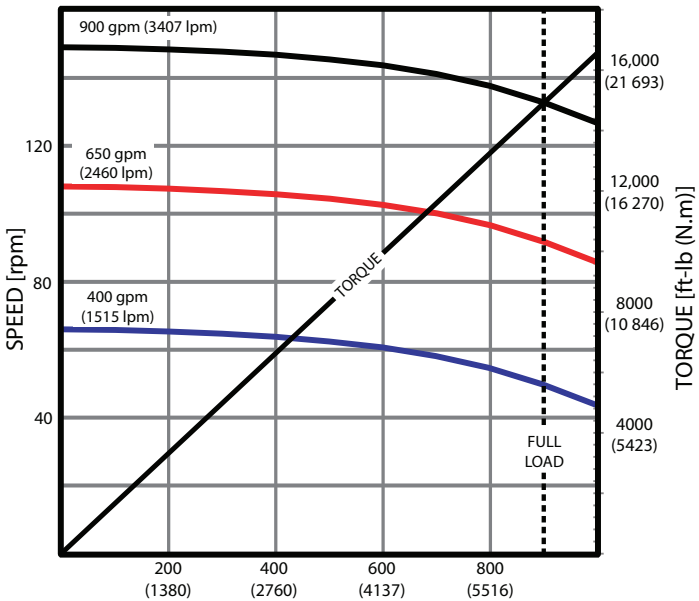


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.65 ft	2.03 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	87,360 lbs	38,860 daN
Max Pull while back Reaming	145,600 lbs	64,760 daN
Absolute Overpull	908,350 lbs	404,030 daN
Tool Weight	3550 lbs	1610 kg
Length	31.56 ft	9.62 m
Adjustable Torque (S22)	40,000 ft lbs	54,200 Nm
Stabilizer Torque	35,000 ft lbs	47,400 Nm

7 3/4” 197 mm 7/8 - 4 Stg. HR

Performance Specifications	Imperial	Metric
Flow Range	400 - 900 gpm	1,515 - 3,407 lpm
Speed Range	66 - 149 rpm	66 - 149 rpm
Speed Ratio	0.166 rev/gal	0.044 rev/l
Recommended Max Differential Pressure	900 psi	6,206 kPa
Torque Ratio	16.589 ft lbs/ psi	3.265 Nm/ kPa
Torque at Recommended Max Differential	14,940 ft lbs	20,259 Nm
Stall Torque	22,400 ft lbs	30,374 Nm

7.75/8.00 (197/203mm) 7-8 4.0 Stg. HR

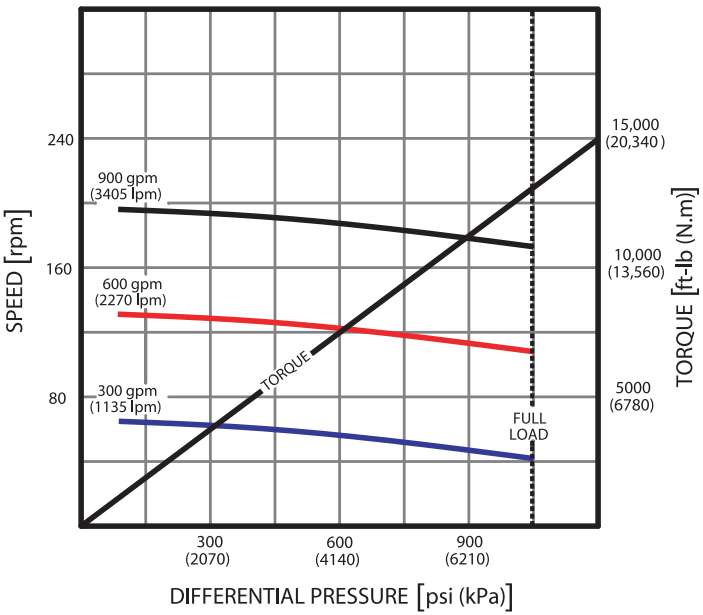


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.65 ft	2.03 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	87,360 lbs	38,860 daN
Max Pull while back Reaming	145,600 lbs	64,760 daN
Absolute Overpull	908,350 lbs	404,030 daN
Tool Weight	3550 lbs	1610 kg
Length	31.56 ft	9.62 m
Adjustable Torque (S22)	40,000 ft lbs	54,200 Nm
Stabilizer Torque	35,000 ft lbs	47,400 Nm

7 3/4” 197 mm 8/9 - 6 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	65 - 196 rpm	65 - 196 rpm
Speed Ratio	0.22 rev/gal	0.058 rev/l
Recommended Max Differential Pressure	1,050 psi	7,239 kPa
Torque Ratio	11.95 ft lbs/ psi	2.350 Nm/ kPa
Torque at Recommended Max Differential	12,548 ft lbs	17,012 Nm
Stall Torque	18,821 ft lbs	25,518 Nm

7.75/8.00 (197/203mm) 8-9 6 Stg.

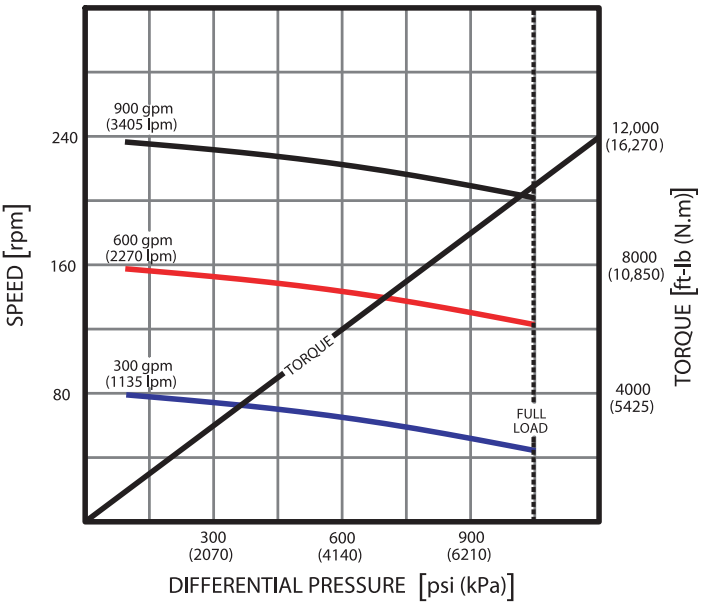


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.65 ft	2.03 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	87,360 lbs	38,860 daN
Max Pull while back Reaming	145,600 lbs	64,760 daN
Absolute Overpull	908,350 lbs	404,030 daN
Tool Weight	3550 lbs	1610 kg
Length	31.56 ft	9.62 m
Adjustable Torque (S22)	40,000 ft lbs	54,200 Nm
Stabilizer Torque	35,000 ft lbs	47,400 Nm

8” 203 mm 6/7 - 6 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	79 - 237 rpm	79 - 237 rpm
Speed Ratio	0.26 rev/gal	0.069 rev/l
Recommended Max Differential Pressure	1,050 psi	7,239 kPa
Torque Ratio	9.93 ft lbs/ psi	1.953 Nm/ kPa
Torque at Recommended Max Differential	10,427 ft lbs	14,137 Nm
Stall Torque	15,641 ft lbs	21,206 Nm

8.0 (203 mm) 6-7 6 Stg.

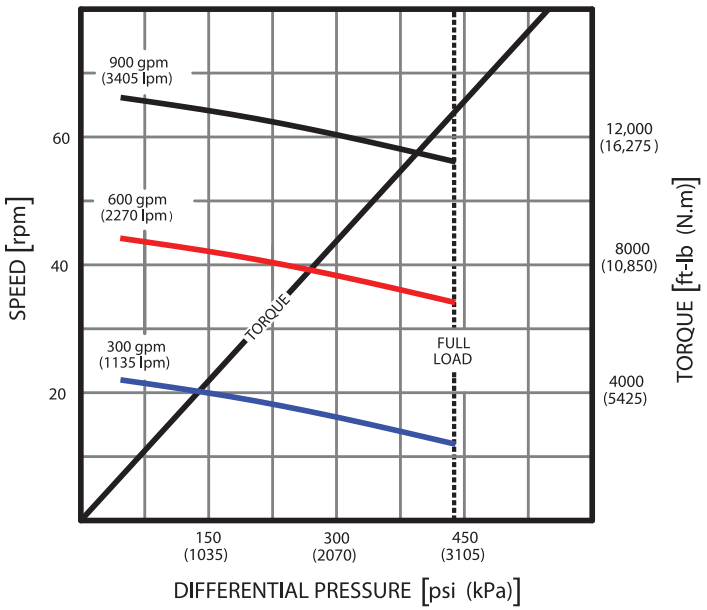


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.68 ft	2.04 m
Hole Size	9 5/8” - 12 ¼”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	105,000 lbs	46,700 daN
Max Pull while back Reaming	175,000 lbs	77,800 daN
Absolute Overpull	1,116,000 lbs	496,400 daN
Tool Weight	3810 lbs	1730 kg
Length	31.67 ft	9.65 m
Adjustable Torque (S22)	45,000 ft lbs	61,000 Nm
Adjustable Torque (S14)	40,000 ft lbs Left	54,200 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

8” 203 mm 7/8 - 2.5 Stage Slow

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	22 - 66 rpm	22 - 66 rpm
Speed Ratio	0.07 rev/gal	0.018 rev/l
Recommended Max Differential Pressure	438 psi	3,020 kPa
Torque Ratio	29.26 ft lbs/ psi	5.754 Nm/ kPa
Torque at Recommended Max Differential	12,816 ft lbs	17,376 Nm
Stall Torque	19,224 ft lbs	26,064 Nm

7.75/8.00 (197/203mm) 7-8 2.5 Stg.

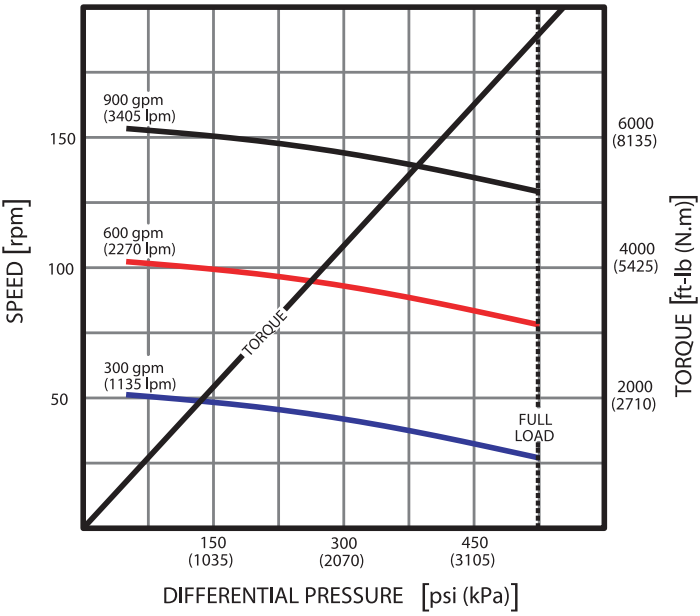


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.68 ft	2.04 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	105,000 lbs	46,700 daN
Max Pull while back Reaming	175,000 lbs	77,800 daN
Absolute Overpull	1,116,000 lbs	496,400 daN
Tool Weight	4290 lbs	1945 kg
Length	35.67 ft	10.87 m
Adjustable Torque (S22)	45,000 ft lbs	61,000 Nm
Adjustable Torque (S14)	40,000 ft lbs Left	54,200 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

8” 203 mm 7/8 - 3 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	51 - 153 rpm	51 - 153 rpm
Speed Ratio	0.17 rev/gal	0.045 rev/l
Recommended Max Differential Pressure	525 psi	3,620 kPa
Torque Ratio	14.38 ft lbs/ psi	2.828 Nm/ kPa
Torque at Recommended Max Differential	7,550 ft lbs	10,236 Nm
Stall Torque	11,325 ft lbs	15,354 Nm

7.75/8.00 (197/203mm) 7-8 3 Stg.

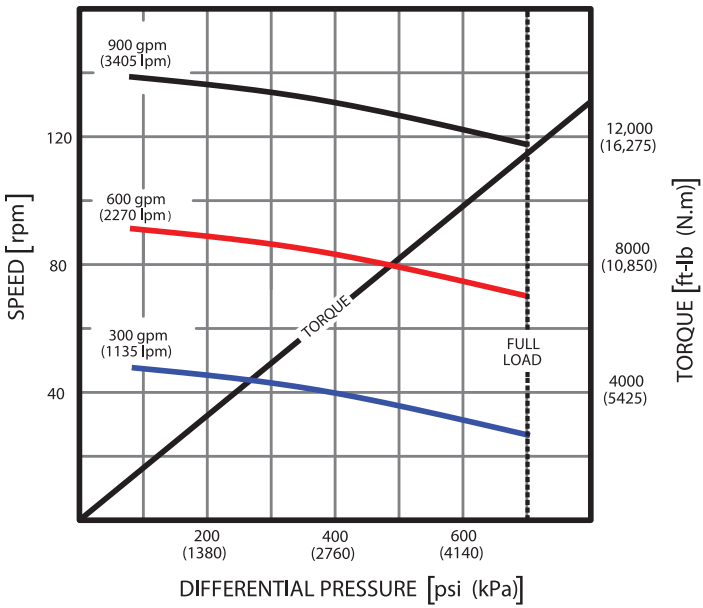


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.68 ft	2.04 m
Hole Size	9 5/8” - 12 ¼”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	105,000 lbs	46,700 daN
Max Pull while back Reaming	175,000 lbs	77,800 daN
Absolute Overpull	1,116,000 lbs	496,400 daN
Tool Weight	3350 lbs	1520 kg
Length	27.83 ft	8.48 m
Adjustable Torque (S22)	45,000 ft lbs	61,000 Nm
Adjustable Torque (S14)	40,000 ft lbs Left	54,200 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

8” 203 mm 7/8 - 4 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	48 - 143 rpm	48 - 143 rpm
Speed Ratio	0.16 rev/gal	0.042 rev/l
Recommended Max Differential Pressure	700 psi	4,826 kPa
Torque Ratio	16.38 ft lbs/ psi	3.222 Nm/ kPa
Torque at Recommended Max Differential	11,469 ft lbs	15,549 Nm
Stall Torque	17,203 ft lbs	23,324 Nm

7.75/8.00 (197/203mm) 7-8 4 Stg.

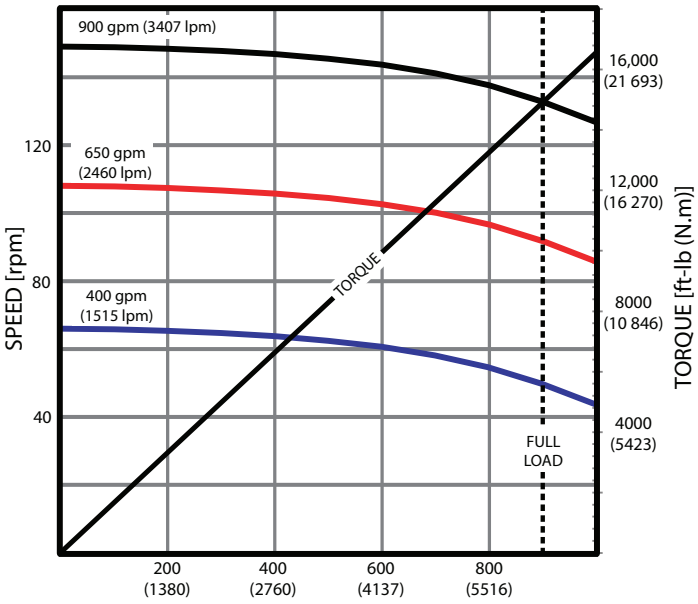


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.68 ft	2.04 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	105,000 lbs	46,700 daN
Max Pull while back Reaming	175,000 lbs	77,800 daN
Absolute Overpull	1,116,000 lbs	496,400 daN
Tool Weight	3810 lbs	1730 kg
Length	31.67 ft	9.65 m
Adjustable Torque (S22)	45,000 ft lbs	61,000 Nm
Adjustable Torque (S14)	40,000 ft lbs Left	54,200 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

8” 203 mm 7/8 - 4 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	400 - 900 gpm	1,515 - 3,407 lpm
Speed Range	66 - 149 rpm	66 - 149 rpm
Speed Ratio	0.166 rev/gal	0.044 rev/l
Recommended Max Differential Pressure	900 psi	6,206 kPa
Torque Ratio	16.589 ft lbs/ psi	3.265 Nm/ kPa
Torque at Recommended Max Differential	14,940 ft lbs	20,259 Nm
Stall Torque	22,400 ft lbs	30,374 Nm

7.75/8.00 (197/203mm) 7-8 4.0 Stg. HR

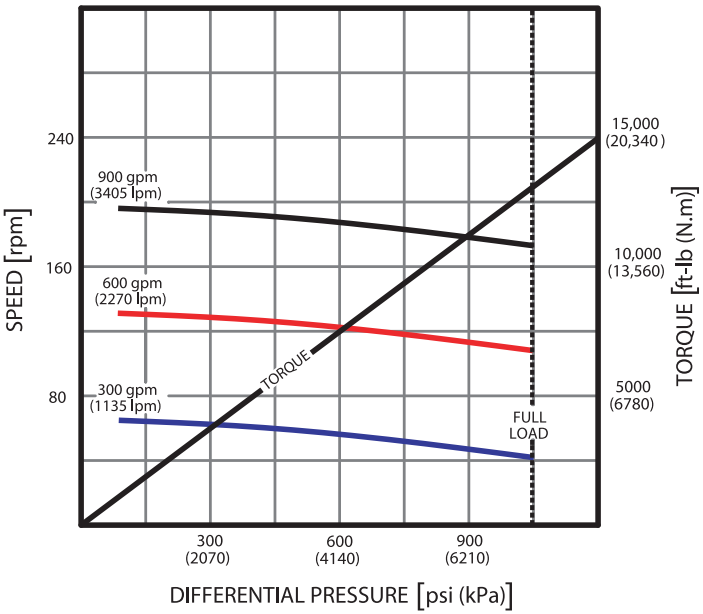


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.68 ft	2.04 m
Hole Size	9 5/8” - 12 ¼”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	105,000 lbs	46,700 daN
Max Pull while back Reaming	175,000 lbs	77,800 daN
Absolute Overpull	1,116,000 lbs	496,400 daN
Tool Weight	3810 lbs	1730 kg
Length	31.67 ft	9.65 m
Adjustable Torque (S22)	45,000 ft lbs	61,000 Nm
Adjustable Torque (S14)	40,000 ft lbs Left	54,200 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

8” 203 mm 8/9 - 6 Stage

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1,136 - 3,407 lpm
Speed Range	65 - 196 rpm	65 - 196 rpm
Speed Ratio	0.22 rev/gal	0.058 rev/l
Recommended Max Differential Pressure	1,050 psi	7,239 kPa
Torque Ratio	11.95 ft lbs/ psi	2.350 Nm/ kPa
Torque at Recommended Max Differential	12,548 ft lbs	17,012 Nm
Stall Torque	18,821 ft lbs	25,518 Nm

7.75/8.00 (197/203mm) 8-9 6 Stg.

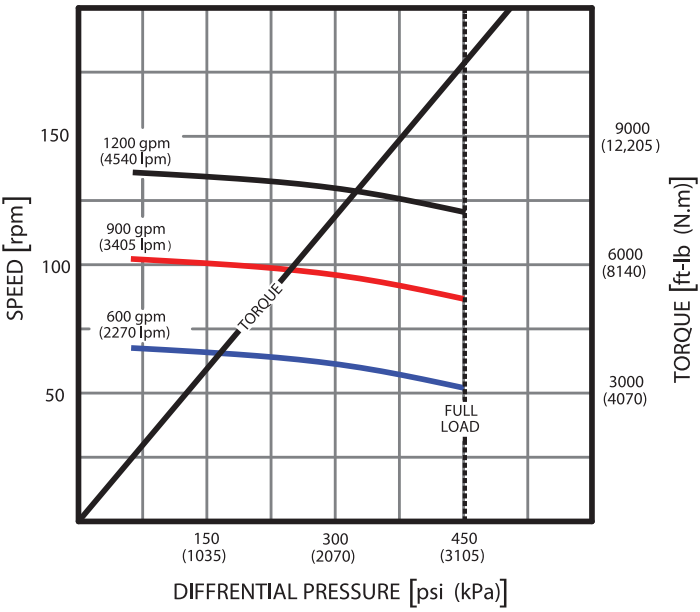


M6 Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	6.68 ft	2.04 m
Hole Size	9 5/8” - 12 1/4”	245 - 311 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	105,000 lbs	46,700 daN
Max Pull while back Reaming	175,000 lbs	77,800 daN
Absolute Overpull	1,116,000 lbs	496,400 daN
Tool Weight	3810 lbs	1730 kg
Length	31.67 ft	9.65 m
Adjustable Torque (S22)	45,000 ft lbs	61,000 Nm
Adjustable Torque (S14)	40,000 ft lbs Left	54,200 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

9 1/2” 241 mm 5/6 - 3 Stage

Performance Specifications	Imperial	Metric
Flow Range	600 - 1,200 gpm	2,271 - 4,542 lpm
Speed Range	67 - 135 rpm	67 - 135 rpm
Speed Ratio	0.112 rev/gal	0.030 rev/l
Recommended Max Differential Pressure	450 psi	3,103 kPa
Torque Ratio	23.75 ft lbs/ psi	4.67 Nm/ kPa
Torque at Recommended Max Differential	10,685 ft lbs	14,489 Nm
Stall Torque	30,400 ft lbs	41,222 Nm

9.62 (244mm) 5-6 3 Stg.

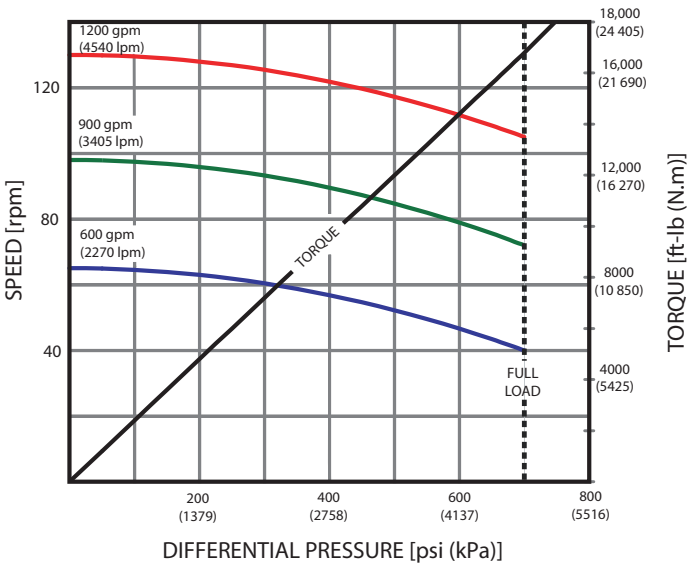


10B Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	9.33 ft	2.84 m
Bit Box to Bend - FBH	8.77 ft	2.67 m
Hole Size	12 ¼” - 17 ½”	311 - 445 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	190,000 lbs	84,500 daN
Max Pull while back Reaming	136,640 lbs	60,780 daN
Absolute Overpull	1,328,000 lbs	590,660 daN
Tool Weight	5740 lbs	2605 kg
Length	32.98 ft	10.05 m
Adjustable Torque (S22)	60,000 ft lbs	81,350 Nm
Adjustable Torque (S14)	60,000 ft lbs Left	81,350 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

9 1/2” 241 mm 5/6 - 4 Stage

Performance Specifications	Imperial	Metric
Flow Range	600 - 1,200 gpm	2,271 - 4,542 lpm
Speed Range	65 - 130 rpm	65 - 130 rpm
Speed Ratio	0.11 rev/gal	0.029 rev/l
Recommended Max Differential Pressure	700 psi	4,826 kPa
Torque Ratio	23.99 ft lbs/ psi	4.718 Nm/ kPa
Torque at Recommended Max Differential	16,792 ft lbs	22,766 Nm
Stall Torque	25,188 ft lbs	34,149 Nm

9.62 (244 mm) 5-6 4 Stg.

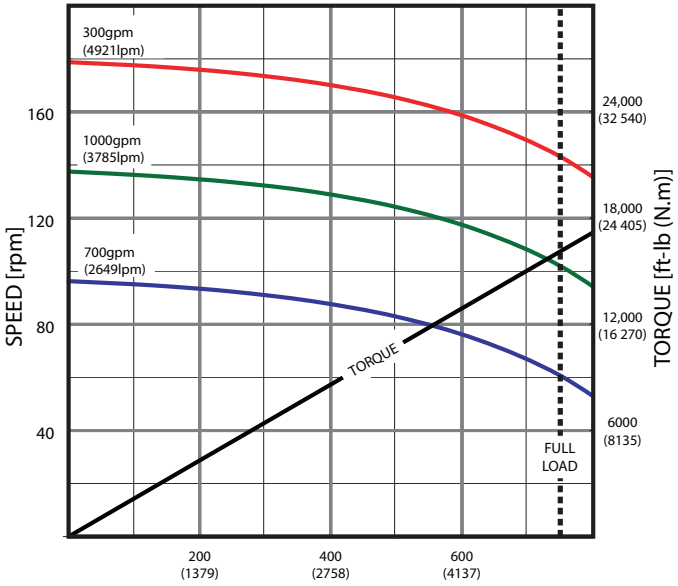


10B Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	9.33 ft	2.84 m
Bit Box to Bend - FBH	8.77 ft	2.67 m
Hole Size	12 ¼” - 17 ½”	311 - 445 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	190,000 lbs	84,500 daN
Max Pull while back Reaming	136,640 lbs	60,780 daN
Absolute Overpull	1,328,000 lbs	590,660 daN
Tool Weight	6500 lbs	2950 kg
Length	37.32 ft	11.37 m
Adjustable Torque (S22)	60,000 ft lbs	81,350 Nm
Adjustable Torque (S14)	60,000 ft lbs Left	81,350 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

9 1/2” 241 mm 5/6 - 5 Stage

Performance Specifications	Imperial	Metric
Flow Range	700 - 1300 gpm	2650 - 4920 lpm
Speed Range	96 - 180 rpm	96 - 180 rpm
Speed Ratio	0.14 rev/gal	0.036 rev/l
Recommended Max Differential Pressure	750 psi	5170 kPa
Torque Ratio	21.49 ft lbs/ psi	4.225 Nm/ kPa
Torque at Recommended Max Differential	16,120 ft lbs	21,850 Nm
Stall Torque	24,170 ft lbs	32,770 Nm

9.62 (244 mm) 5-6 5 Stg.

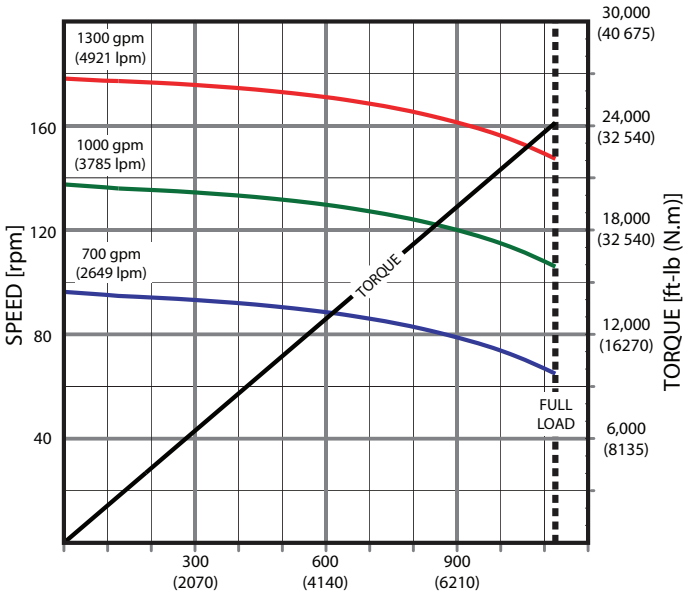


10B Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	9.33 ft	2.84 m
Bit Box to Bend - FBH	8.77 ft	2.67 m
Hole Size	12 ¼” - 17 ½”	311 - 445 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	190,000 lbs	84,500 daN
Max Pull while back Reaming	136,640 lbs	60,780 daN
Absolute Overpull	1,328,000 lbs	590,660 daN
Tool Weight	6530 lbs	2960 kg
Length	37.48 ft	11.42 m
Adjustable Torque (S22)	60,000 ft lbs	81,300 Nm
Adjustable Torque (S14)	60,000 ft lbs Left	81,350 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

9 1/2” 241 mm 5/6 - 5 Stage HR

Performance Specifications	Imperial	Metric
Flow Range	700 - 1300 gpm	2650 - 4920 lpm
Speed Range	96 - 180 rpm	96 - 180 rpm
Speed Ratio	0.14 rev/gal	0.036 rev/l
Recommended Max Differential Pressure	1,130 psi	7760 kPa
Torque Ratio	21.49 ft lbs/ psi	4.225 Nm/ kPa
Torque at Recommended Max Differential	24,170 ft lbs	32,770 Nm
Stall Torque	36,260 ft lbs	49,160 Nm

9.62 (244 mm) 5-6 5.0 Stg. HR

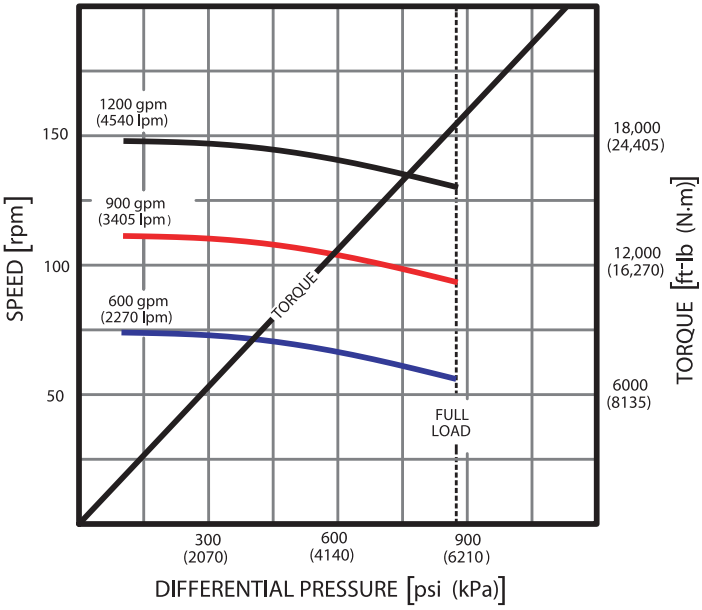


10B Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	9.33 ft	2.84 m
Bit Box to Bend - FBH	8.77 ft	2.67 m
Hole Size	12 ¼” - 17 ½”	311 - 445 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	190,000 lbs	84,500 daN
Max Pull while back Reaming	136,640 lbs	60,780 daN
Absolute Overpull	1,328,000 lbs	590,660 daN
Tool Weight	6530 lbs	2960 kg
Length	37.48 ft	11.42 m
Adjustable Torque (S22)	60,000 ft lbs	81,350 Nm
Adjustable Torque (S14)	60,000 ft lbs Left	81,350 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

9 1/2” 241 mm 6/7 - 5 Stage

Performance Specifications	Imperial	Metric
Flow Range	600 - 1,200 gpm	2,271 - 4,542 lpm
Speed Range	74 - 148 rpm	74 - 148 rpm
Speed Ratio	0.12 rev/gal	0.032 rev/l
Recommended Max Differential Pressure	875 psi	6,033 kPa
Torque Ratio	21.08 ft lbs/ psi	4.147 Nm/ kPa
Torque at Recommended Max Differential	18,449 ft lbs	25,013 Nm
Stall Torque	27,674 ft lbs	37,520 Nm

9.62 (244 mm) 6-7 5 Stg.

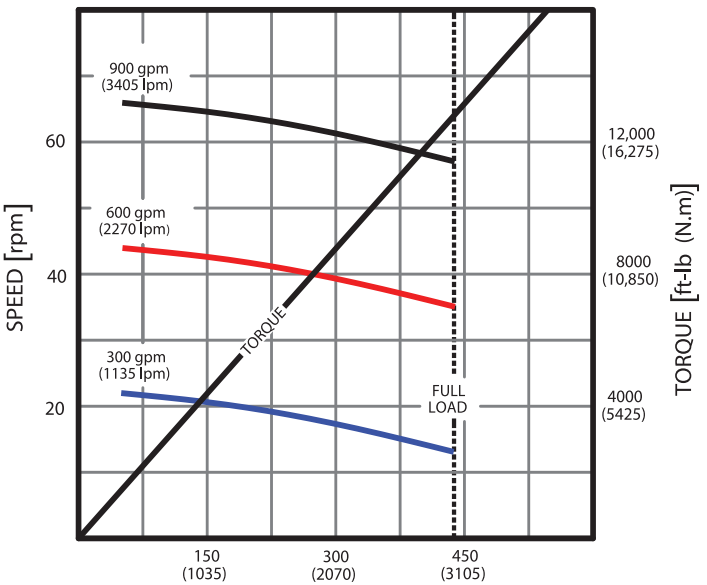


10B Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	9.33 ft	2.84 m
Bit Box to Bend - FBH	8.77 ft	2.67 m
Hole Size	12 ¼” - 17 ½”	311 - 445 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	190,000 lbs	84,500 daN
Max Pull while back Reaming	136,640 lbs	60,780 daN
Absolute Overpull	1,328,000 lbs	590,660 daN
Tool Weight	6240 lbs	2830 kg
Length	35.82 ft	10.92 m
Adjustable Torque (S22)	60,000 ft lbs	81,350 Nm
Adjustable Torque (S14)	60,000 ft lbs Left	81,350 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

9 1/2” 241 mm 7/8 - 2.5 Stage Slow

Performance Specifications	Imperial	Metric
Flow Range	300 - 900 gpm	1136 - 3407 lpm
Speed Range	22 - 66 rpm	22 - 66 rpm
Speed Ratio	0.07 rev/gal	0.018 rev/l
Recommended Max Differential Pressure	438 psi	3,020 kPa
Torque Ratio	29.26 ft lbs/ psi	5.754 Nm/ kPa
Torque at Recommended Max Differential	12,816 ft lbs	17,376 Nm
Stall Torque	19,224 ft lbs	26,064 Nm

9.62 (244 mm) 7-8 2.5 Stg. Slow

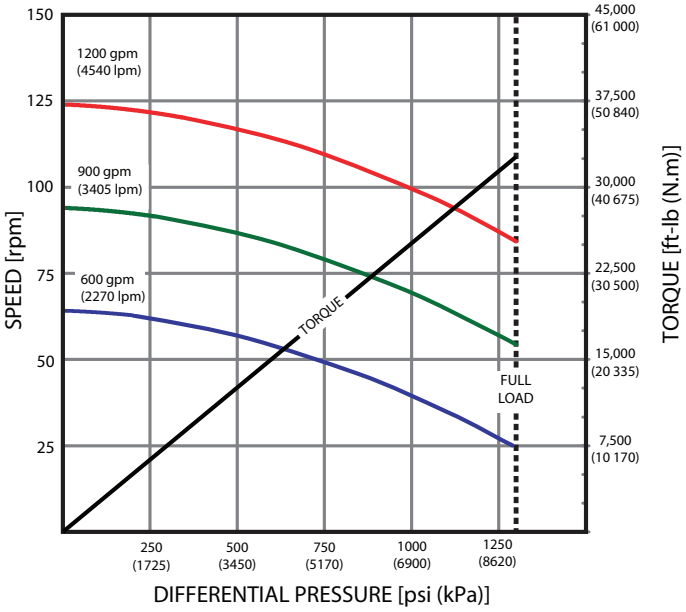


10B Motor Specifications	Imperial	Metric
Bit Box to Bend - ABH	9.33 ft	2.84 m
Bit Box to Bend - FBH	8.77 ft	2.67 m
Hole Size	12 ¼” - 17 ½”	311 - 445 mm
Standard Bit Box Thread	6 5/8 Reg	6 5/8 Reg
Max WOB	190,000 lbs	84,500 daN
Max Pull while back Reaming	136,640 lbs	60,780 daN
Absolute Overpull	1,328,000 lbs	590,660 daN
Tool Weight	6848 lbs	3100 kg
Length	39.32 ft	11.98 m
Adjustable Torque (S22)	60,000 ft lbs	81,350 Nm
Adjustable Torque (S14)	60,000 ft lbs Left	81,350 Nm Left
Stabilizer Torque	40,000 ft lbs	54,200 Nm

11 1/4” 286mm 6/7-3.5 Stg. ERT

Performance Specifications	Imperial	Metric
Flow Range	600 - 1,200 gpm	2,271 - 4,542 lpm
Speed Range	65 - 125 rpm	65 - 125 rpm
Speed Ratio	0.107 rev/gal	0.028 rev/l
Recommended Max Differential Pressure	1300 psi	8965 kPa
Torque Ratio	24.83 ft lbs/ psi	4.883 Nm/ kPa
Torque at Recommended Max Differential	32,275 ft lbs	43,760 Nm
Stall Torque	54,000 ft lbs	73,225 Nm

11.25 (286 mm) 6-7 3.5 Stg. ERT



10A Motor Specifications	Imperial	Metric
Bit Box to Bend	10.12 ft	3.1 m
Hole Size	12 ¼” - 26”	311 - 660 mm
Standard Bit Box Thread	7 5/8 Reg	7 5/8 Reg
Max WOB	225,000 lbs	100,100 daN
Max Pull while back Reaming	191,700 lbs	85,300 daN
Absolute Overpull	1,948,300 lbs	866,600 daN
Tool Weight	8635 lbs	3915 kg
Length (Fixed Bend)	34.4 ft	10.49 m
Length (Adjustable)	34.4 ft	10.49 m
Adjustable Torque (S14)	60,000 ft lbs Left	81,360 Nm Left
Stabilizer Torque	50,000 ft lbs	67,800 Nm

Mud Lube Motors

Mud Lube Motors

- The Wenzel Mud Lube Motor is designed for higher weight, torque, and down hole temperatures.
- The angular contact bearing stack can accommodate radial loads as well as axial loads in two directions.
- The Bearing Assembly is fully supported with flow bearings above and below the bearing stack.
- The Bearing assembly design is uncomplicated and compact, making it easier to service. The bit to bend length is reasonably short.
- The motor can be equipped with the Maxi-torque Driveline and the Easy Set Adjustable Housing. Near bit stabilizers are also optional.
- Motor components are manufactured from premium materials, under a stringent quality program.
- Patents Pending

Mud Lube Motors Specifications

Power sections for the Mud Lube Motors are available in the same configurations as the Millennium Motors. See the Specifications section for the power performance tables and charts.

4 3/4" (121mm) Mud Lube Motor		
Specification	**Imperial**	**Metric**
Bit Box to Bend	4.8 ft	1.46 m
Hole Size	5 7/8" - 7 7/8"	149 - 200 mm
Standard Bit Box Thread	3 1/2 API Reg	
Maximum WOB	47,420 lbs	21 090 daN
Max Pull while Back Reaming	47,420 lbs	21 090 daN
Absolute Overpull	430,000 lbs	191 260 daN
Average Tool Weight	1250 lbs	570 kg
Average Length	27 ft	8.23 m
Adjustable Torque (S22)	15,000	20 340
Stabilizer Torque	6000 ft.lbs	8130 Nm

6 3/4" (171mm) Mud Lube Motor		
Specification	**Imperial**	**Metric**
Bit Box to Bend	5.3 ft	1.60 m
Hole Size	8 1/2" - 9 7/8"	216 - 250 mm
Standard Bit Box Thread	4 1/2 API Reg	
Maximum WOB	86,800 lbs	38 610 daN
Max Pull while Back Reaming	86,800 lbs	38 610 daN
Absolute Overpull	815,200 lbs	362 600 daN
Average Tool Weight	2500 lbs	1135 kg
Average Length	28.4 ft	8.66 m
Adjustable Torque (S22)	35,000 ft.lbs	47 450 Nm
Stabilizer Torque	15,000 ft.lbs	20 340 Nm

Mud Lube Motors Specifications

7 3/4" (197mm) Mud Lube Motor		
Specification	**Imperial**	**Metric**
Bit Box to Bend	6.5 ft	1.98 m
Hole Size	9 5/8" - 12 1/4"	245 - 311 mm
Standard Bit Box Thread	6 5/8 API Reg	
Maximum WOB	111,165 lbs	49 450 daN
Max Pull while Back Reaming	111,165 lbs	49 450 daN
Absolute Overpull	986,500 lbs	438 800 daN
Average Tool Weight	3400 lbs	1540 kg
Average Length	30.2 ft	9.20 m
Adjustable Torque (S22)	40,000 ft.lbs	54 230 Nm
Stabilizer Torque	35,000 ft.lbs	47 400 Nm

High Build Motor

High Build Motor (HB21)

Short Bit to Bend Motors

Features:

- Sealed and oil filled bearing assembly
- 0 - 2 degree adjustable housing
- Developed to acheive higher build rates at rotatable bend settings
- Capable of transmitting extremely high torque
- Suitable for use with even wall technology, hard rubber, and other high torque power sections
- Utilizes Maxi-torque driveline
- Patents Pending

Short Bit to Bend Motors

Predicted Build Rates

Bend Setting (degrees)	**4 3/4" Motor Predicted Build Rate** for 6 1/8" Hole Size (deg/100ft.)	**6 1/2" Motor Predicted Build Rate** for 8 3/4" Hole Size (deg/100ft.)
0.00	0	0
0.26	1	3
0.52	3	6
0.77	6	9
1.00	9	11
1.22	11	14
1.41	12	16
1.59	14	18
1.73	15	19
1.85	17	20
1.93	17	21
1.98	18	22
2.00	18	22

-BUR predictions are theoretical values. Many factors can affect BUR. Values are provided for information only. Use at your own risk.

-Where the motor is set at 1.59° or less, drill string rotary speed should be kept under 60rpm. For motor settings above 1.59°, drill string rotary speed should be kept under 30rpm.

-The above table is based on: 4 3/4" motor with 5 7/8" Near Bit Stabilizer and 200inch long power section in 6 1/8" Hole Size. 6 1/2" Motor with 8 1/2" Near Bit Stabilizer and 206inch long power section in 8 3/4" Hole Size. Please contact Wenzel Downhole for information on other configurations.

Specifications

4 3/4" HB21 Motor Specifications

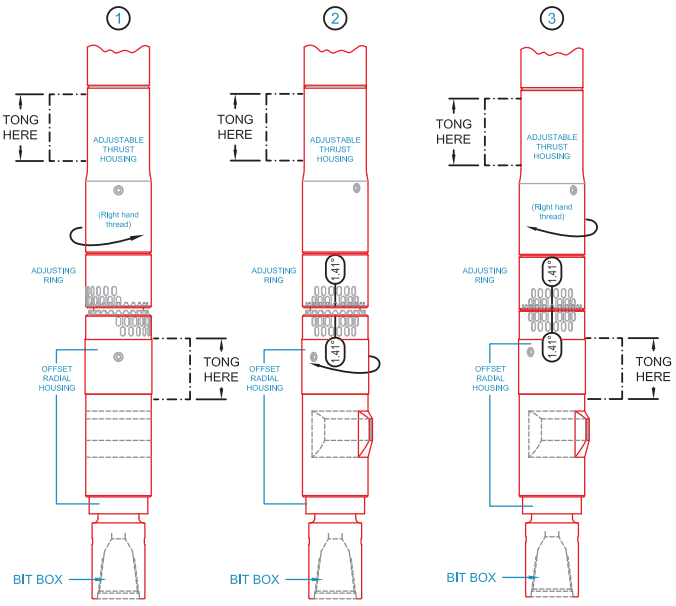
Specification	Imperial	Metric
Nominal Motor Size	4.75 inches	121 mm
Bit Box to Bend	30.0 inches	760 mm
Hole Size	5 7/8" – 7 7/8"	149 – 200 mm
Standard Bit Box Thread	3 1/2 Reg	
Maximum WOB	42,350 lbs	18 840 daN
Max. Pull while back Reaming	36,950 lbs	16 440 daN
Absolute Overpull	235,500 lbs	106 107 daN
Average Tool Weight	1315 lbs	595 kg
Average Length	30.3 feet	9.25 m
Torque for Adjustable Housing	15,000 ft·lbs	20 340 N·m
Stabilizer Torque	6000 ft·lbs	8000 N·m

6 1/2" HB21 Motor Specifications

Specification	Imperial	Metric
Nominal Motor Size	6.50 inches	165 mm
Bit Box to Bend	31.5 inches	800 mm
Hole Size	7 7/8" – 9 7/8"	200 – 250 mm
Standard Bit Box Thread	4 1/2 Reg	
Maximum WOB	68,500 lbs	30 450 daN
Max. Pull while back Reaming	55,200 lbs	24 500 daN
Absolute Overpull	597,000 lbs	265 400 daN
Average Tool Weight	2100 lbs	970 kg
Average Length	28.08 feet	8.56 m
Torque for Adjustable Housing	30,000 ft·lbs	40 700 N·m
Stabilizer Torque	12,000 ft·lbs	16 300 N·m

Power sections for the High Build motors are available in the same configurations as the Millennium motors. See the Specifications section for power performance tables and charts.

Wenzel Adjustable Housing
Series 21 High Build Bearing Assembly
Rig Setting Procedure



Break connection and unscrew using a chain tong to expose teeth

Turn to desired bend setting (Maximum rotation (total) is limited to 1/2 turn by internal stop).

Turn the Adjustable Thrust Housing, using a chain tong, to lower the Adjusting Ring to the Radial Offset Housing. Maintain alignment of desired setting marks while turning. Torque to the recommended value.

RECOMMENDED MAKE UP TORQUE		
TOOL SIZE (inches)	TORQUE (ft·lbs)	TORQUE (N·m)
4 3/4	15,000	20 340
6 1/2	30,000	40 700

Shock Tools and Jars

Shock Tools and Jars

Tool Sizes

Shock Tools

Available in:

3.50”	(89mm)	9.00”	(229mm)
4.75”	(121mm)	9.50”	(241mm)
6.25”	(159mm)	10.00”	(254mm)
6.50”	(164mm)	11.00”	(279mm)
6.75”	(172mm)	12.00”	(305mm)
8.00”	(203mm)		

Hydraulic / Mechanical Jars

Available in:

3.12”	(79mm)	6.50”	(164mm)
3.50”	(89mm)	6.62”	(168mm)
3.75”	(95mm)	6.75”	(172mm)
4.75”	(121mm)	8.00”	(203mm)
5.25”	(133mm)	9.00”	(229mm)
6.25”	(159mm)	9.50”	(241mm)

Double Acting Hydraulic Jars

Available in:

3.38”	(86mm)	6.50”	(164mm)
4.25”	(108mm)	6.75”	(172mm)
4.75”	(121mm)	8.00”	(203mm)
6.25”	(159mm)	9.50”	(241mm)

Ultimate Drilling Jars, Hydraulic/Mechanical

Available in:

4.75”	(121mm)	6.62”	(168mm)
5.25”	(133mm)	6.75”	(172mm)
6.25”	(159mm)	8.00”	(203mm)
6.50”	(164mm)		

Ultimate Drilling Jars, Double Acting Hydraulic

Available in:

4.75”	(121mm)	8.00”	(203mm)
6.50”	(165mm)		

Wenzel Shock Tools

The Wenzel Shock Tool effectively reduces impact loading on the bit to extend bit life and reduce bit trips. By isolating axial bit vibrations from the drill string, the shock tool will reduce lateral and torsional drill string vibrations, and related fatigue damage or failure of the rotary connections. The shock tool allows optimum bit speed to be used under rough drilling conditions, increasing the rate of penetration.

DESIGN FEATURES

- Does not use temperature-sensitive elastomers for shock absorption, therefore is suitable for use in temperatures to 250°F (120°C), with optional seals available for temperatures up to 320°F (160°C).
- Reliable Belleville disc springs provide optimum load/deflection characteristics to maintain consistent contact between bit and formation, effectively reducing impact loading to extend bit life.
- Isolates bit induced vibrations from the drill string.
- Fully oil-sealed and lubricated for extended service life.
- Pressure balanced to eliminate the effect of downhole hydrostatic pressure.
- Low friction torsional drive permits free vertical movement.
- Well-stabilized, with internal three-point lateral support to minimize deflection.
- Reduces wear and tear on rig and equipment, and fatigue failures on drill collars and drill pipe.
- Automatically compensates for pump open force

SHOCK TOOL OPERATION

- For maximum effectiveness, the shock tool should be positioned immediately above the bit.
- With a packed bottom hole assembly, the shock tool may be located a minimum of two drill collar lengths above the top stabilizer, however bit protection will be reduced due to the greater un-sprung mass below the tool.
- Automatic compensation of pump open effect makes the shock tool effective with any combination of bit weight or circulating pressure.

Nominal O.D.	Length	Thru Bore	Approx. Weight	Pump Open Area	Torsional Limit	Tensile Yield	Recommended Body Joint Torque
3.50 inch	7.8 ft	1.00 inch	230 lb	5.9 in^2	10,000 ft lbs	239,000 lbs	4,500 ft lbs
89 mm	2.4 m	25 mm	100 kg	3 800 mm^2	14 000 N·m	106 300 daN	6 000 N·m
4.75 inch	10.7 ft	1.50 inch	540 lb	11.0 in^2	20,000 ft lbs	561,500 lbs	11,000 ft lbs
121 mm	3.3 m	38 mm	250 kg	7 100 mm^2	28 000 N·m	249 800 daN	15 000 N·m
6.25 inch	11.7 ft	2.25 inch	1000 lb	19.6 in^2	37,900 ft lbs	926,600 lbs	24,000 ft lbs
159 mm	3.6 m	57 mm	450 kg	12 700 mm^2	53 000 N·m	412 200 daN	33 000 N·m
6.50 inch	11.6 ft	2.25 inch	1030 lb	19.6 in^2	39,500 ft lbs	960,000 lbs	24,000 ft lbs
165 mm	3.5 m	57 mm	470 kg	12 700 mm^2	55 000 N·m	427 000 daN	33 000 N·m
6.75 inch	11.5 ft	2.75 inch	1100 lb	21.6 in^2	46,400 ft lbs	837,400 lbs	26,000 ft lbs
171 mm	3.5 m	70 mm	500 kg	13 900 mm^2	64 000 N·m	372 500 daN	36 000 N·m
8.00 inch	11.9 ft	2.75 inch	1690 lb	30.6 in^2	104,600 ft lbs	1,378,800 lbs	45,000 ft lbs
203 mm	3.6 m	70 mm	770 kg	19 700 mm^2	145 000 N·m	613 300 daN	63 000 N·m
9.00 inch	12.3 ft	3.00 inch	2220 lb	38.5 in^2	125,000 ft lbs	1,502,000 lbs	55,000 ft lbs
229 mm	3.7 m	76 mm	1010 kg	24 800 mm^2	174 000 N·m	668 100 daN	76 000 N·m
9.50 inch	12.3 ft	3.00 inch	2500 lb	41.3 in^2	131,000 ft lbs	1,209,000 lbs	57,000 ft lbs
241 mm	3.7 m	76 mm	1140 kg	26 600 mm^2	182 000 N·m	537 800 daN	79 000 N·m
10.00 inch	12.3 ft	3.00 inch	2680 lb	41.3 in^2	132,300 ft lbs	1,246,500 lbs	65,000 ft lbs
254 mm	3.7 m	76 mm	1220 kg	26 600 mm^2	184 000 N·m	554 500 daN	90 000 N·m
11.00 inch	12.0 ft	3.00 inch	3240 lb	63.6 in^2	225,600 ft lbs	1 628 300 lbs	100,000 ft lbs
279 mm	3.7 m	76 mm	1470 kg	41 000 mm^2	313 000 N·m	724 300 daN	139 000 N·m
12.00 inch	12.0 ft	3.00 inch	3900 lb	63.6 in^2	345,400 ft lbs	1,628,300 lbs	115,000 ft lbs
305 mm	3.7 m	76 mm	1770 kg	41 000 mm^2	480 000 N·m	724 300 daN	160 000 N·m

Wenzel Hydraulic/Mechanical Drilling Jars

The Wenzel Jar operates with a simple up and down motion and is insensitive to right or left hand torque. It is most commonly run as a hydraulic/mechanical, but can be run as a mechanical jar, by omitting the valve, or as a hydraulic jar by omitting the latch. When configured as a hydraulic/mechanical jar or straight mechanical jar, it is run in the latched position. This eliminates unexpected jarring and prolongs seal life.

DESIGN FEATURES

- Jar will **NOT** accidentally fire when making connections, drilling, tripping, or tagging bottom.
- Safety clamps or special handling procedures are **NOT** required.
- Jar placement is more flexible than with hydraulic jars. These jars can be run in tension or compression provided the preset latch settings are not exceeded.
- Lower connection time than hydraulic jars when run in compression. The mechanical latch eliminates the need to wait for the hydraulic delay when tagging bottom or picking up off bottom.
- Mechanical latch is **NOT** affected by right or left hand torque
- Mechanical latch release settings are shop adjustable.
- Up jarring impact force can be altered after the latch setting has been exceeded by changing the overpull during the hydraulic delay sequence.
- Standard seals are effective up to 250°F (120°C)
- Optional high temperature seals are rated for up to 400°F (204°C)
- Carbide coating and Wenzel downhole's specialized polishing process on all mandrel sealing surfaces greatly enhances seal and tool life in a broad variety of drilling environments.

JAR OPERATION

- To jar upwards the tension force at the jar must exceed the up latch setting. When the latch setting is exceeded the tension force can be increased or decreased during the hydraulic delay period, which is typically between 30 and 90 seconds. The jar then enters free stroke and the hammer surface of the jar accelerates until it contacts the anvil surface of the jar thus exerting an upward impact force at the stuck point. The jarring cycle can be repeated by lowering the drill string to re-engage the mechanical latch.
- To jar downwards the compression force at the jar must exceed the down latch setting. There is no hydraulic delay when jarring down. After exceeding the down latch setting the jar closes immediately exerting a downward impact force at the stuck point. The jarring cycle can be repeated by raising the drill string to re-engage the mechanical latch.
- Circulating while jarring will cause a pump open force. This force can be calculated by multiplying the pressure drop across the bit by the pump open area shown on the jar specification table. This force will reduce the overpull required to overcome the up latch setting, and increase the compressive force required to overcome the down latch setting.
- The down latch releases at approximately 45% of the up latch setting.

Nominal OD	Length	Thru Bore	Approx. Weight	Pump Open Area	Torsional Limit	Max Pull During Delay	Tensile Yield	Recommended Body Joint Torque
3.12 inch	13.9 ft	1.00 inch	270 lb	4.0 in^2	8,200 ft·lbs	42,000 lbs	154,500 lbs	5,000 ft·lbs
79 mm	4.2 m	25.4 mm	120 kg	2581 mm^2	11 120 N·m	18 680 daN	68 700 daN	6 780 N·m
3.50 inch	14.9 ft	1.25 inch	370 lb	6.0 in^2	10,300 ft·lbs	50,000 lbs	211,500 lbs	5,000 ft·lbs
89 mm	4.5 m	31.8 mm	170 kg	3871 mm^2	13 960 N·m	22 240 daN	94 100 daN	6 780 N·m
3.75 inch	15.1 ft	1.19 inch	420 lb	6.0 in^2	11,300 ft·lbs	65,000 lbs	214,000 lbs	6,000 ft·lbs
95 mm	4.6 m	30.2 mm	190 kg	3871 mm^2	15 320 N·m	28 910 daN	95 200 daN	8 130 N·m
4.75 inch	17.0 ft	2.25 inch	680 lb	11.8 in^2	20,000 ft·lbs	85,000 lbs	391,000 lbs	11,000 ft·lbs
121 mm	5.2 m	57.2 mm	310 kg	7613 mm^2	27 120 N·m	37 810 daN	173 900 daN	14 910 N·m
5.25 inch	17.9 ft	2.25 inch	820 lb	14.2 in^2	31,000 ft·lbs	120,000 lbs	554,100 lbs	15,000 ft·lbs
133 mm	5.5 m	57.2 mm	370 kg	9161 mm^2	42 030 N·m	53 380 daN	246 500 daN	20 340 N·m
6.25 inch	18.0 ft	2.25 inch	1370 lb	19.6 in^2	48,500 ft·lbs	160,000 lbs	777,000 lbs	24,000 ft·lbs
159 mm	5.5 m	57.2 mm	620 kg	12 664 mm^2	65 760 N·m	71 170 daN	345 600 daN	32 540 N·m
6.50 inch	18.0 ft	2.25 inch	1430 lb	19.6 in^2	52,400 ft·lbs	160,000 lbs	777,000 lbs	24,000 ft·lbs
165 mm	5.5 m	57.2 mm	650 kg	12 664 mm^2	71 040 N·m	71 170 daN	345 600 daN	32 540 N·m
6.62 inch	17.9 ft	2.75 inch	1400 lb	21.7 in^2	53,800 ft·lbs	170,000 lbs	722,500 lbs	28,000 ft·lbs
168 mm	5.5 m	69.9 mm	640 kg	13 968 mm^2	72 940 N·m	75 620 daN	321 400 daN	37 960 N·m
6.75 inch	17.9 ft	2.75 inch	1500 lb	23.8 in^2	48,800 ft·lbs	190,000 lbs	907,500 lbs	28,000 ft·lbs
171 mm	5.5 m	69.9 mm	680 kg	15 323 mm^2	66 160 N·m	84 510 daN	403 700 daN	37 960 N·m
8.00 inch	18.2 ft	2.81 inch	2200 lb	30.7 in^2	98,000 ft·lbs	240,000 lbs	949,000 lbs	45,000 ft·lbs
203 mm	5.5 m	71.4 mm	1000 kg	19 806 mm^2	132 870 N·m	106 750 daN	422 100 daN	61 010 N·m
9.00 inch	19.1 ft	3.00 inch	3200 lb	38.5 in^2	162,500 ft·lbs	240,000 lbs	1,221,000 lbs	55,000 ft·lbs
229 mm	5.8 m	76.2 mm	1450 kg	24 826 mm^2	220 320 N·m	106 750 daN	543 100 daN	74 570 N·m
9.50 inch	19.2 ft	3.00 inch	3500 lb	41.3 in^2	178,400 ft·lbs	240,000 lbs	1,658,500 lbs	80,000 ft·lbs
241 mm	5.9 m	76.2 mm	1590 kg	26 632 mm^2	241 870 Nm	106 750 daN	737 700 daN	108 460 N·m

Double Acting Hydraulic Drilling Jar

The Wenzel Downhole Double Acting Hydraulic Drilling Jar (HJDA) is a bi-directional drilling jar incorporating hydraulic delay without a latch mechanism. This jar will allow the operator to apply variable impact in both the up and down directions. The HJDA is intended for use in highly deviated or high friction wells, where conditions may prevent applying sufficient force to release a mechanical latch.

DESIGN FEATURES

- The Wenzel Downhole HJDA is hydraulically controlled and jars in both directions, with impact force controlled by the operator.
- Impact force is controlled by a metering device that ensures consistent delay times over the full range of operating temperatures.
- The HJDA operates via a simple up and down motion and is unaffected by right- or left-hand torque.
- Standard seals are suitable for use up to 250°F (120°C). Optional high temperature seal kits are available suitable for service to 400°F (200°C). External sealing surfaces are tungsten carbide-coated to enhance wear and corrosion resistance.

JAR OPERATION

Jarring Up

- With the jar in the neutral position, apply the desired overpull in excess of the free string weight, starting the hydraulic delay sequence. At the end of the hydraulic delay, the jar will release causing an upward impact force.
- If necessary, lower the drill string sufficiently to close the jar to the neutral position, ready to jar up again.

Jarring Down

- With the jar in the neutral position, lower the drill string to apply the desired down force, starting the hydraulic delay sequence. At the end of the hydraulic delay, the jar will release causing a downward impact force.
- If necessary, raise the drill string sufficiently to open the jar to the neutral position, ready to jar down again.

Handling

- To prevent unintentional tripping during handling, the HJDA is fitted with a safety clamp to keep the jar in the fully extended position. The safety clamp must remain installed until the jar is ready to run into the hole.
- When preparing to run into the hole, connect the jar to the drill string and apply tension before removing the safety clamp.
- When coming out of the hole, install the safety clamp while the jar is still under tension and fully extended.

Nominal OD	Length	Thru Bore	Tensile Yield	Torsional Limit	Max Pull During Delay	Pump Open Area	Free Stroke Up	Free Stroke Down	Total Stroke
3.38 inch	14.3 ft	1.50 inch	234,865 lbs	9,000 ft·lbs	50,000 lbs	5.9 in^2	7 inch	7 inch	21 inch
86 mm	4.3 m	38 mm	104 470 daN	12 200 Nm	22 240 daN	3 806 mm^2	178 mm	178 mm	533 mm
4.25 inch	16.9 ft	2.00 inch	300,840 lbs	16,300 ft·lbs	70,000 lbs	8.9 in^2	8 inch	8 inch	25 inch
108 mm	5.2 m	51 mm	133 810 daN	22 100 Nm	31 140 daN	5 742 mm^2	203 mm	203 mm	635 mm
4.75 inch	17.4 ft	2.25 inch	370,600 lbs	21,500 ft·lbs	85,000 lbs	11.8 in^2	8 inch	8 inch	25 inch
121 mm	5.3 m	57 mm	164 840 daN	29 150 Nm	37 810 daN	7 613 mm^2	203 mm	203 mm	635 mm
6.25 inch	17.9 ft	2.25 inch	938,900 lbs	50,700 ft·lbs	160,000 lbs	19.6 in^2	8 inch	8 inch	25 inch
159 mm	5.4 m	57 mm	417 620 daN	68 740 Nm	71 170 daN	12 645 mm^2	203 mm	203 mm	635 mm
6.50 inch	18.1 ft	2.75 inch	1,220,000 lbs	51,000 ft·lbs	175,000 lbs	23.7 in^2	8 inch	8 inch	25 inch
165 mm	5.5 m	70 mm	542 660 daN	69 150 Nm	77 840 daN	15 290 mm^2	203 mm	203 mm	635 mm
6.75 inch	17.9 ft	2.75 inch	1,220,000 lbs	51,500 ft·lbs	190,000 lbs	23.8 in^2	8 inch	8 inch	25 inch
171 mm	5.5 m	70 mm	542 660 daN	69 820 Nm	84 510 daN	15 355 mm^2	203 mm	203 mm	635 mm
8.00 inch	18.2 ft	2.81 inch	1,293,890 lbs	103,200 ft·lbs	240,000 lbs	30.7 in^2	8 inch	8 inch	25 inch
203 mm	5.5 m	71 mm	575 520 daN	139 920 Nm	106 750 daN	19 806 mm^2	203 mm	203 mm	635 mm
9.50 inch	19.0 ft	3.00 inch	2,106,900 lbs	189,300 ft·lbs	300,000 lbs	41.3 in^2	8 inch	8 inch	25 inch
241 mm	5.8 m	76 mm	937 150 daN	256 650 Nm	133 440 daN	26 645 mm^2	203 mm	203 mm	635 mm

Ultimate Drilling Jars

SOMETIMES YOU NEED BIGGER HAMMER

The next generation in Extreme overpull high impact drilling jars...

Using proprietary new technology, Wenzel Downhole Tools has dramatically increased the allowable overpull force of our Jars and are excited to offer this new line of Ultimate Drilling Jars to our customers.

UDJ - High Overpull Hydraulic Mechanical Jars

and

UDJ - High Overpull Double Acting Hydraulic Jars

UDJ - High Overpull HMJ

High Overpull Hydraulic Mechanical Jar

The High Overpull HMJ is a double acting jar designed to deliver hydrulic delay when jarring up and mechanical realease when jarring in the down direction. The jar incorporates a latch mechanism to keep the jar locked in neutral position and eliminate unexpected jarring while tripping or racking back in the derrick.

DESIGN FEATURES

- The Jar operates with a simple up and down motion and is not affected by torque.
- The spline drive and latch mechanism are enclosed in a single, sealed oil chamber without ports that might fill with cuttings and restrict the down jar stroke.
- The hydraulic delay mechanism is located in a separate chamber to prevent contamination and increase reliability.
- With the latch mechanism in the cocked or latched position, the inner mandrel and outer housing act integrally, virtually eliminating seal and inner tool wear during normal drilling conditions. There is no need to extend or open the jar before running in the hole.
- Standard seals in the tool are effective to 250°F (120°C). The jar can be dressed with seals effective to 400°F (200°C) for hot hole environments. External sealing surfaces are tungsten carbide-coated to enhance wear and corrosion resistance.
- The Jar can be run in tension or in compression within the preset latch settings.

JAR OPERATION

Jarring Up

- Jarring up is achieved by applying sufficient overpull to overcome the latch setting, which initiates the hydraulic time delay. During the time delay, the overpull at surface can be adjusted to vary the impact force.
- After impact, apply a down force sufficient to close jar and re-engage latch, then repeat the jarring cycle as required.

Jarring Down

- Jarring down is achieved by applying sufficient downward force to overcome the latch setting and pump open force. At that point, the Jar will release and jar downward.
- After impact, pick up the work string to re-engage the mechanical latch then repeat the jarring cycle as required.

Nominal OD	Length	Thru Bore	Approx. Weight	Tensile Yield	Torsional Limit	Pump Open Area	Max Pull During Delay
4.75 inch	19.6 ft	2.25 inch	765 lb	391,000 lbs	20,000 ft·lbs	11.8 in^2	132,000 lbs
121 mm	6.0 m	57.2 mm	350 kg	173 900 daN	27 120 N·m	7,606 mm^2	58 710 daN
5.25 inch	19.6 ft	2.25 inch	890 lb	391,000 lbs	31,500 ft·lbs	11.8 in^2	132,000 lbs
133 mm	6.0 m	57.2 mm	400 kg	173 900 daN	42 710 N·m	7,606 mm^2	58 710 daN
6.25 inch	20.5 ft	2.25 inch	1,570 lb	777,000 lbs	48,500 ft·lbs	19.6 in^2	250,000 lbs
159 mm	6.3 m	57.2 mm	710 kg	345 600 daN	65 760 N·m	12 664 mm^2	111 200 daN
6.50 inch	20.5 ft	2.25 inch	1,630 lb	777,000 lbs	52,400 ft·lbs	19.6 in^2	250,000 lbs
165 mm	6.3 m	57.2 mm	740 kg	345 600 daN	71 040 N·m	12 664 mm^2	111 200 daN
6.62 inch	20.6 ft	2.75 inch	1,600 lb	722,500 lbs	53,800 ft·lbs	21.7 in^2	250,000 lbs
168 mm	6.3 m	69.9 mm	730 kg	321 400 daN	72 940 N·m	13 968 mm^2	111 200 daN
6.75 inch	20.5 ft	2.75 inch	1,760 lb	907,500 lbs	48,800 ft·lbs	23.8 in^2	270,000 lbs
171 mm	6.2 m	69.9 mm	800 kg	403 700 daN	66 160 N·m	15 323 mm^2	120 100 daN
8.00 inch	20.7 ft	2.81 inch	2,600 lb	949,000 lbs	98,000 ft·lbs	30.7 in^2	400,000 lbs
203 mm	6.3 m	71.4 mm	1180 kg	422 100 daN	132 870 N·m	19 806 mm^2	177 920 daN

UDJ - High Overpull HJDA

High Overpull Double Acing Hydraulic Jar

The High Overpull Double Acting Hydraulic Drilling Jar is a bi-directional drilling jar incorporating hydraulic delay without a latch mechanism. This jar will allow the operator to apply variable impact in both the up and down directions. The HJDA is intended for use in highly deviated or high friction wells, where conditions may prevent applying sufficient force to release a mechanical latch.

DESIGN FEATURES

- The Wenzel Downhole HJDA is hydraulically controlled and jars in both directions, with impact force controlled by the operator.
- Impact force is controlled by a metering device that ensures consistent delay times over the full range of operating temperatures.
- The HJDA operates via a simple up and down motion and is unaffected by right- or left-hand torque.
- Standard seals are suitable for use up to 250°F (120°C). Optional high temperature seal kits are available suitable for service to 400°F (200°C). External sealing surfaces are tungsten carbide-coated to enhance wear and corrosion resistance.

JAR OPERATION

Jarring Up

- With the jar in the neutral position, apply the desired overpull in excess of the free string weight, starting the hydraulic delay sequence. At the end of the hydraulic delay, the jar will release causing an upward impact force.
- If necessary, lower the drill string sufficiently to close the jar to the neutral position, ready to jar up again.

Jarring Down

- With the jar in the neutral position, lower the drill string to apply the desired down force, starting the hydraulic delay sequence. At the end of the hydraulic delay, the jar will release causing a downward impact force.
- If necessary, raise the drill string sufficiently to open the jar to the neutral position, ready to jar down again.

Handling

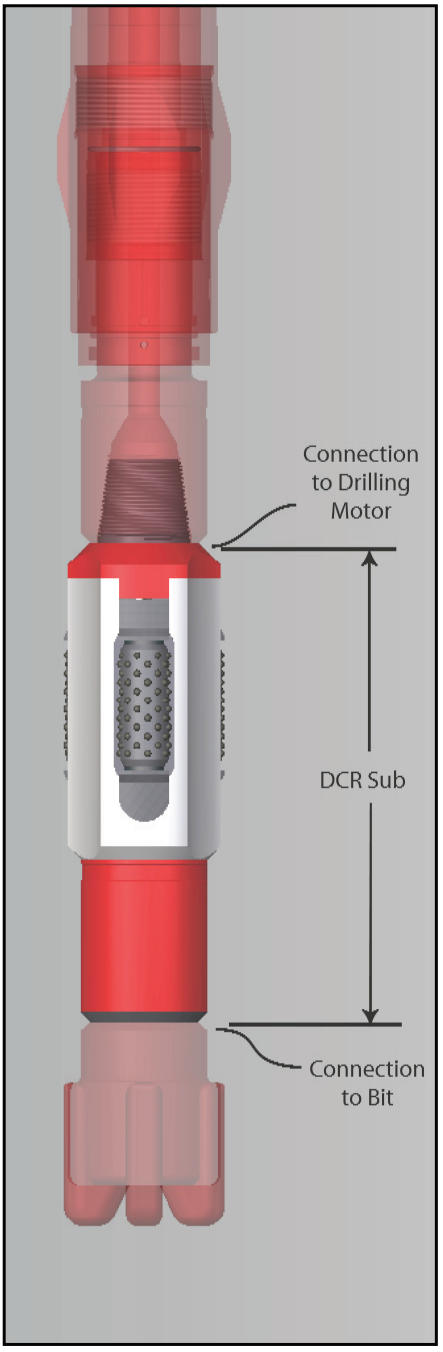
- To prevent unintentional tripping during handling, the HJDA is fitted with a safety clamp to keep the jar in the fully extended position. The safety clamp must remain installed until the jar is ready to run into the hole.
- When preparing to run into the hole, connect the jar to the drill string and apply tension before removing the safety clamp.
- When coming out of the hole, install the safety clamp while the jar is still under tension and fully extended.

Nominal OD	Length	Thru Bore	Approx. Weight	Tensile Yield	Torsional Limit	Pump Open Area	Max Pull During Delay
4.75 inch	22.0 ft	2.25 inch	850 lb	370,600 lbs	21,500 ft·lbs	11.8 in^2	132,000 lbs
121 mm	6.7 m	57 mm	386 kg	164 840 daN	29 150 N·m	7606 mm^2	58 710 daN
6.50 inch	23.1 ft	2.75 inch	1795 lb	1,220,000 lbs	51,000 ft·lbs	23.8 in^2	275,000 lbs
165 mm	7.0 m	70 mm	814 kg	542 660 daN	69 150 N·m	15 329 mm^2	122 320 daN
8.00 inch	23.2 ft	2.81 inch	2910 lb	1,293,890 lbs	103,200 ft·lbs	30.7 in^2	400,000 lbs
203 mm	7.1 m	71 mm	1320 kg	575 520 daN	139 920 N·m	19 794 mm^2	177 920 daN

Deviation Control Reamer

DCR Sub

Deviation Control Reamer

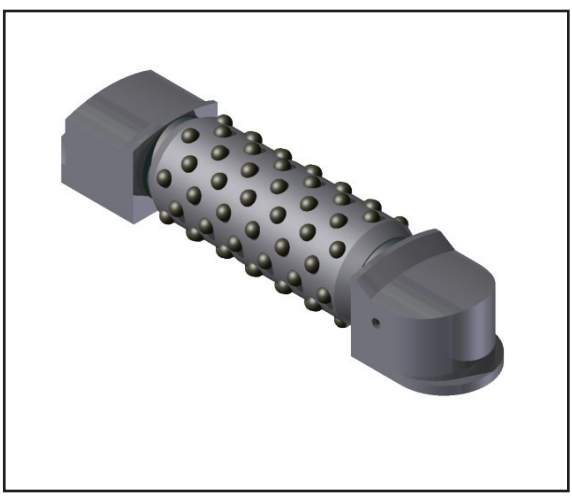


The Wenzel Deviation Control Reamer

The Wenzel Downhole Deviation Control Reamer (DCR Sub) acts as a near bit reamer/stabilizer. The three point sealed bearing cutters maintain hole gauge and also function as a low torque stabilizer to control hole deviation. The extremely short length of this sub is possible due to the unique patented cutter retention method.

Features:

- Sealed and lubricated reamer cutters with internal bushings provide the greatest durability in a near bit environment.
- Cutter pins are produced from hardened steel for long life.
- Cutter types; domed button or straight ridge.
- Replaceable thrust washers are installed at each end of the cutters.
- Cutter blocks are precision machined to ensure correct gauge. They are manufactured from alloy steel and finished hardened for a superior combination of strength and wear resistance.
- No bolts or screws are used to retain the reamer blocks.



Deviation Control Reamer Specifications

Downhole Motor Size	Reaming Diameter	Number of Points	Sub Length	Thru Bore	Standard Bit Box	Approximate Weight
6 1/2 inch	7 7/8 inch	3	1.8 feet	1.5 inch	4 1/2 API Regular	200 lbs.
165 mm	200 mm		.56 m	38 mm		90 kg
6 1/2 inch	8 1/2 inch	3	1.9 feet	1.5 inch	4 1/2 API Regular	200 lbs.
165 mm	215 mm		.57 m	38 mm		90 kg
6 1/2 inch	8 3/4 inch	3	1.9 feet	1.5 inch	4 1/2 API Regular	200 lbs.
165 mm	222 mm		.57 m	38 mm		90 kg
8 inch	12 1/4 inch	3	2.0 feet	2.0 inch	6 5/8 API Regular	550 lbs.
203 mm	311 mm		.62 m	51 mm		250 kg

Optional Equipment

Optional Equipment

- Dump Sub
  - Alternate Top Sub or Plugged Dump Sub
  - Alternate Top Bent Sub
  - Alternate Float Sub
  - Rotor Catch Sub
  - Flex Top Sub
  - Float Bores for Float Valves
- Alternate Oversized Stator
  - Optional Jetted Rotor
- Adjustable Bent Housing
  - Alternate Straight Housing
  - Alternate Fix Bent Housing, 4° max
  - Standard 0° to 3°
  - Optional 0° to 2° and 0° to 4°
- Articulated Connecting Rod
  - Alternate Titanium Flex Shaft
- Sealed Bearing Assembly w/ Thread Protector for slick assembly
  - Alternate Near Bit Screw-on Stabilizer
  - Alternate Near Bit Integral Stabilizer
- Chrome Plated Rotors
- Carbide Coated Rotors
- Crossover Subs
- DCR Subs (Deviation Control Reamer)

Tables and Formulas

Formulas

Hydraulic Power

$$\text{Power (HP)} = \frac{P_b \times Q}{1714}$$

Pb = Pressure drop across bit jet nozzles (psi)

Q = Flow rate (US gpm)

$$\text{Power (KW)} = \frac{P_b \times Q}{6000}$$

Pb = Pressure drop across bit jet nozzles (kPa)

Q = Flow rate (US lpm)

Mechanical Power

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

T = Torque (ft-lbs)

N = Speed (rpm)

$$\text{Power (kW)} = \frac{T \times N}{9548.8}$$

T = Torque (N.m)

N = Speed (rpm)

Pressure Drop Across the Bit Jet Nozzle (Pb)

$$P_b \text{ (psi)} = \frac{Q^2 \times W}{10858 \times A^2}$$

Q = Flow rate (US gpm)

W = Mud weight (lb/gal)

A = Area (in^2)

$$P_b \text{ (psi)} = \frac{Q^2 \times W}{6.49643 \times A^2}$$

Q = Flow rate (lpm)

W = Mud weight (kg/m^3)

A = Area (mm^2)

Total Flow Area (TFA) to Obtain a Specific Bit Pressure Loss

$$\text{TFA } (in^2) = \sqrt{\frac{W \times Q^2}{10858 \times P_b}}$$

W = Mud Weight (lb/gal)

Q = Flow rate (US gpm)

Pb = Bit pressure loss (psi)

$$\text{TFA } (mm^2) = \sqrt{\frac{W \times Q^2}{6.49643 \times P_b}}$$

W = Mud Weight (kg/m^3)

Q = Flow rate (US lpm)

Pb = Bit pressure loss (kPa)

Imperial Conversions

	TO CONVERT FROM	
	SYMBOL	UNIT
LENGTH	in	inch
	in	inch
	ft	feet
	m	mile
MASS	lb	pound
STRESS	psi	pounds/square inch
	psi	pounds/square inch
	psi	pounds/square inch
PRESSURE	psi	pounds/square inch
	psi	pounds/square inch
	psi	pounds/square inch
	psi	pounds/square inch
	psi	pounds/square inch
FLOW	gpm (US)	gallons (US) per minute
	gpm (US)	gallons (US) per minute
	bbl/min (US)	barrels (US) per minute
FORCE	lbf	pound
	lbf	pound
	lbf	pound
	lbf	pound
AREA	in^2	square inch
	in^2	square inch
	ft^2	square feet
VOLUME	gal (US)	gallon (US)
	gal (US)	gallon (US)
	ft^3	cubic feet
	bbl (US)	barrel (US)
TORQUE	ft-lb	foot pound
	ft-lb	foot pound
	ft-lb	foot pound
POWER	HP	horsepower
DENSITY	lbs/gal	pounds per gallon (US)
	lbs/gal	pounds per gallon (US)
	lbs/in^3	pounds per cubic inch
	lbs/in^3	pounds per cubic inch
TEMPERATURE	°F	°Fahrenheit
NOZZLE	32nds inch	32nds inch

TO		MULTIPLY BY
SYMBOL	UNIT	
mm	millimeter	25.4
cm	centimeter	2.54
m	meter	0.3048
km	kilometer	1.609
kg	kilogram	0.4536
MPa	megapascal	0.006895
kgf/cm²	kilogramf/square centimeter	0.006895
bar	bar	0.06895
kPa	kilopascal	6.8948
MPa	megapascal	0.006895
kgf/cm²	kilogramf/square centimeter	0.0703067
atm	atmosphere	0.0680462
bar	bar	0.06895
lpm	liters/minute	3.785
m³/min.	cubic meters/minute	0.003785
m³/min.	cubic meters/minute	0.1589
kgf	kilogram_force	0.4536
N	newton	4.4482
daN	decanewton	0.4448
kN	kilonewton	0.004448
cm²	square centimeter	6.4516
mm²	square millimeter	645.16
m²	square meter	0.0929
l	liter	3.785
m³	cubic meter	0.003785
m³	cubic meter	0.02831
m³	cubic meter	0.1589
N.m	newton meter	1.356
kN.m	kilonewton.meter	0.00136
kg.m	kilogram.meter	0.13820
kW	kilowatt	0.7457
kg/m³	kilograms/cubic meter	119.82
g/cm³	grams/cubic centimeter	0.11982
kg/m³	kilograms/cubic meter	27679.7
g/cm³	grams/cubic centimeter	27.6797
°C	°Celsius	(°F-32)/1.8
mm	millimeter	0.793

Metric Conversions

	TO CONVERT FROM	
	SYMBOL	UNIT
LENGTH	mm	millimeter
	cm	centimeter
	m	meter
	km	kilometer
MASS	kg	kilogram
STRESS	MPa	megapascal
	kgf/cm^2	kilogramf/square centimeter
	bar	bar
PRESSURE	kPa	kilopascal
	MPa	megapascal
	kgf/cm^2	kilogramf/square centimeter
	atm	atmosphere
	bar	bar
FLOW	lpm	liters/minute
	$m^3/min.$	cubic meters/minute
	$m^3/min.$	cubic meters/minute
FORCE	kgf	kilogram_force
	N	newton
	daN	decanewton
	kN	kilonewton
AREA	cm^2	square centimeter
	mm^2	square millimeter
	m^2	square meter
VOLUME	l	liter
	m^3	cubic meter
	m^3	cubic meter
	m^3	cubic meter
TORQUE	N.m	newton.meter
	kN.m	kilonewton.meter
	kg.m	kilogram.meter
POWER	kW	kilowatt
DENSITY	kg/m^3	kilograms/cubic meter
	g/cm^3	grams/cubic centimeter
	kg/m^3	kilograms/cubic meter
	g/cm^3	grams/cubic centimeter
TEMPERATURE	°C	°Celsius
NOZZLE	mm	millimeter

TO		MULTIPLY BY
SYMBOL	UNIT	
in	inch	0.03937
in	inch	0.39370
ft	feet	3.28084
m	mile	0.62150
lb	pound	2.20462
psi	pounds/square inch	145.03263
psi	pounds/square inch	145.03263
psi	pounds/square inch	14.50326
psi	pounds/square inch	0.14504
psi	pounds/square inch	145.03263
psi	pounds/square inch	14.22340
psi	pounds/square inch	14.69590
psi	pounds/square inch	14.50326
gpm (US)	gallons (US) per minute	0.26420
gpm (US)	gallons (US) per minute	264.20079
bbl/min (US)	barrels (US) per minute	6.29327
lbf	pound	2.20459
lbf	pound	0.22481
lbf	pound	2.24820
lbf	pound	224.82014
in^2	square inch	0.15500
in^2	square inch	0.00155
ft^2	square feet	10.76426
gal (US)	gallon (US)	0.26420
gal (US)	gallon (US)	264.20079
ft^3	cubic feet	35.32321
bbl (US)	barrel (US)	6.29327
ft-lb	foot pound	0.73746
ft-lb	foot pound	735.29412
ft-lb	foot pound	7.23589
HP	horsepower	1.34102
lbs/gal	pounds per gallon (US)	0.00835
lbs/gal	pounds per gallon (US)	8.34585
lbs/in^3	pounds per cubic inch	0.0000361
lbs/in^3	pounds per cubic inch	0.03613
°F	°Fahrenheit	(°Cx1.8)+32
32nds inch	32nds inch	1.26103

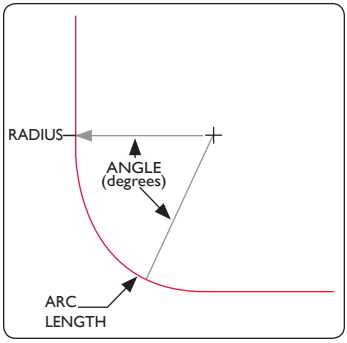
Imperial Conversions

BUILD RATE	RADIUS OF HOLE	
DEGREES per 100 ft (30m)	FEET	METERS
2	2865	873
4	1432	437
6	955	291
8	716	218
10	573	175
12	477	146
14	409	125
16	358	109
18	318	97
20	286	87
22	260	79
24	239	73
26	220	67
28	205	62
30	191	58
32	179	55
34	169	51
36	159	49
38	151	46
40	143	44
42	136	42
44	130	40
46	125	38
48	119	36
50	115	35
52	110	34
54	106	32
56	102	31
58	99	30
60	95	29
62	92	28
64	90	27
66	87	26
68	84	26
70	82	25
72	80	24
74	77	24
76	75	23
78	73	22
80	72	22
82	70	21
84	68	21
86	67	20
88	65	20
90	64	19
92	62	19
94	61	19
96	60	18
98	58	18
100	57	17

BUILD RATE	RADIUS OF HOLE	
DEGREES per 100 ft (30m)	FEET	METERS
105	55	17
110	52	16
115	50	15
120	48	15
125	46	14
130	44	13
135	42	13
140	41	12
145	40	12
150	38	12
155	37	11
160	36	11
165	35	11
170	34	10
175	33	10
180	32	10
185	31	9
190	30	9
195	29	9
200	29	9
210	27	8
220	26	8
230	25	8
240	24	7
250	23	7
260	22	7
270	21	6
280	20	6
290	20	6
300	19	6

FORMULA:

$$R = \frac{\text{Arc Length (ft)}}{.017453 \times \text{Angle } (^\circ)}$$



Rotary Shoulder Connection Interchange

Common Name		Same as or Interchanges with
Style	Size (in.)	
Internal Flush (IF)	2 3/8 in.	2 7/8" Slim Hole NC 26
	2 7/8 in.	3 1/2" Slim Hole NC 31
	3 1/2 in.	4 1/2" Slim Hole NC 38
	4 in.	4 1/2" Extra Hole NC 46
	4 1/2 in.	5" Extra Hole NC 50
		5 1/2" Double Streamline
Full Hole (FH)	4 in.	4 1/2" Double Streamline
Extra Hole (XH) or (EH)	2 7/8 in.	3 1/2" Double Streamline
	3 1/2 in.	4" Slim Hole
		4 1/2" External Flush
	4 1/2 in.	4" Internal Flush NC 46
	5 in.	4 1/2" Internal Flush NC 50
		5 1/2" Double Streamline
Slim Hole (SH)	2 7/8 in.	2 3/8 in. Internal Flush NC 26
	3 1/2 in.	2 7/8 in. Internal Flush NC 31
	4 in.	3 1/2 in. Extra Hole
		4 1/2 in. External Flush
Double Streamline (DSL)	4 1/2 in.	3 1/2 in. Internal Flush NC 38
	3 1/2 in.	3 1/2 in. Extra Hole
	4 1/2 in.	4 in. Full Hole NC 40
	5 1/2 in.	4 1/2 in. Internal Flush
		5 in. Extra Hole NC 40
Numbered Connections (NC)	26	2 3/8 in. Internal Flush
		2 7/8 in. Slim Hole
	31	2 7/8 in. Internal Flush
		3 1/2 in. Slim Hole
	38	3 1/2 in. Internal Flush
		4 1/2 in. Slim Hole
	40	4 in. Full Hole
		4 1/2 in. Double Streamline
	46	4 in. Internal Flush
		4 1/2 in. Extra Hole
	50	4 1/2 in. Internal Flush
		5 in. Extra Hole
		5 1/2 in. Double Streamline
External Flush (EF)	4 1/2 in.	4 in. Slim Hole
		3 1/2 in. Extra hole

Casing Dimensions and Bit Clearance

(Dimensions in inches unless noted otherwise.)

OD	Wt -(lb/ft)	Wall	ID	OD	Drift	Bit Size	Bit Size	Clear-ance
4 1/2	9.5	0.205	4.090	5.000	3.965	3 7/8	3.875	0.090
	11.6	0.250	4.000	5.000	3.875	3 7/8	3.875	0.000
	13.5	0.290	3.920	5.000	3.795	3 3/4	3.750	0.045
	15.1	0.337	3.826	5.000	3.701	3 5/8	3.625	0.076
5	11.5	0.220	4.560	5.563	4.435	4 1/4	4.250	0.185
	13.0	0.253	4.494	5.563	4.369	4 1/4	4.250	0.119
	15.0	0.296	4.408	5.563	4.283	4 1/4	4.250	0.033
	18.0	0.362	4.276	5.563	4.151	4 1/8	4.125	0.026
5 1/2	13.0	0.228	5.044	6.050	4.919	4 3/4	4.750	0.169
	14.0	0.244	5.012	6.050	4.887	4 3/4	4.750	0.137
	15.5	0.275	4.950	6.050	4.825	4 3/4	4.750	0.075
	17.0	0.304	4.892	6.050	4.767	4 3/4	4.750	0.017
	20.0	0.361	4.778	6.050	4.653	4 5/8	4.625	0.028
	23.0	0.415	4.670	6.050	4.545	4 1/2	4.500	0.045
6	15.0	0.238	5.524	6.625	5.399	5 3/8	5.375	0.024
	18.0	0.288	5.425	6.625	5.299	5 1/8	5.125	0.174
	20.0	0.324	5.352	6.625	5.227	5 1/8	5.125	0.102
	23.0	0.380	5.240	6.625	5.115	4 7/8	4.875	0.240
	26.0	0.434	5.132	6.625	5.007	4 7/8	4.875	0.132
6 5/8	17.0	0.245	6.135	7390	6.010	6	6.000	0.010
	20.0	0.288	6.049	7.390	5.924	5 7/8	5.875	0.049
	24.0	0.352	5.921	7.390	5.796	5 3/4	5.750	0.046
	28.0	0.417	5.791	7.390	5.666	5 5/8	5.625	0.041
	32.0	0.475	5.675	7.390	5.550	5 3/8	5.375	0.175
7	17.0	0.231	6.538	7.656	6.431	6 3/8	6.375	0.038
	20.0	0.272	6.456	7.656	6.331	6 1/4	6.250	0.081
	23.0	0.317	6.366	7.656	6.241	6 1/8	6.125	0116
	26.0	0.362	6.276	7.656	6.151	6 1/8	6.125	0.026
	29.0	0.408	6.184	7.656	6.059	6	6.000	0.059
	32.0	0.453	6.094	7.656	5.969	5 7/8	5.875	0.094
	35.0	0.498	6.004	7.656	5.879	5 7/8	5.875	0.004
	38.0	0.540	5.920	7.656	5.795	5 3/4	5.750	0.045
7 5/8	20.0	0.250	7.125	8.500	7.000	6 3/4	6.750	0.250
	24.0	0.300	7.025	8.500	6.900	6 3/4	6.750	0.150
	26.4	0.328	6.969	8.500	6.844	6 3/4	6.750	0.094
	29.7	0.375	6.875	8.500	6.750	6 3/4	6.750	0.000
	33.7	0.430	6.765	8.500	6.640	6 5/8	6.625	0.015
	39.0	0.500	6.625	8.500	6.500	6 3/8	6.375	0.125

Casing Dimensions and Bit Clearance (cont.)

(Dimensions in inches unless noted otherwise.)

OD	Wt -(lb/ft)	Wall	ID	OD	Drift	Bit Size	Bit Size	Clear-ance
8 5/8	24.0	0.264	8.097	9.625	7.972	7 7/8	7.875	0.097
	28.0	0.304	8.017	9.625	7.892	7 7/8	7.875	0.017
	32.0	0.352	7.921	9.625	7.796	7 3/4	7.750	0.046
	36.0	0.400	7.825	9.625	7.700	7 5/8	7.625	0.075
	40.0	0.450	7.725	9.625	7.600	7 3/8	7.375	0.225
	44.0	0.500	7.625	9.625	7.500	7 3/8	7.375	0.125
	49.0	0.557	7.511	9.625	7.386	7 3/8	7.375	0.011
9 5/8	29.3	0.281	9.063	10.625	8.907	8 3/4	8.750	0.157
	32.3	0.312	9.001	10.625	8.845	8 3/4	8.750	0.095
	36.0	0.352	8.921	10.625	8.765	8 3/4	8.750	0.015
	40.0	0.395	8.835	10.625	8.697	8 5/8	8.625	0.072
	43.5	0.435	8.755	10.625	8.599	8 1/2	8.500	0.099
	47.0	0.472	8.681	10.625	8.525	8 1/2	8.500	0.025
	53.5	0.545	8.535	10.625	8.379	8 3/8	8.375	0.004
10 3/4	32.75	0.279	10.192	11.750	10.038	9 7/8	9.875	0.161
	40.50	0.350	10.050	11.750	9.894	9 7/8	9.875	0.019
	45.50	0.400	9.950	11.750	9.794	9 3/4	9.750	0.044
	51.00	0.450	9.850	11.750	9.694	9 5/8	9.625	0.069
	55.50	0.495	9.760	11.750	9.604	9	9.000	0.604
	60.70	0.545	9.660	11.750	95.04	9	9.000	0.504
	65.70	0.595	9.560	11.750	9.404	9	9.000	0.404
11 3/4	38.00	0.300	11.150	12.750	10.994	10 5/8	10.625	0.369
	42.00	0.333	11.084	12.750	10.928	10 5/8	10.625	0.303
	47.00	0.375	11.000	12.750	10.844	10 5/8	10.625	0.219
	54.00	0.435	10.880	12.750	10.724	10 5/8	10.625	0.099
	60.00	0.489	10.772	12.750	10.616	9 7/8	9.875	0.741
13 3/8	48.00	0.330	12.715	14.375	12.559	12 1/4	12.250	0.309
	54.50	0.380	12.615	14.375	12.459	12 1/4	12.250	0209
	61.00	0.430	12.515	14.375	12.359	12 1/4	12.250	0.109
	68.00	0.480	12.415	14.375	12.259	12 1/4	12.250	0.009
	72.00	0.514	12.374	14.375	12.191	10	10.000	2.191
16	55.00	0.312	15.375	17.000	15.188	15	15.000	0.188
	65.00	0.375	15.250	17.000	15.062	15	15.000	0.062
	75.00	0.438	15.125	17.000	14.938	14 3/4	14.750	0.188
	84.00	0.495	15.010	17.000	14.823	14 3/4	14.750	0.073
20	94.00	0.438	19.124	21.000	18.936	17 1/2	17.500	1.436

Collar Weights in Pounds Per Foot

OD of Drill Collar in	Bore of Drill Collar in												
	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 13/16	3	3 1/4	3 1/2	3 3/4	4
2 7/8	19	18	16										
3	21	20	18										
3 1/8	22	22	20										
3 1/4	26	24	22										
3 1/2	30	29	27										
3 3/4	35	33	32										
4	40	39	37	35	32	29							
4 1/8	43	41	39	37	35	32							
4 1/4	46	44	42	40	38	35							
4 1/2	51	50	48	46	43	41							
4 3/4			54	52	50	47	44						
5			61	59	56	53	50						
5 1/4			68	65	63	60	57						
5 1/2			75	73	70	67	64	60					
5 3/4			82	80	78	75	72	67	64	60			
6			90	88	85	83	79	75	72	68			
6 1/4			98	96	94	91	88	83	80	76	72		
6 1/2			107	105	102	99	96	91	89	85	80		
6 3/4			116	114	111	108	105	100	98	93	89		
7			125	123	120	117	114	110	107	103	98	93	84
7 1/4			134	132	130	127	124	119	116	112	108	103	93
7 1/2			144	142	139	137	133	129	126	122	117	113	102
7 3/4			154	152	150	147	144	139	136	132	128	123	112
8			165	163	160	157	154	150	147	143	138	133	122
8 1/4			176	174	171	168	165	160	158	154	149	144	133
8 1/2			187	185	182	179	176	172	169	165	160	155	150
9			210	208	206	203	200	195	192	188	184	179	174
9 1/2			234	232	230	227	224	220	216	212	209	206	198
9 3/4			248	245	243	240	237	232	229	225	221	216	211
10			261	259	257	254	251	246	243	239	235	230	225
11			317	315	313	310	307	302	299	295	291	286	281
12			379	377	374	371	368	364	361	357	352	347	342

Rock Bits Recommended Make-Up Torque

Bit Size (in.)	Bit Size (mm)	API Pin Size (in.)	API Pin Size (mm)	Recommended Torque (ft-lbs)	Recommended Torque (N-m)
3 1/2-4 1/2	89-114	2 3/8 Reg	60	3,000-3500	4000-4800
4 5/8-5	118-127	2 7/8 Reg	73	6,000-7,000	8000-9500
5 1/8-7 3/8	137-187	3 1/2 Reg	89	7,000-9,000	9500-12,000
7 1/2-9	194-229	4 1/2 Reg	114	12,000-16,000	16,000-22,000
9 1/2-28*	241-711*	6 5/8 Reg	168	28,000-32,000	38,000-43,000
14 3/4-28*	375-711*	6 5/8 Reg or 7 5/8 Reg	168 or 194	34,000-40,000	46,000-54,000
18 1/2-28*	470-711*	7 5/8 Reg or 8 5/8 Reg	194 or 219	40,000-60,000	54,000-81,000

*Makeup torque to correspond to API pin connection for each size.

PDC Bits Recommended Make-Up Torque

API Connection Size	Bit Sub OD	Recommended Torque	
		Minimum	Maximum
(inch)	(inches) *(mm)*	Ft-lbs *(N-m)*	Ft-lbs *(N-m)*
2 3/8 Reg	3	1,970	2,450
	76	*2,670*	*3,320*
	3 1/8	2,660	3,300
	79	*3,610*	*4,470*
	3 1/4	3,400	4,200
	83	*4,610*	*5,690*
2 7/8 Reg	3 1/2	3,380	4,200
	89	*4,580*	*5,690*
	3 3/4 & over	5,080	6,300
	95 & over	*6,890*	*8,540*
3 1/2 Reg	4 1/8	5,700	7,000
	105	*7,730*	*9,490*
	4 1/4	6,940	8,550
	108	*9,410*	*11,590*
	4 1/2 & over	8,400	10,500
	114 & over	*11,390*	*14,240*
4 1/2 Reg	5 1/2	13,700	17,000
	140	*18,570*	*23,050*
	5 3/4	18,100	22,400
	146	*24,540*	*30,370*
	6 & over	18,550	22,900
	152 & over	*25,150*	*31,050*
6 5/8 Reg	7 1/2	40,670	50,200
	191	*55,140*	*68,060*
	7 3/4 & over	41,050	50,750
	197	*55,660*	*68,810*
7 5/8 Reg	8 1/2	53,100	65,670
	216	*71,990*	*89,040*
	8 3/4	63,500	78,300
	222	*86,090*	*106,160*
	9 & over	68,600	84,750
	229	*93,010*	*114,900*
8 5/8 Reg	10	96,170	108,950
	254	*130,390*	*147,710*
	10 1/4 & over	96,170	108,950
	260 & over	*130,390*	*147,710*

Millimeter Equivalents of Common Inch Measurements

in	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16
0	0	1.6	3.2	4.8	6.3	7.9	9.5	11.1
1	25.4	27.0	28.6	30.2	31.7	33.3	34.9	36.5
2	50.8	52.4	54.0	55.6	57.1	58.7	60.3	61.9
3	76.2	77.8	79.4	81.0	82.5	84.1	85.7	87.3
4	101.6	103.2	104.8	106.4	107.9	109.5	111.1	112.7
5	127.0	128.6	130.2	131.8	133.3	134.9	136.5	138.1
6	152.4	154.0	155.6	157.2	158.7	160.3	161.9	163.5
7	177.8	179.4	181.0	182.6	184.1	185.7	187.3	188.9
8	203.2	204.8	206.4	208.0	209.5	211.1	212.7	214.3
9	228.6	230.2	231.8	233.4	234.9	236.5	238.1	239.7
10	254.0	255.6	257.2	258.8	260.3	261.9	263.5	265.1
11	279.4	281.0	282.6	284.2	285.7	287.3	288.9	290.5
12	304.8	306.4	308.0	309.6	311.1	312.7	314.3	315.9
13	330.2	331.8	333.4	335.0	336.5	338.1	339.7	341.3
14	355.6	357.2	358.8	360.4	361.9	363.5	365.1	366.7
15	381.0	382.6	384.2	385.8	387.3	388.9	390.5	392.1
16	406.4	408.0	409.6	411.2	412.7	414.3	415.9	417.5
17	431.8	433.4	435.0	436.6	438.1	439.7	441.3	442.9
18	457.2	458.8	460.4	462.0	463.5	465.1	466.7	468.3
19	482.6	484.2	485.8	487.4	488.9	490.5	492.1	493.7
20	508.0	509.6	511.2	512.8	514.3	515.9	517.5	519.1
21	533.4	535.0	536.6	538.2	539.7	541.3	542.9	544.5
22	558.8	560.4	562.0	563.6	565.1	566.7	568.3	569.9
23	584.2	585.8	587.4	589.0	590.5	592.1	593.7	595.3
24	609.6	611.2	612.8	614.4	615.9	617.5	619.1	620.7

Millimeter Equivalents of Common Inch Measurements

in	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
0	12.7	14.3	15.9	17.5	19.0	20.6	22.2	23.8
1	38.1	39.7	41.3	42.9	44.4	46.0	47.6	49.2
2	63.5	65.1	66.7	68.3	69.8	71.4	73.0	74.6
3	88.9	90.5	92.1	93.7	95.2	96.8	98.4	100.0
4	114.3	115.9	117.5	119.1	120.6	122.2	123.8	125.4
5	139.7	141.3	142.9	144.5	146.0	147.6	149.2	150.8
6	165.1	166.7	168.3	169.9	171.4	173.0	174.6	176.2
7	190.5	192.1	193.7	195.3	196.8	198.4	200.0	201.6
8	215.9	217.5	219.1	220.7	222.2	223.8	225.4	227.0
9	241.3	242.9	244.5	246.1	247.6	249.2	250.8	252.4
10	266.7	268.3	269.9	271.5	273.0	274.6	276.2	277.8
11	292.1	293.7	295.3	296.9	298.4	300.0	301.6	303.2
12	317.5	319.1	320.7	322.3	323.8	325.4	327.0	328.6
13	342.9	344.5	346.1	347.7	349.2	350.8	352.4	354.0
14	368.3	369.9	371.5	373.1	374.6	376.2	377.8	379.4
15	393.7	395.3	396.9	398.5	400.0	401.6	403.2	404.8
16	419.1	420.7	422.3	423.9	425.4	427.0	428.6	430.2
17	444.5	446.1	447.7	449.3	450.8	452.4	454.0	455.6
18	469.9	471.5	473.1	474.7	476.2	477.8	479.4	481.0
19	495.3	496.9	498.5	500.1	501.6	503.2	504.8	506.4
20	520.7	522.3	523.9	525.5	527.0	528.6	530.2	531.8
21	546.1	547.7	549.3	550.9	552.4	554.0	555.6	557.2
22	571.5	573.1	574.7	576.3	577.8	579.4	581.0	582.6
23	596.9	598.5	600.1	601.7	603.2	604.8	606.4	608.0
24	622.3	623.9	625.5	627.1	628.6	630.2	631.8	633.4

Notes

Notes

Notes

CORPORATE OFFICE / CALGARY SALES
1000 Elveden House
717 - 7 Avenue SW
Calgary, Alberta
Canada T2P 0Z3
Phone: (403) 262-3050
Fax: (403) 265-8154
info@wenzel-downhole.com

MANUFACTURING / SALES FACILITIES
3115 - 93 Street N.W.
Edmonton, Alberta
Canada T6N 1L7
Phone: (780) 440-4220
Fax: (780) 469-8054
Toll Free: 1-800-306-4046
info@wenzel-downhole.com

WYOMING
5081 Yellowstone Hwy.
Casper, Wyoming
U.S.A. 82604
Phone: (307) 266-1580
Fax: (307) 266-1656
Toll Free: 1-866-522-1144
caspersales@wenzel-downhole.com

OKLAHOMA
100 South Cooley Drive
Oklahoma City, Oklahoma
U.S.A. 73127
Phone: (405) 787-4145
Fax: (405) 470-1968

WEST VIRGINIA
400 Caterpillar Road
Morgantown, West Virginia
U.S.A. 26508
Phone: (304) 777-2534
Fax: (304) 777-2539

COLOMBIA
Celta Trade Park,
Bodega # 47, Km 7 Autopista Medellin
Colombia
ventas.colombia@basinsupply.com

US HEADQUARTERS
4205 FM 1485
Conroe, Texas
U.S.A. 77306
Phone: (936) 441-1480
Fax: (936) 756-5335
conroesales@wenzel-downhole.com

WEST TEXAS
1506 South Country Road 1309
Midland, Texas
U.S.A. 79707
Phone: (432) 848-3977

EUROPE
Grafftring 5
29227 Celle
Germany
Phone: 49 (0) 5141 977 65 0
Fax: 49 (0) 5141 977 65 29

INTERNATIONAL
39 Queens Gate Gardens
Flat 5
London SW7 5RR
United Kingdom
Phone: 44 20758 97085

www.downhole.com

Wenzel Downhole Tools