

Drilformance

R-SPEC™

DRILLING MOTORS

SUPERIOR MOTOR TECHNOLOGY



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Please note the interpretation and utilization of the information contained herein is the responsibility of the user. Drilformance is not in any way responsible as to the result of work done based on information obtained from this book.

Drilformance

80

YEARS

OF

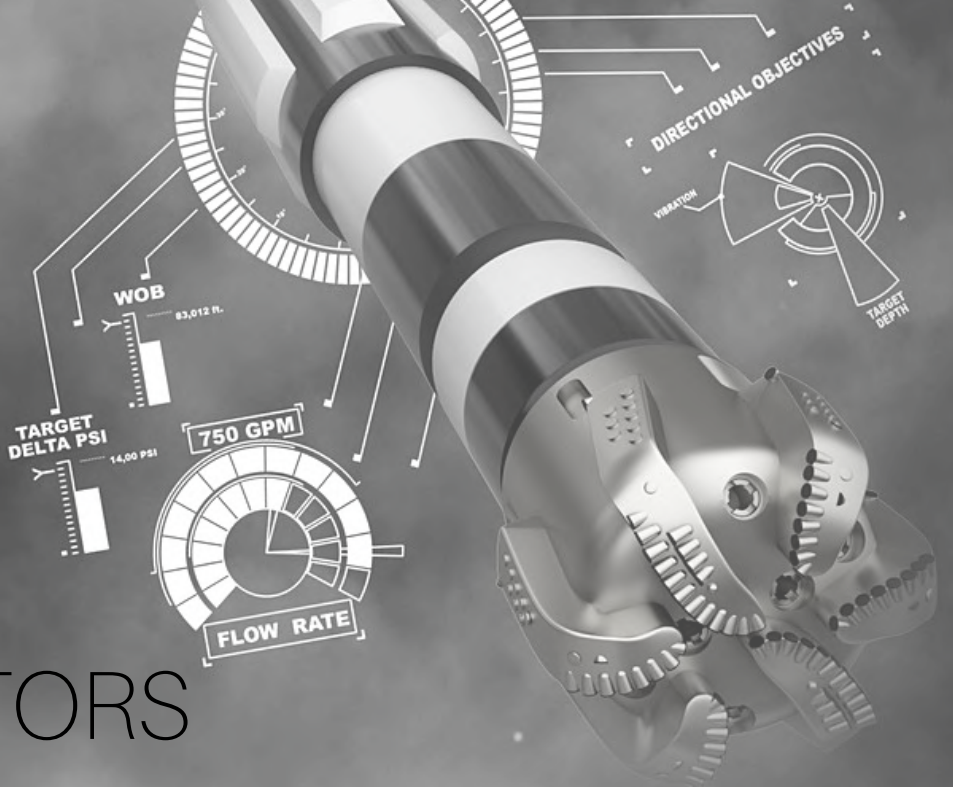
Our motor technology engineers, technicians and machinist have been producing high quality motor design and performance parts for a combined eight decades.

PRECISION

Drilformance

R-SPEC™

DRILLING MOTORS



PERFORMANCE AND RELIABILITY

The Drilformance R-Spec Mud Lube Bearing Motor features the strongest driveline on the market today, allowing the choice of any power section required to meet the drilling requirements.

FEATURES

- Mandrel Catch System allows for increased protection
- Design ensures maximum horsepower with increased bit life and penetration rates
- Minimum pressure drop ensuring maximum hydraulic power
- Proprietary Transmission Backup Catch System
- Threaded protector or a threaded on stabilizer according to drilling situations and hole size requirements
- Entire fixed bend housing fleet ensures increased reliability
- Unique tapered mandrel pin thread design distributes stress evenly across connections, reducing cracking
- Choice of 1.50, 1.75, 1.83, 2.00, 2.25 and 2.50 degree fixed housings
- Ball Bearings generate less friction than carbide/diamond button bearings



DRILLING MOTORS

PERFORMANCE AND RELIABILITY

Drilformance provides clients with the very latest high performance power sections and mud-lube bearing technology. Extensive options available for varying bit speeds and with state of the art serialized part tracking inventory systems to ensure complete, accurate and immediate asset management.

BENEFITS

- Higher operating temperatures
- Higher radial load capacity
- Easy to service; Beneficial in remote locations
- No chain reaction failures
- Versatile; Operates in a wide variety of drilling fluids
- Higher dynamic weight-on-bit capacity
- No oil lube seals that high downhole pressures and temperature affect
- All parts made and machined in-house with high strength steel alloys
- Entire fleet fitted with Hard Rubber elastomers for withstanding the harshest drilling conditions

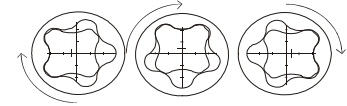


DRILLING MOTORS

PERFORMANCE AND RELIABILITY

800 Series





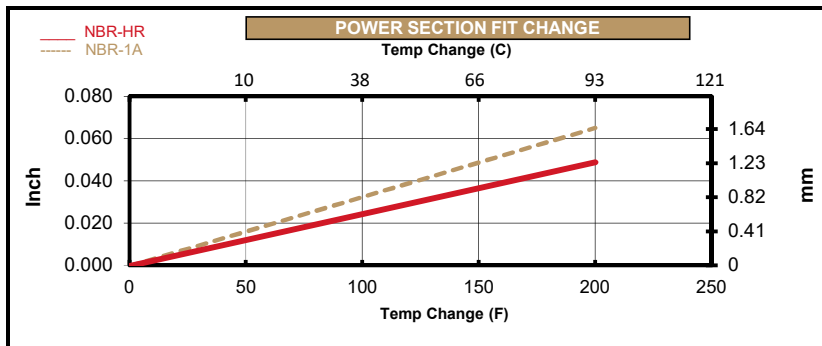
POWER SECTION

ROTOR SPECIFICATIONS		
	Inch	mm
Overall Length	293.0	7442
Contour Length	285.0	7239
Eccentricity	0.291	7.38
Major Diameter	5.307	134.80
Head Diameter	4.750	120.70
Weight	1331 (lbs)	603.7 (kg)
Material	17-4SS	
Thread Form*	3 1/2 API IF	

STATOR SPECIFICATIONS		
	Inch	mm
Overall Length	300.0	7620
Rubber Cut Back	8.0	203
Tube O.D.	8.00	203.2
Tube I.D.	6.50	165.1
Weight	1601 (lbs)	726 (kg)
Number of Stages	3.4	
Rubber Type	NBR-1A, NBR-HR	
Tube Material	4142 Seamless Tubing	

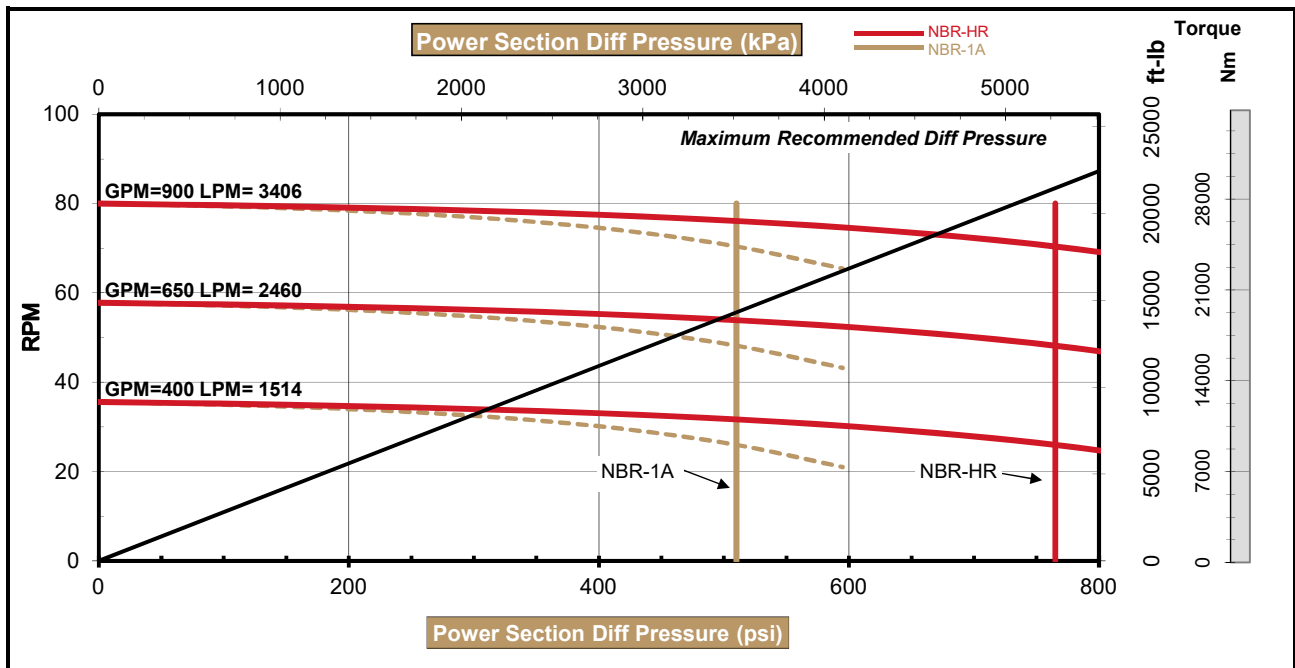
FIT INFORMATION		
NBR-1A	Minor Diameter	
Stator Size	Inch	mm
Standard	4.727	120.07
Override		
Double Override		
Nominal Fit at 75 F (25 C)		
Standard	-0.001	-0.03
Override		
Double Override		

* Alternate or custom thread forms are available

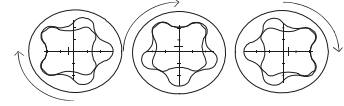


FIT INFORMATION		
NBR-HR	Minor Diameter	
Stator Size	Inch	mm
Undersize		
Standard	4.731	120.17
Override		
Double Override		
Nominal Fit at 75 F (25 C)		
Undersize		
Standard	-0.005	-0.13
Override		
Double Override		

PERFORMANCE SPECIFICATIONS			PERFORMANCE DETAILS		
Torque Slope	28.040 ft-lb/psi	5.514 Nm/kPa	Max Diff Press psi (kPa)	NBR-1A 510 (3520)	NBR-HR 770 (5270)
Flow Range	400 to 900 GPM	1510 to 3410 Litre/min	Max Torque ft-lb (Nm)	14300 (19390)	21450 (29080)
Rotation	0.089 Rev/Gal	0.024 Rev/Litre	Stall Diff Press psi (kPa)	770 (5270)	1150 (7910)
Speed Range	35 to 81 RPM		Stall Torque ft-lb (Nm)	21450 (29080)	32180 (43630)
Off Bottom Press	150 psi	1030 kPa	Max Recommended HP(kW)	218 (163)	311 (232)



Stator life may be reduced if a power section is operated above the maximum recommended differential pressure. Performance information is only for reference and is subject to change without notice. Down hole temperature and rotor/stator fit may vary and affect actual power section performance. Maximum RPM and full torque are the basis for power calculation. Stator sizes subject to change without notice.



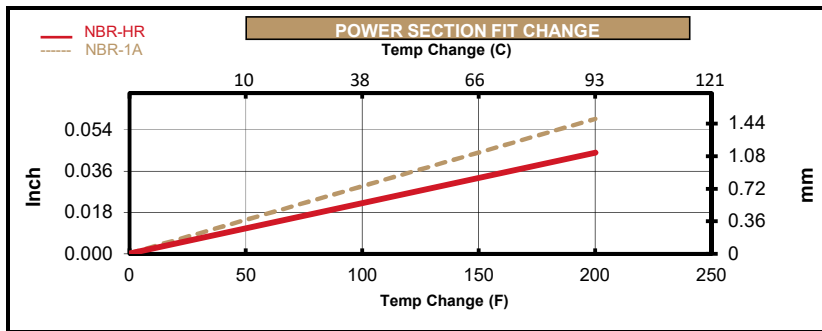
POWER SECTION

ROTOR SPECIFICATIONS		
	Inch	mm
Overall Length	196.3	4985
Contour Length	188.3	4782
Eccentricity	0.293	7.44
Major Diameter	5.186	131.72
Head Diameter	4.750	120.70
Weight	883 (lbs)	400.5 (kg)
Material	17-4SS	
Thread Form*	3 1/2 API IF	

STATOR SPECIFICATIONS		
	Inch	mm
Overall Length	203.2	5161
Rubber Cut Back	8.0	203
Tube O.D.	8.00	203.2
Tube I.D.	6.25	158.8
Weight	1253 (lbs)	568 (kg)
Number of Stages	4.0	
Rubber Type	NBR-1A, NBR-HR	
Tube Material	4142 Seamless Tubing	

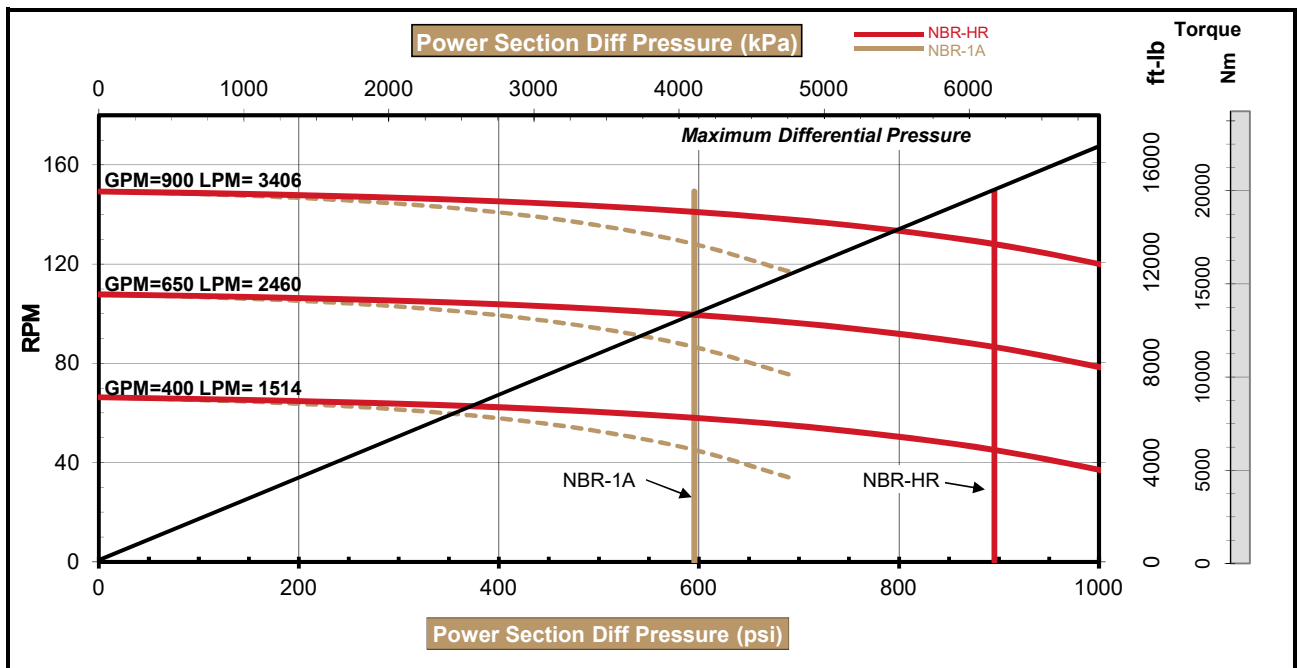
FIT INFORMATION		
NBR-1A	Minor Diameter	
Stator Size	Inch	mm
Standard	4.581	116.36
Oversize	4.606	116.99
Double Oversize		
Third Oversize		
Nominal Fit at 75 F (25 C)		
Standard	0.019	0.48
Oversize	-0.006	-0.15
Double Oversize		
Third Oversize		

* Alternate or custom thread forms are available

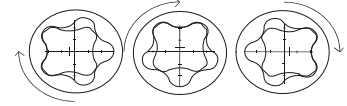


FIT INFORMATION		
NBR-HR	Minor Diameter	
Stator Size	Inch	mm
Undersize	4.574	116.18
Standard	4.596	116.74
Oversize	4.613	117.17
Double Oversize	4.623	117.42
Nominal Fit at 75 F (25 C)		
Undersize	0.026	0.66
Standard	0.004	0.10
Oversize	-0.013	-0.33
Double Oversize	-0.023	-0.58

PERFORMANCE SPECIFICATIONS			PERFORMANCE DETAILS		
			NBR-1A	NBR-HR	
Torque Slope	16.589 ft-lb/psi	3.262 Nm/kPa	Max Diff Press psi (kPa)	600 (4140)	900 (6210)
Flow Range	400 to 900 GPM	1510 to 3410 Litre/min	Max Torque ft-lb (Nm)	9950 (13490)	14930 (20240)
Rotation	0.166 Rev/Gal	0.044 Rev/Litre	Stall Diff Press psi (kPa)	900 (6210)	1350 (9310)
Speed Range	66 to 150 RPM		Stall Torque ft-lb (Nm)	14930 (20240)	22400 (30360)
Off Bottom Press	126 psi	870 kPa	Max Recommended HP(kW)	283 (211)	401 (299)



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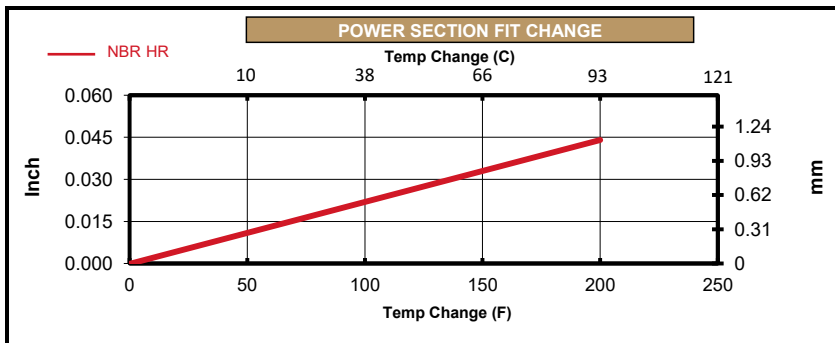


POWER SECTION

ROTOR SPECIFICATIONS		
	Inch	mm
Overall Length	284.5	7226
Contour Length	278.8	7080
Eccentricity	0.293	7.44
Major Diameter	5.186	131.72
Head Diameter	5.500	139.70
Weight	1287.43 (lbs)	584 (kg)
Material	145 KSI 17-4SS	
Thread Form*	N/A	

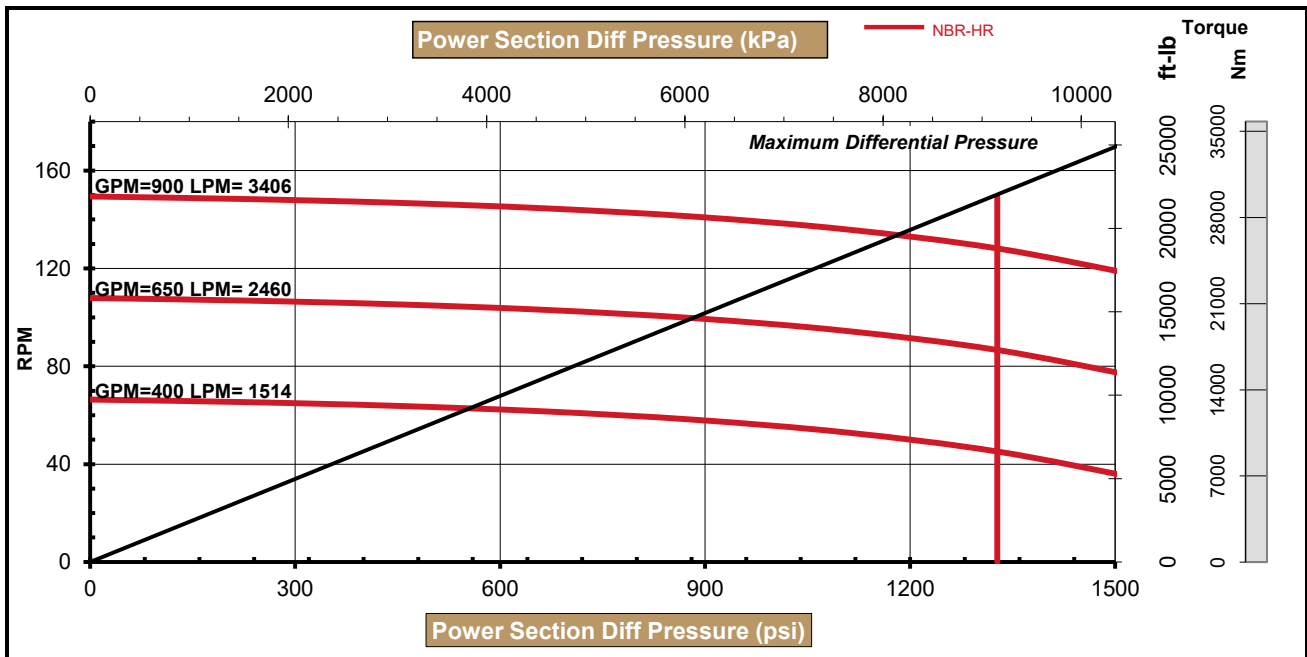
STATOR SPECIFICATIONS		
	Inch	mm
Overall Length	300.0	7620
Rubber Cut Back	15.5 & 8	394 & 203
Tube O.D.	8.00	203.2
Tube I.D.	6.25	158.8
Weight	1825 (lbs)	828 (kg)
Number of Stages	5.9	
Rubber Type	NBR-HR	
Tube Material	4142 Seamless Tubing	

* Alternate or custom thread forms are available



FIT INFORMATION		
NBR-HR	Minor Diameter	
Stator Size	Inch	mm
Undersize		
Standard	4.588	116.54
Oversize		
Double Oversize		
Nominal Fit at 75 F (25 C)		
Undersize		
Standard	0.012	0.30
Oversize		
Double Oversize		

PERFORMANCE SPECIFICATIONS			PERFORMANCE DETAILS		
Torque Slope	16.589 ft-lb/psi	3.262 Nm/kPa	Max Diff Press psi (kPa)		NBR-HR 1330 (9150)
Flow Range	400 to 900 GPM	1510 to 3410 Litre/min	Max Torque ft-lb (Nm)		22020 (29860)
Rotation	0.166 Rev/Gal	0.044 Rev/Litre	Stall Diff Press psi (kPa)		1990 (13730)
Speed Range	66 to 150 RPM		Stall Torque ft-lb (Nm)		33030 (44780)
Off Bottom Press	134 psi	920 kPa	Max Recommended HP(kW)		592 (442)



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DRILLING MOTORS

PERFORMANCE AND RELIABILITY

700 Series



Rotor Specification		
Overall Length		202.50 in.
Contour Length		195.50 in.
Major Diameter		4.220 in.
Eccentricity		0.355 in.
Head Diameter		4.000 in.
Thread Form		2.875 API REG
Weight		576 lbs.
Material		17-4 PH ¹

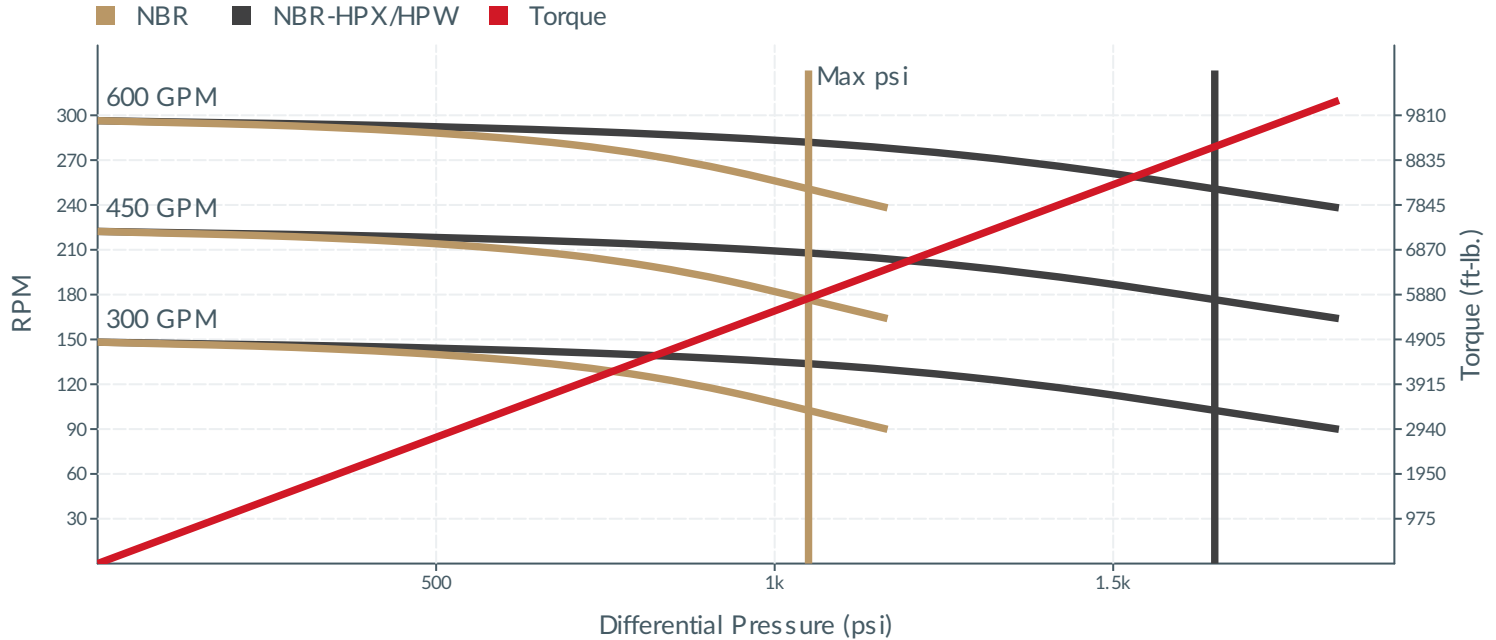
Stator Specification		
Overall Length		210.00 in.
Tube OD		6.75 in.
Tube ID		5.50 in.
Rubber Cutback Top/End		7.5/7.5 in.
Weight		826 lbs.
Number of Stages		7.0 in.
Tube Material		4140/4142 Alloy Steel
Rubber Options		NBR, NBR-HPX/HPW

NBR (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	--	--	--	--	--	--
STD	3.503	0.007	0.025	0.043	0.070	0.088
0.5 OS	3.513	-0.003	0.015	0.033	0.060	0.077
1 OS	3.529	-0.019	-0.001	0.016	0.043	0.061
1.5 OS	3.544	-0.034	-0.016	0.001	0.028	0.045
2 OS	3.559	-0.049	-0.032	-0.014	0.012	0.030
2.5 OS	3.587	-0.077	-0.060	-0.043	-0.017	0.000

NBR-HPX/HPW (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	--	--	--	--	--	--
STD	3.499	0.011	0.029	0.047	0.074	0.092
0.5 OS	3.509	0.001	0.019	0.037	0.064	0.082
1 OS	3.525	-0.015	0.003	0.021	0.047	0.065
1.5 OS	3.540	-0.030	-0.012	0.005	0.032	0.049
2 OS	3.555	-0.045	-0.027	-0.010	0.016	0.034
2.5 OS	3.583	-0.073	-0.056	-0.038	-0.013	0.005

Performance Specifications	
Flow Range	300 - 600 GPM
Speed Range	150 - 300 RPM
Torque Slope	5.36 ft-lb./psi
Rotation	0.494 rev/gal
Off Bottom Pressure	150 psi

Performance Details		
	NBR	NBR-HPX/HPW
Max Diff. Press.	1050 psi	1650 psi
Stall Diff. Press.	1580 psi	2600 psi
Max Torque	5630 ft-lb.	8820 ft-lb.
Stall Torque	8450 ft-lb.	13890 ft-lb.



¹ Coating options of chrome or tungsten carbide are available ² Vector Gauge Readings at Room Temp 75°F ³ BHCT Exceeding 275°F will void warranty for NBR (320°F for HPW/HPX)

Performance curves are based on new rotor and stator dimensions and for reference only. Actual performance may vary depending on fit and drilling conditions. The stall torque may exceed that specified for the connected components. Operating over the recommended limits may result in damage to the power section and connected components. Please visit drilformance.com for the latest specification revisions.

LOCATIONS

US Houston 15815 Waverly Dr. Houston, TX 77032 (832) 772-7808
 US West Texas 5400 N. Big Spring St Bldg E, Midland, TX 79705 1 (877) PDC DRIL
 US East Texas (AK/LA/TX) 2209 E. Loop 281 Longview, TX 75605 (903) 757-6300

Model No: 700568.3

Rotor Specifications	
	Inches
Overall Length	252.00
Contour Length	244.00
Major Diameter	4.663
Eccentricity	0.294
Head diameter	4.700
Thread Form	1.375-6 SA
Weight	833 lbs
Material	17-4 PH ¹

Stator Specifications	
	Inches
Overall Length	260.00
Tube OD	7.00
Tube ID	5.75
Rubber Cutback Top/End	10.00 / 10.00
Weight	885 lbs
Number of Stages	8.3
Tube Material	4140/4142 Alloy Steel
Rubber Options	NBR, NBR-HPW & NBR-HPX

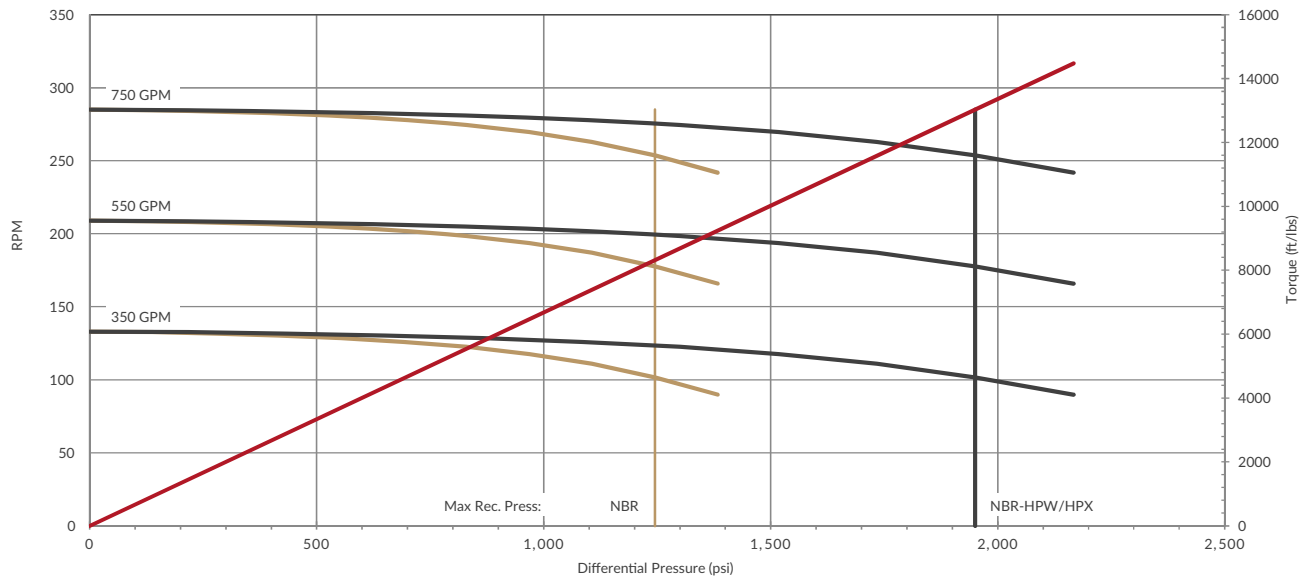
Size	Fits (+ Compression / - Loose)					
	Minor ²	75 °F	125 °F	175 °F	250 °F	300 °F ³
.5 US						
STD	4.071	0.005	0.025	0.044	0.074	0.094
.5 OS	4.086	-0.010	0.010	0.029	0.059	0.078
1.0 OS	4.101	-0.025	-0.006	0.014	0.043	0.062
1.5 OS						
2.0 OS						
2.5 OS						

Size	Fits (+ Compression / - Loose)					
	Minor ²	75 °F	125 °F	175 °F	250 °F	300 °F ³
.5 US						
STD	4.067	0.009	0.026	0.043	0.068	0.085
.5 OS	4.082	-0.006	0.011	0.028	0.053	0.070
1.0 OS	4.097	-0.021	-0.004	0.012	0.037	0.054
1.5 OS						
2.0 OS						
2.5 OS						

Performance Specifications	
Flow Range (gpm)	350 - 750
Speed Range (rpm)	130 - 290
Torque Slope (ft-lb/psi)	6.68
Rotation (rev/gal)	0.380
Off Bottom Pressure (psi)	180

	Performance Details	
	NBR	NBR-HPW/HPX
Max Diff Press (psi)	1250	1960
Stall Diff Press (psi)	1870	3080
Max Torque (ft-lb)	8320	13030
Stall Torque (ft-lb)	12480	20530

■ (NBR) ■ (NBR-HPW/HPX) ■ Torque

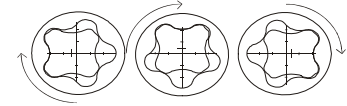


¹ Coating options of chrome or tungsten carbide are available. ² Vector Gauge Readings at Room Temp 75° F. ³ BHCT exceeding 275°F will void warranty for NBR (320°F for HPW /HPX).

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LOCATIONS

- US Houston 15815 Waverly Dr. Houston, TX 77032 (832) 772-7808
- US West Texas 5400 N. Big Spring St Bldg E, Midland, TX 79705 (903) 363-8030
- US East Texas (AK/LA/TX) 2209 E. Loop 281 Longview, TX 75605 1 (877) PDC DRIL



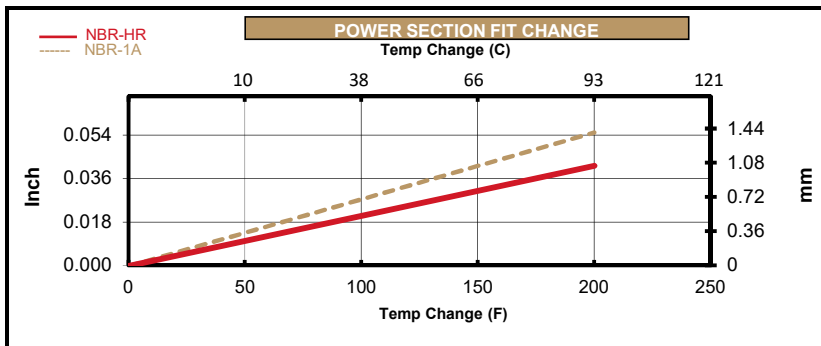
POWER SECTION

ROTOR SPECIFICATIONS		
	Inch	mm
Overall Length	188.0	4775
Contour Length	181.0	4597
Eccentricity	0.256	6.5
Major Diameter	4.520	114.81
Head Diameter	4.000	101.60
Weight	620 (lbs)	281.2 (kg)
Material	17-4SS	
Thread Form*	2 7/8 API REG	

STATOR SPECIFICATIONS		
	Inch	mm
Overall Length	194.5	4940
Rubber Cut Back	7.3	184
Tube O.D.	7.00	177.8
Tube I.D.	5.50	139.7
Weight	811 (lbs)	368 (kg)
Number of Stages	5.0	
Rubber Type	NBR-1A, NBR-HR	
Tube Material	4142 Seamless Tubing	

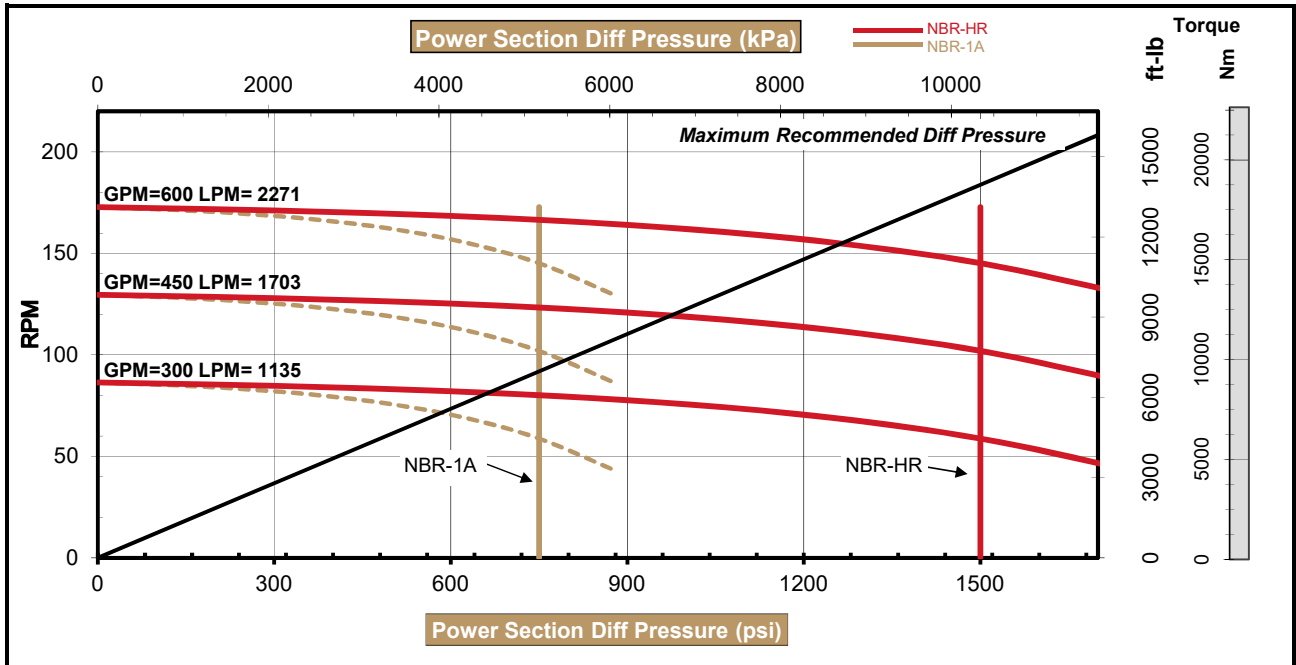
FIT INFORMATION		
NBR-1A	Minor Diameter	
Stator Size	Inch	mm
Standard	3.981	101.12
Oversize	4.010	101.85
Double Oversize	4.037	102.54
Nominal Fit at 75 F (25 C)		
Standard	0.027	0.69
Oversize	-0.002	-0.05
Double Oversize	-0.029	-0.74

* Alternate or custom thread forms are available



FIT INFORMATION		
NBR-HR	Minor Diameter	
Stator Size	Inch	mm
Undersize		
Standard	3.987	101.27
Oversize	4.012	101.90
Double Oversize	4.028	102.31
Nominal Fit at 75 F (25 C)		
Undersize		
Standard	0.021	0.53
Oversize	-0.004	-0.10
Double Oversize	-0.020	-0.51

PERFORMANCE SPECIFICATIONS			PERFORMANCE DETAILS		
			NBR-1A	NBR-HR	
Torque Slope	9.300 ft-lb/psi	1.829 Nm/kPa	750 (5170)	1500 (10340)	
Flow Range	300 to 600 GPM	1140 to 2270 Litre/min	6980 (9460)	13950 (18920)	
Rotation	0.288 Rev/Gal	0.076 Rev/Litre	1130 (7760)	2250 (15510)	
Speed Range	86 to 180 RPM		10460 (14190)	20930 (28370)	
Off Bottom Press	137 psi	940 kPa	Max Recommended HP(kW)	229 (171)	430 (321)



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Rotor Specification		
Overall Length		252.00 in.
Contour Length		245.00 in.
Major Diameter		4.644 in.
Eccentricity		0.246 in.
Head Diameter		4.500 in.
Thread Form		2.875 API REG
Weight		1002 lbs.
Material		17-4 PH ¹

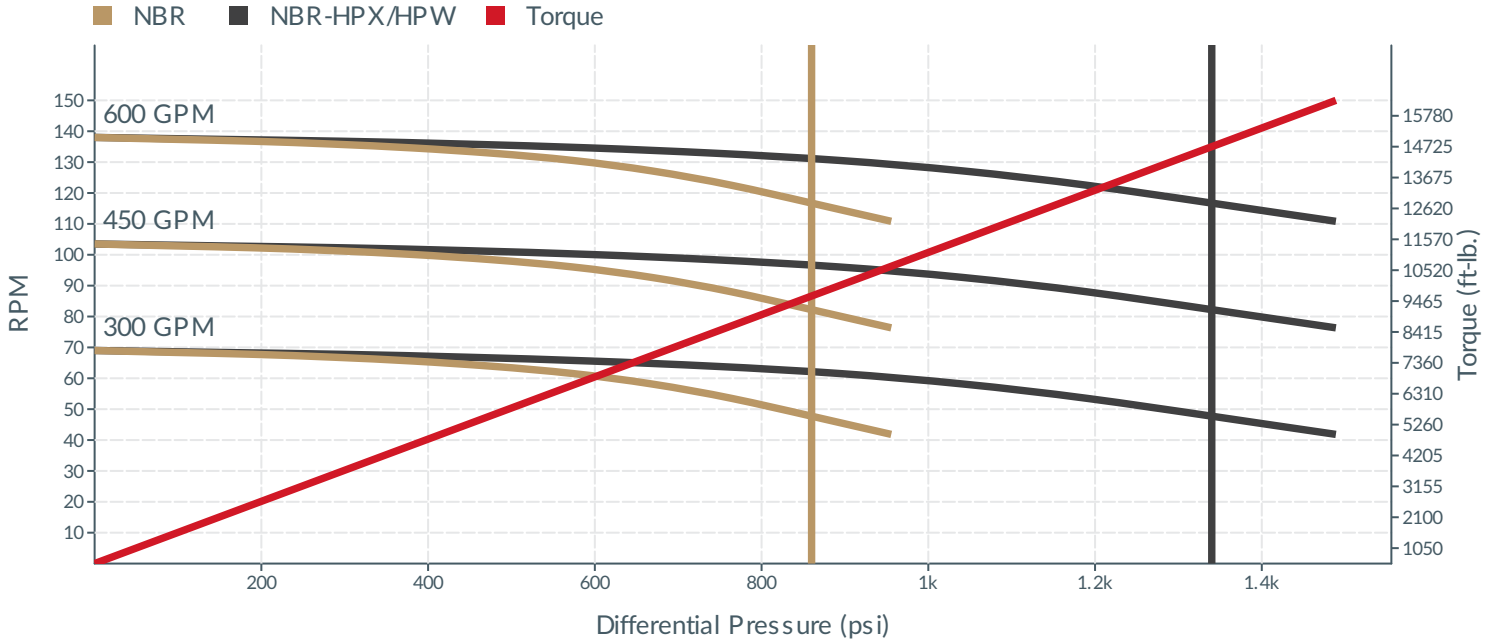
Stator Specification		
Overall Length		260.00 in.
Tube OD		6.75 in.
Tube ID		5.50 in.
Rubber Cutback Top/End		8/8 in.
Weight		856 lbs.
Number of Stages		5.7 in.
Tube Material		4140/4142 Alloy Steel
Rubber Options		NBR, NBR-HPX/HPW

NBR (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	4.139	0.013	0.029	0.045	0.069	0.085
STD	4.149	0.003	0.019	0.035	0.059	0.075
0.5 OS	4.159	-0.007	0.008	0.024	0.048	0.064
1 OS	4.176	-0.024	-0.009	0.007	0.031	0.046
1.5 OS	4.189	-0.037	-0.022	-0.006	0.017	0.033
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

NBR-HPX/HPW (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	4.137	0.015	0.031	0.047	0.071	0.087
STD	4.147	0.005	0.021	0.037	0.061	0.077
0.5 OS	4.157	-0.005	0.010	0.026	0.050	0.066
1 OS	4.174	-0.023	-0.007	0.009	0.033	0.048
1.5 OS	4.187	-0.035	-0.020	-0.004	0.019	0.035
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

Performance Specifications	
Flow Range	300 - 600 GPM
Speed Range	70 - 140 RPM
Torque Slope	10.60 ft-lb./psi
Rotation	0.230 rev/gal
Off Bottom Pressure	100 psi

Performance Details		
	NBR	NBR-HPX/HPW
Max Diff. Press.	860 psi	1340 psi
Stall Diff. Press.	1290 psi	2110 psi
Max Torque	9070 ft-lb.	14200 ft-lb.
Stall Torque	13600 ft-lb.	22370 ft-lb.



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 US East Texas (AK/LA/TX) 2209 E. Loop 281 Longview, TX 75605 (903) 757-6300

Rotor Specification		
Overall Length		267.00 in.
Contour Length		259.00 in.
Major Diameter		4.747 in.
Eccentricity		0.302 in.
Head Diameter		4.750 in.
Thread Form		2.875 SLIMLINE H-90
Weight		932 lbs.
Material		17-4 PH ¹

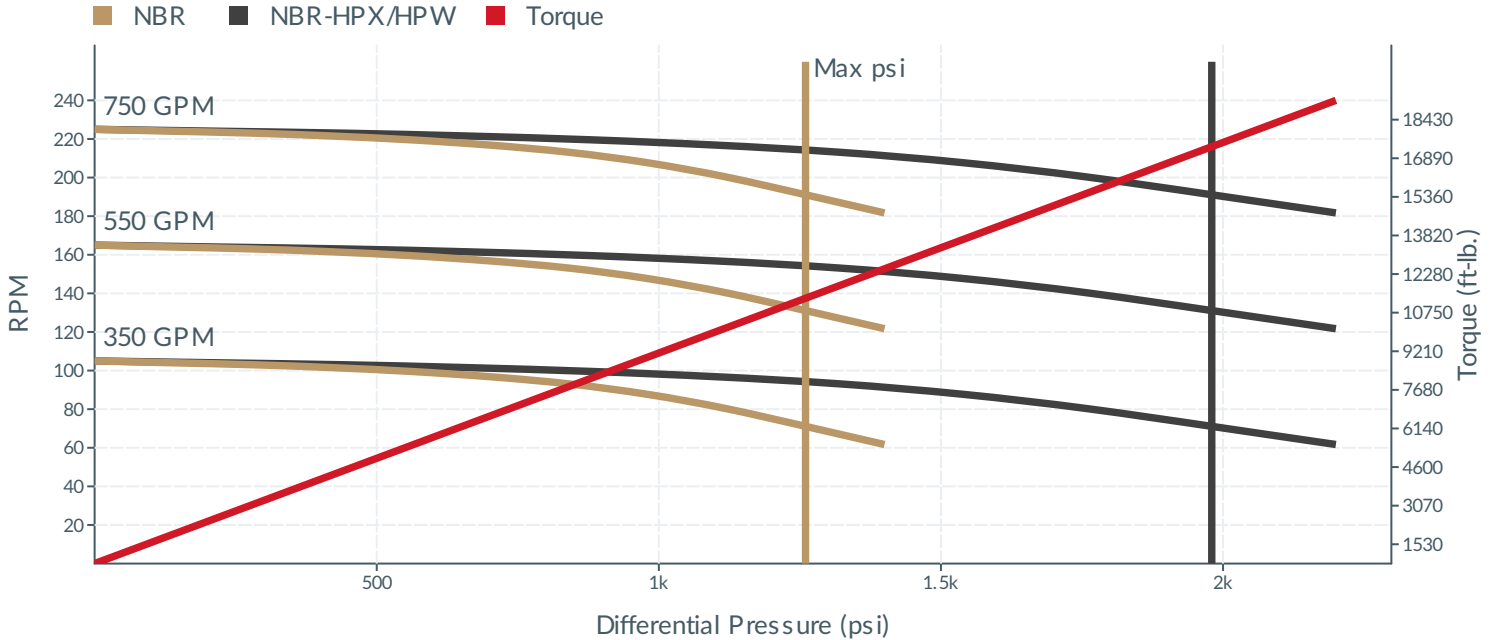
Stator Specification		
Overall Length		275.00 in.
Tube OD		7.00 in.
Tube ID		5.75 in.
Rubber Cutback Top/End		8/8 in.
Weight		983 lbs.
Number of Stages		8.4 in.
Tube Material		4140/4142 Alloy Steel
Rubber Options		NBR, NBR-HPX/HPW

NBR (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	--	--	--	--	--	--
STD	4.142	0.001	0.020	0.039	0.068	0.087
0.5 OS	4.155	-0.012	0.007	0.026	0.054	0.073
1 OS	4.167	-0.024	-0.005	0.014	0.042	0.061
1.5 OS	--	--	--	--	--	--
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

NBR-HPX/HPW (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	--	--	--	--	--	--
STD	4.138	0.005	0.022	0.038	0.063	0.079
0.5 OS	4.151	-0.008	0.009	0.025	0.049	0.065
1 OS	4.163	-0.020	-0.003	0.013	0.037	0.053
1.5 OS	--	--	--	--	--	--
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

Performance Specifications	
Flow Range	350 - 750 GPM
Speed Range	110 - 230 RPM
Torque Slope	8.38 ft-lb./psi
Rotation	0.300 rev/gal
Off Bottom Pressure	160 psi

Performance Details		
	NBR	NBR-HPX/HPW
Max Diff. Press.	1260 psi	1980 psi
Stall Diff. Press.	1890 psi	3110 psi
Max Torque	10560 ft-lb.	16550 ft-lb.
Stall Torque	15840 ft-lb.	26060 ft-lb.

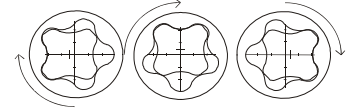


¹ Coating options of chrome or tungsten carbide are available ² Vector Gauge Readings at Room Temp 75°F ³ BHCT Exceeding 275°F will void warranty for NBR (320°F for HPW/HPX)

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US	East Texas (AK/LA/TX)	2209 E. Loop 281 Longview, TX 75605 (903) 757-6300

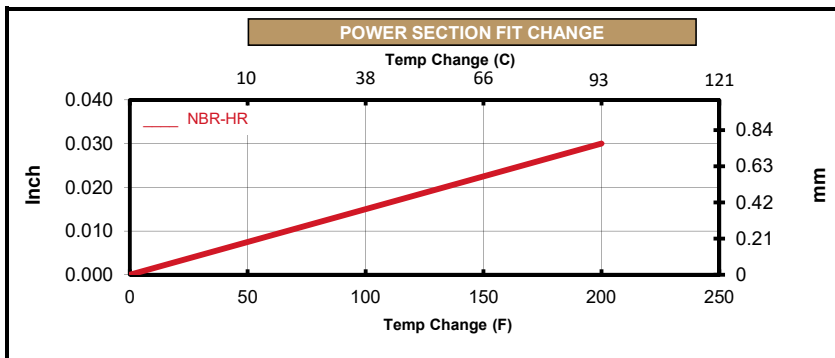


POWER SECTION

ROTOR SPECIFICATIONS		
	Inch	mm
Overall Length	294.0	7468
Contour Length	288.0	7315
Eccentricity	0.268	6.79
Major Diameter	5.024	127.61
Head Diameter	5.000	127.00
Weight	1261 (lbs) 572 (kg)	
Material	145 KSI 17-4SS	
Thread Form*	N/A	

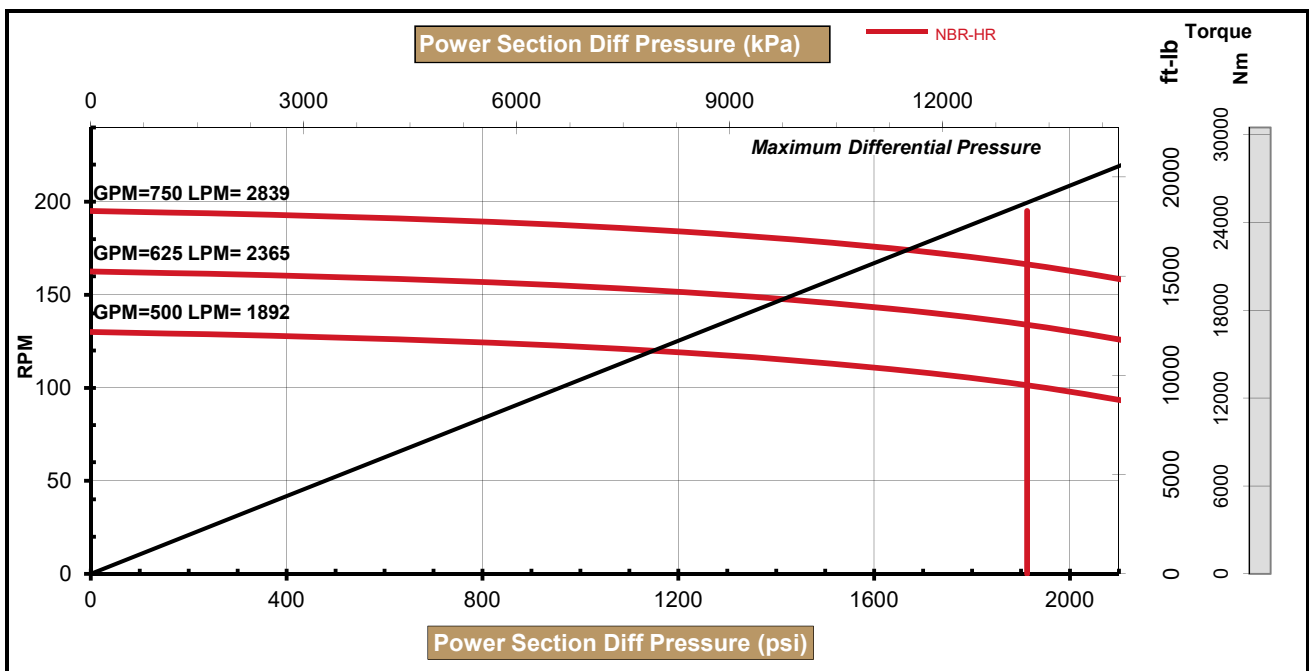
STATOR SPECIFICATIONS		
	Inch	mm
Overall Length	300.0	7620
Rubber Cut Back	7.0	178
Tube O.D.	7.00	177.8
Tube I.D.	5.75	146.1
Weight	975 (lbs) 442 (kg)	
Number of Stages	8.5	
Rubber Type	NBR-HR	
Tube Material	4142 Seamless Tubing	

* Alternate or custom thread forms are available



FIT INFORMATION		
NBR-HR	Minor Diameter	
Stator Size	Inch	mm
Undersize		
Standard	4.489	114.02
Oversize		
Double Oversize		
Nominal Fit at 75 F (25 C)		
Undersize		
Standard	0.000	0.00
Oversize		
Double Oversize		

PERFORMANCE SPECIFICATIONS			PERFORMANCE DETAILS	
Torque Slope	9.783 ft-lb/psi	1.924 Nm/kPa	Max Diff Press psi (kPa)	NBR-HR 1910 (13190)
Flow Range	500 to 750 GPM	1890 to 2840 Litre/min	Max Torque ft-lb (Nm)	18710 (25370)
Rotation	0.260 Rev/Gal	0.069 Rev/Litre	Stall Diff Press psi (kPa)	2870 (19780)
Speed Range	130 to 200 RPM		Stall Torque ft-lb (Nm)	28060 (38060)
Off Bottom Press	179 psi	1230 kPa	Max Recommended HP(kW)	651 (486)



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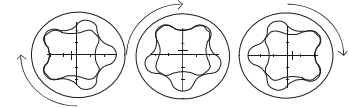


DRILLING MOTORS

PERFORMANCE AND RELIABILITY

500 Series





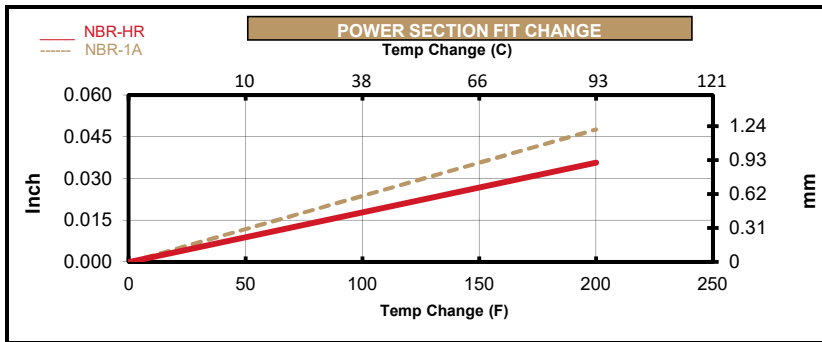
POWER SECTION

ROTOR SPECIFICATIONS		
	Inch	mm
Overall Length	229.4	5827
Contour Length	223.4	5674
Eccentricity	0.207	5.26
Major Diameter	2.916	74.07
Head Diameter	2.750	69.90
Weight	275 (lbs)	124.7 (kg)
Material	17-4SS	
Thread Form*	2 3/8 Hughes External Flush Mod	

STATOR SPECIFICATIONS		
	Inch	mm
Overall Length	242.6	6162
Rubber Cut Back	8.3	211
Tube O.D.	5.00	127.0
Tube I.D.	3.75	95.3
Weight	636 (lbs)	288 (kg)
Number of Stages	8.3	
Rubber Type	NBR-1A, NBR-HR	
Tube Material	4142 Seamless Tubing	

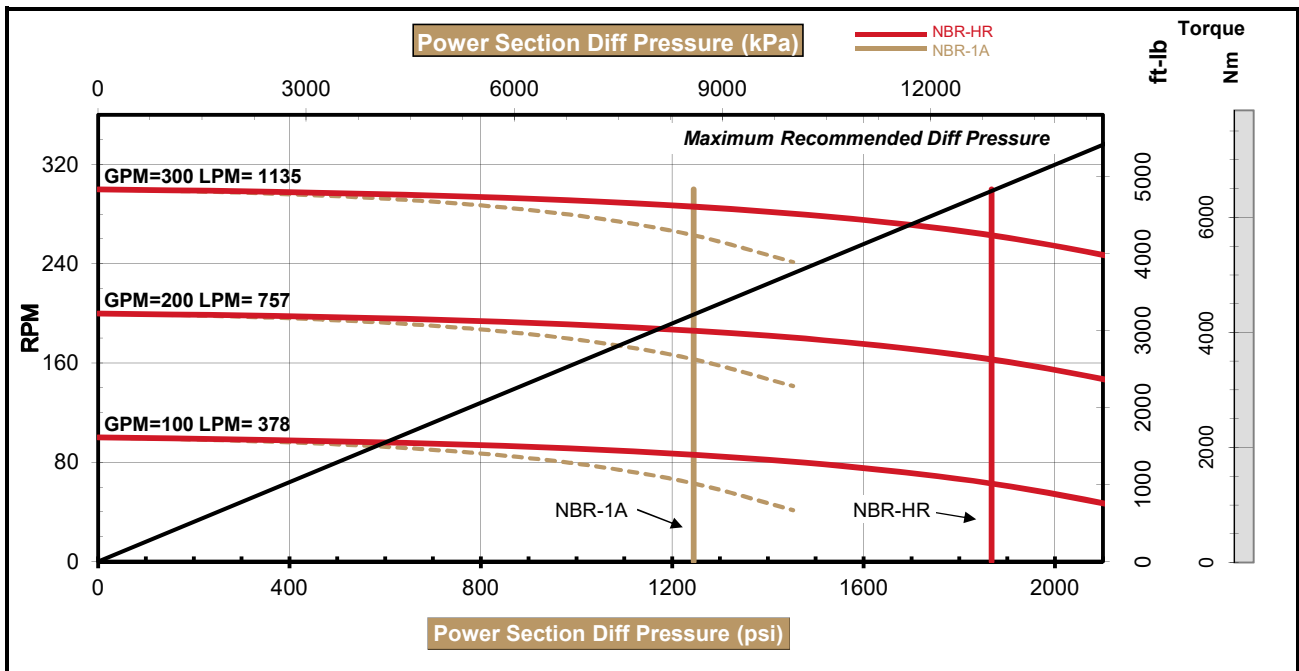
FIT INFORMATION		
NBR-1A	Minor Diameter	
Stator Size	Inch	mm
Standard	2.489	63.22
Oversize	2.517	63.93
Double Oversize		
Third Oversize	2.540	64.52
Nominal Fit at 75 F (25 C)		
Standard	0.013	0.33
Oversize	-0.015	-0.38
Double Oversize		
Third Oversize	-0.038	-0.97

* Alternate or custom thread forms are available

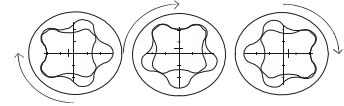


FIT INFORMATION		
NBR-HR	Minor Diameter	
Stator Size	Inch	mm
Undersize		
Standard	2.489	63.22
Oversize	2.513	63.83
Double Oversize	2.525	64.14
Nominal Fit at 75 F (25 C)		
Undersize		
Standard	0.013	0.33
Oversize	-0.011	-0.28
Double Oversize	-0.023	-0.58

PERFORMANCE SPECIFICATIONS			PERFORMANCE DETAILS		
			NBR-1A	NBR-HR	
Torque Slope	2.576 ft-lb/psi	0.507 Nm/kPa	Max Diff Press psi (kPa)	1250 (8580)	1870 (12880)
Flow Range	100 to 300 GPM	380 to 1140 Litre/min	Max Torque ft-lb (Nm)	3210 (4350)	4810 (6530)
Rotation	1.000 Rev/Gal	0.264 Rev/Litre	Stall Diff Press psi (kPa)	1870 (12880)	2800 (19310)
Speed Range	100 to 300 RPM		Stall Torque ft-lb (Nm)	4810 (6530)	7220 (9790)
Off Bottom Press	116 psi	800 kPa	Max Recommended HP(kW)	183 (137)	262 (195)



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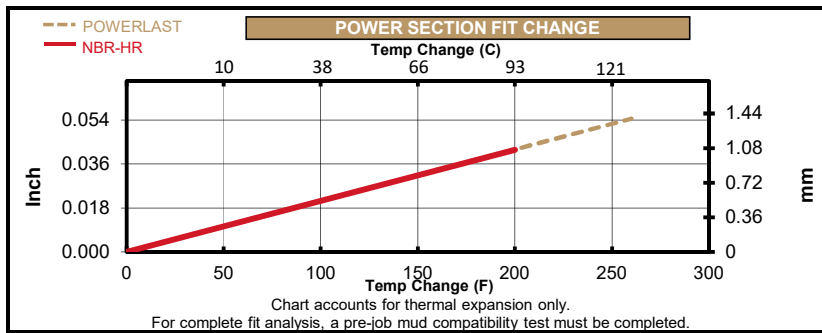
POWER SECTION

ROTOR SPECIFICATIONS		
	Inch	mm
Overall Length	233.5	5931
Contour Length	226.8	5760
Eccentricity	0.192	4.86
Major Diameter	3.018	76.66
Head Diameter	2.750	69.90
Weight	343 (lbs)	155.6 (kg)
Material	17-4SS	
Thread Form*	2 3/8 Hughes External Flush Mod	

STATOR SPECIFICATIONS		
	Inch	mm
Overall Length	246.0	6248
Rubber Cut Back	7.5	191
Tube O.D.	5.00	127.0
Tube I.D.	4.00	101.6
Weight	640 (lbs)	290 (kg)
Number of Stages	8.0	
Rubber Type	POWERLAST, NBR-HR	
Tube Material	4142 Seamless Tubing	

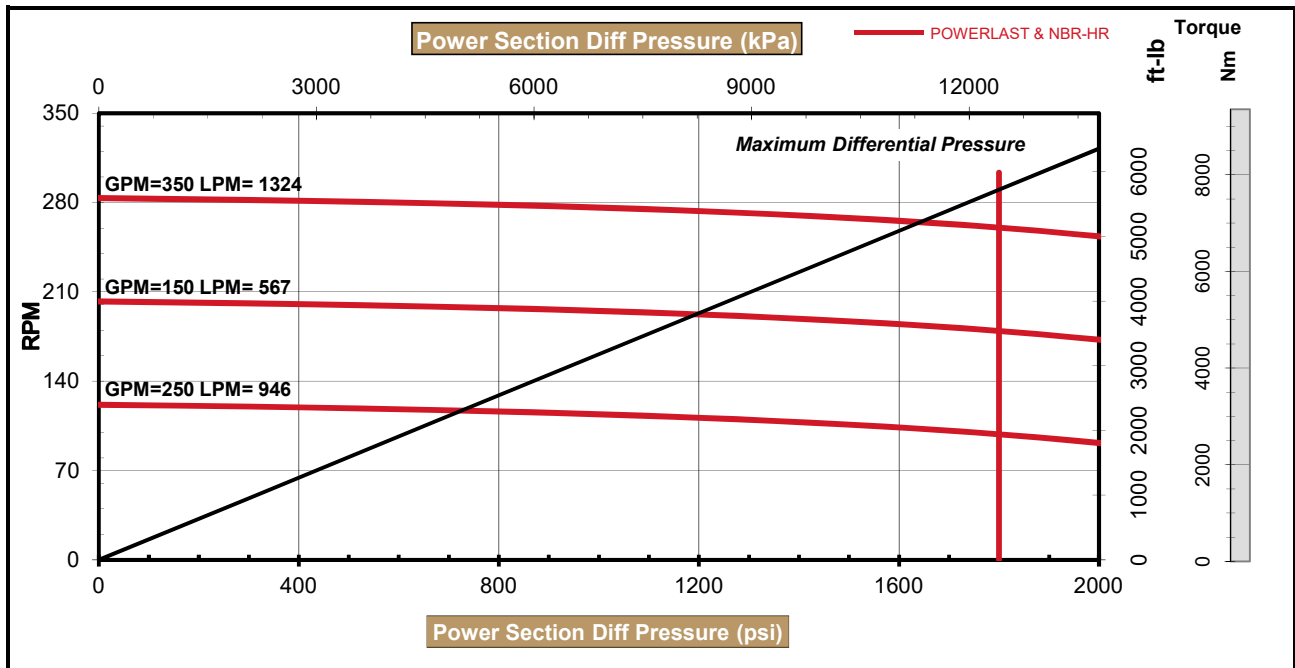
FIT INFORMATION		
POWERLAST	Minor Diameter	
Stator Size	Inch	mm
Standard	2.626	66.70
Oversize	2.642	67.11
Double Oversize		
Nominal Fit at 75 F (25 C)		
Standard	0.009	0.23
Oversize	-0.007	-0.18
Double Oversize		

* Alternate or custom thread forms are available



FIT INFORMATION		
NBR-HR	Minor Diameter	
Stator Size	Inch	mm
Standard	2.619	66.52
Oversize	2.635	66.93
Double Oversize	2.650	67.31
Nominal Fit at 75 F (25 C)		
Standard	0.016	0.41
Oversize	0.000	0.00
Double Oversize	-0.015	-0.38

PERFORMANCE SPECIFICATIONS		PERFORMANCE DETAILS	
Torque Slope	3.176 ft-lb/psi 0.625 Nm/kPa	Max Diff Press psi (kPa)	1800 (12410)
Flow Range	150 to 350 GPM 570 to 1320 Litre/min	Max Torque ft-lb (Nm)	5720 (7760)
Rotation	0.810 Rev/Gal 0.214 Rev/Litre	Stall Diff Press psi (kPa)	2700 (18620)
Speed Range	121 to 290 RPM	Stall Torque ft-lb (Nm)	8580 (11630)
Off Bottom Press	126 psi 870 kPa	Max Recommended HP(kW)	298 (222)



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DRILLING MOTORS

PERFORMANCE AND RELIABILITY

Thru-Tubing Series



Rotor Specification		
Overall Length		92.00 in.
Contour Length		88.00 in.
Major Diameter		1.909 in.
Eccentricity		0.136 in.
Head Diameter		1.880 in.
Thread Form		N/A
Weight		58 lbs.
Material		17-4 PH ¹

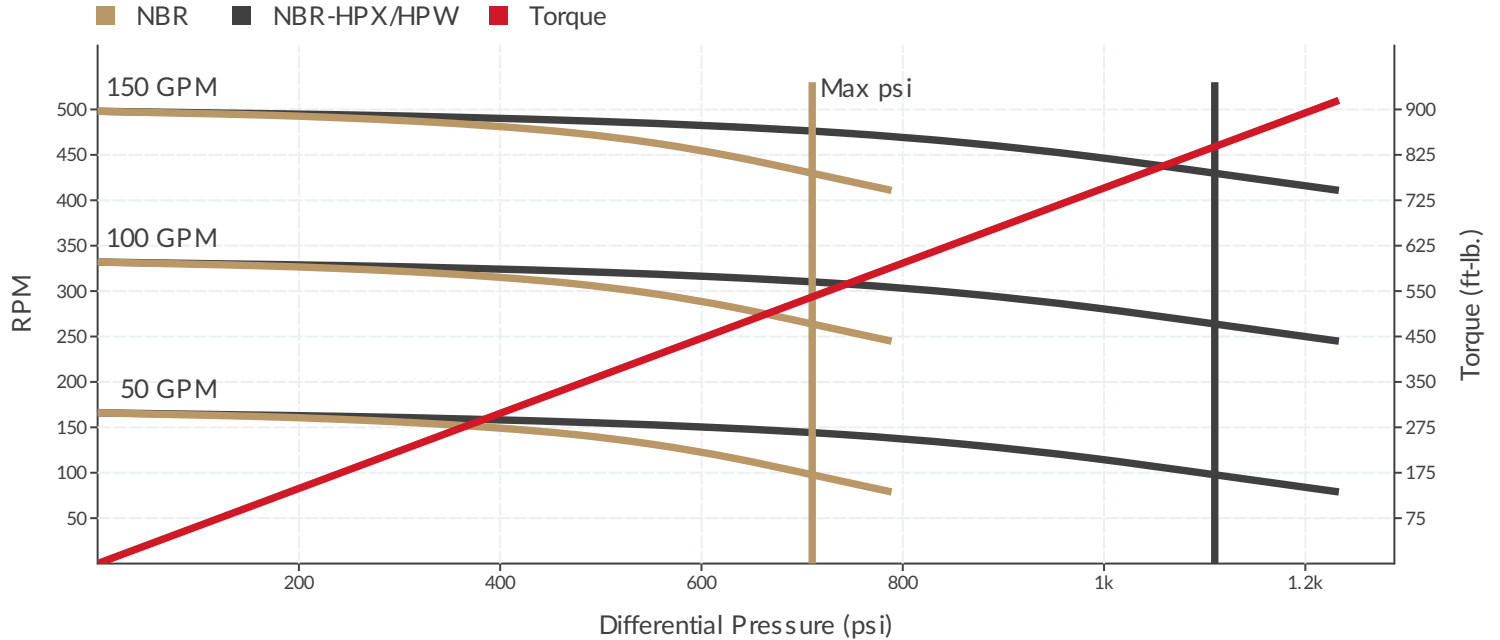
Stator Specification		
Overall Length		105.63 in.
Tube OD		2.88 in.
Tube ID		2.38 in.
Rubber Cutback Top/End		4/16 in.
Weight		70 lbs.
Number of Stages		4.7 in.
Tube Material		4140/4142 Alloy Steel
Rubber Options		NBR, NBR-HPX/HPW

NBR (in.)			Fits (+Compression / -Loose)			
Size	Minor ²	75°F	175°F	250°F	300°F ³	
0.5 US	--	--	--	--	--	--
STD	1.640	-0.003	0.002	0.006	0.013	0.018
0.5 OS	--	--	--	--	--	--
1 OS	1.650	-0.013	-0.008	-0.004	0.003	0.007
1.5 OS	1.670	-0.033	-0.029	-0.024	-0.018	-0.013
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

NBR-HPX/HPW (in.)			Fits (+Compression / -Loose)			
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	--	--	--	--	--	--
STD	1.636	0.001	0.006	0.010	0.017	0.022
0.5 OS	--	--	--	--	--	--
1 OS	1.646	-0.009	-0.004	0.000	0.007	0.012
1.5 OS	1.668	-0.031	-0.027	-0.022	-0.016	-0.011
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

Performance Specifications		
Flow Range		50 - 150 GPM
Speed Range		170 - 500 RPM
Torque Slope		0.75 ft-lb./psi
Rotation		3.320 rev/gal
Off Bottom Pressure		80 psi

Performance Details		
	NBR	NBR-HPX/HPW
Max Diff. Press.	710 psi	1110 psi
Stall Diff. Press.	1060 psi	1740 psi
Max Torque	530 ft-lb.	830 ft-lb.
Stall Torque	800 ft-lb.	1310 ft-lb.



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 US West Texas 5400 N. Big Spring St Bldg E, Midland, TX 79705 1 (877) PDC DRIL
 US East Texas (AK/LA/TX) 2209 E. Loop 281 Longview, TX 75605 (903) 757-6300

Rotor Specification		
Overall Length		86.00 in.
Contour Length		82.00 in.
Major Diameter		2.174 in.
Eccentricity		0.155 in.
Head Diameter		2.175 in.
Thread Form		N/A
Weight		69 lbs.
Material		17-4 PH ¹

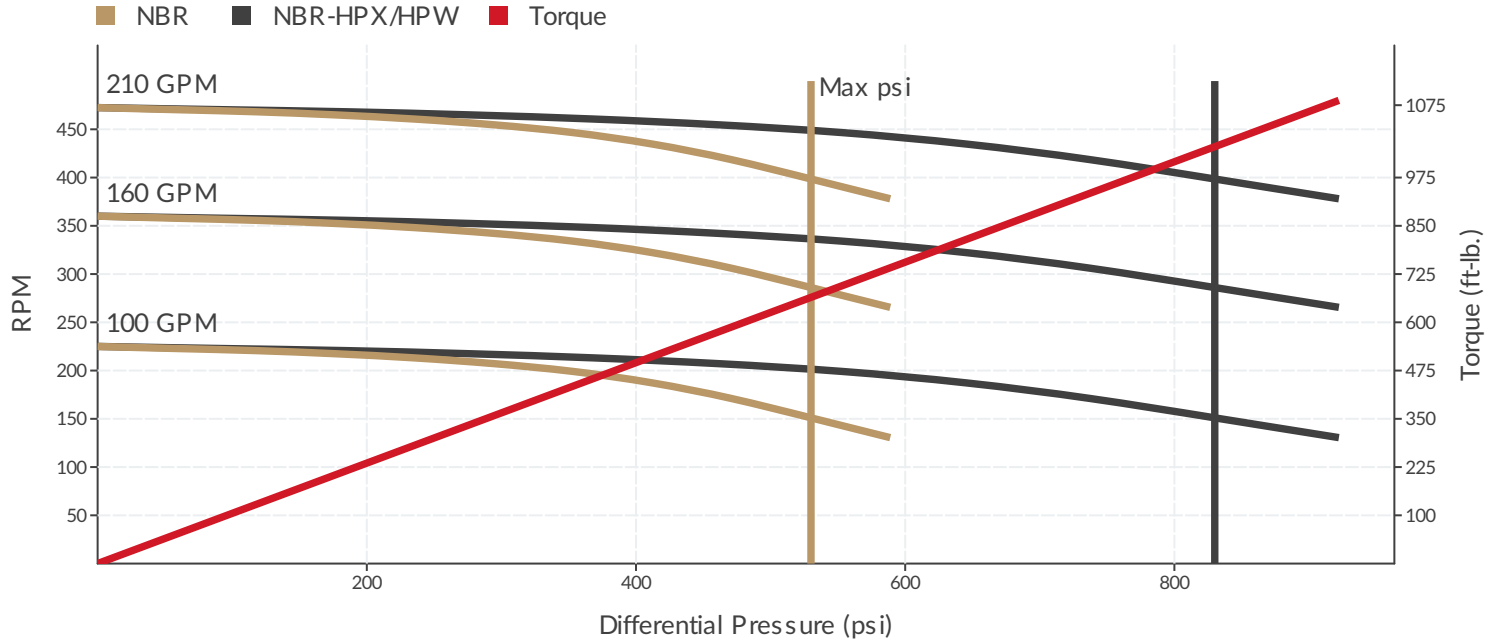
Stator Specification		
Overall Length		88.00 in.
Tube OD		3.13 in.
Tube ID		2.63 in.
Rubber Cutback Top/End		4/4 in.
Weight		65 lbs.
Number of Stages		3.5 in.
Tube Material		4140/4142 Alloy Steel
Rubber Options		NBR, NBR-HPX/HPW

NBR (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	--	--	--	--	--	--
STD	1.870	-0.007	-0.002	0.003	0.010	0.015
0.5 OS	--	--	--	--	--	--
1 OS	1.881	-0.018	-0.013	-0.008	-0.001	0.004
1.5 OS	--	--	--	--	--	--
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

NBR-HPX/HPW (in.)		Fits (+Compression / -Loose)				
Size	Minor ²	75°F	125°F	175°F	250°F	300°F ³
0.5 US	--	--	--	--	--	--
STD	1.868	-0.005	0.000	0.005	0.012	0.017
0.5 OS	--	--	--	--	--	--
1 OS	1.879	-0.016	-0.011	-0.006	0.001	0.006
1.5 OS	--	--	--	--	--	--
2 OS	--	--	--	--	--	--
2.5 OS	--	--	--	--	--	--

Performance Specifications		
Flow Range		100 - 210 GPM
Speed Range		230 - 470 RPM
Torque Slope		1.20 ft-lb./psi
Rotation		2.250 rev/gal
Off Bottom Pressure		90 psi

Performance Details		
	NBR	NBR-HPX/HPW
Max Diff. Press.	530 psi	830 psi
Stall Diff. Press.	790 psi	1300 psi
Max Torque	630 ft-lb.	990 ft-lb.
Stall Torque	950 ft-lb.	1560 ft-lb.



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OPERATING PROCEDURES

Hoisting off bottom

The purpose of the following policy is to ensure that the proper precautions are taken when hoisting off bottom. A majority of downhole tool incidents experienced could have been prevented if we had taken the proper load off the motor before engaging in hoisting off bottom. Below are the procedures for pulling off bottom with a positive displacement motor that must be adhered to on any job.

Pulling Off Bottom While Drilling in Rotary Mode

Top Drive System

- Allow weight on bit to drill off
- Differential pressure should be as close to zero as practical
- Stop top drive rotary
- Allow residual torque in the drill pipe to relax
- Begin to lift drill string slowly while paying close attention to weight indicator
- At the first sign of excessive drag, stop hoisting and observe
- Reverse direction if necessary

Rotary Table System

- Allow weight on bit to drill off
- Differential pressure should be as close to zero as practical
- Disengage rotary table drive
- Allow residual string torque to relax to equilibrium
- Begin to lift drill string slowly while paying close attention to weight
- At the first sign of excessive drag, stop hoisting and observe
- Reverse direction if necessary



OPERATING PROCEDURES

Note: Drilformance recommends a maximum bend setting of 1.83° for rotary drilling. The maximum recommended drill-string rotational speed for Drilformance motors is 60 RPM. The 60 RPM limit helps extend the life of the tool by limiting fatigue cycles and helping to avoid excessive vibration and whirl. Rotary speed should be decreased as necessary based on local conditions. It may be feasible to exceed the 60 RPM limit if using an MWD system to monitor vibrations and downhole RPM in real-time at the rig, so down hole vibrations can be mitigated if and when encountered.

Suggested Rotational Guidelines

- It is strongly recommended to never rotate bend setting above
- 2.5° Adjustable or Fixed
- Permission From Coordinator or Directional Manager is Required Prior to
- Rotating Bend Settings Above 2.38° Adjustable or Fixed
- Maximum recommended rotary speed in curves above 8° DLS is 20 RPM
- regardless of bend setting or hole size
- Maximum recommended rotary speed in laterals is 60 RPM with bend
- housings < 1.83° Adjustable or Fixed
- Maximum recommended rotary speed in lateral is 40 RPM with bend
- housings =< 2.12° Adjustable or Fixed
- It is strictly prohibited to rotate any bend setting in DLS exceeding 17.5°/ 100'

Running In The Hole

- When using a bent sub, or an angle in the adjustable or fixed bearing housing, be careful passing the motor
- through the blowout preventers, casing shoes, liner hangers, ledges, or key seats to ensure that the motor
- or drill bit does not hangup. Do not run into bottom, or 'bottom fill' as it could plug the bit or damage the
- motor housing, transmission and or bearings.



OPERATING PROCEDURES

Warming A Motor For High Bottom Hole Temperatures

Note: When preparing a motor elastomer (power section) for excessive or elevated bottom hole temperatures in excess of 200° F, it is important to allow the elastomer to warm up gradually during its descent.

- Run in hole and stop at the depth where the expected down-hole temperatures are in the
- range of 200°F (93°C).
- Stop and pump drilling fluid to cool the motor. Pump at least 4 minutes after fluid passes bit.
- Pump for about three minutes every 400-500 ft until you reach bottom from this point.
- At bottom start at around half the de-rated differential pressure and work up to the max de-
- rated differential pressure over thirty minutes.

Drilling

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



OPERATING PROCEDURES

Backreaming

Back reaming should be avoided if possible. Uncontrolled or poorly managed back reaming can be a high risk operation that can lead to a stuck BHA, a packed off hole, hole and formation damage and hole collapse. Back reaming adds to the side, or lateral loading that the bearings experience. The bearings in motors experience significant stress, in addition to the the load from the rotor and the weight of the bit or other tools below the motor. These additional loads will reduce the bearing life. Back reaming through curved sections or high dog legs will always create high side loading on the radial bearings. Vibration is generally worse when back reaming because the bottom of the BHA is no longer supported. If back reaming cannot be avoided, a minimal flow rate should be used to reduce the motor speed and low over-pull is recommended to reduce the load on the internal bearings. Using a low flow rate will also minimize the chances of hole washout if the assembly is maintained in the same position for any length of time. Also, if back reaming is anticipated, a drill bit with back reaming/up reaming cutting features should be chosen.

Stalling

If too much weight on bit is applied, the torque required to keep the bit turning creates a higher differential pressure than the seal between the rotor and stator elastomer can maintain. The drilling fluid breaks the seal and leaks through the power section without turning the rotor, so bit ceases rotate, or 'stall'. An increase in standpipe pressure will occur and penetration rate will cease. As the fluid leaks past, it erodes the elastomeric liner, which makes further stalling more likely and damages the liner, eventually leading to chunking. Also, stalling generates large pressure pulses, creating torque spikes that can cause chunking, connection back-off, or fracture of drive components. Motor stalling should be avoided, but when it occurs, it should be remedied quickly using proper methods and procedures. If the bit is pulled up off bottom while drilling, the "trapped" torque within the drill-string will be released uncontrollably, potentially causing damage to down-hole components or causing connections to back-off. This is especially true when a stall has occurred. If a stall condition occurs the following procedures should be followed as soon as possible. Refer to the applications for specific instructions.

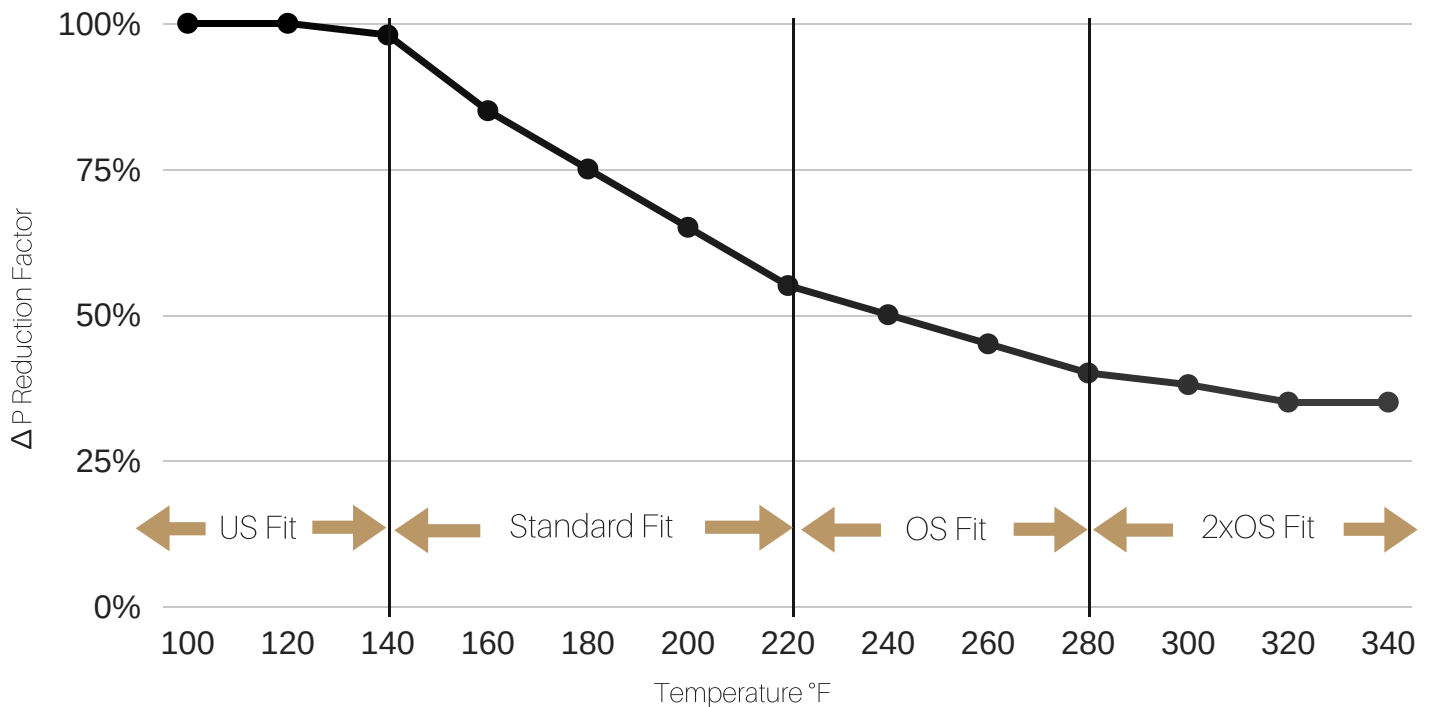
Hoisting Procedures During Motor Stall

- Immediately cut all flow to drill string (stop pumps completely)
- Ensure top drive break or rotary table brake remains locked
- Release standpipe pressure through valves at surface
- Release top drive or rotary table brake and control release of torque
- Hoist drill string high enough to free drill bit and drill string completely
- Restart pumps and check off bottom standpipe pressure is normal before resuming drilling operations

Downhole Temperature

A reduction in stator elastomer strength can be caused by increased downhole temperatures. Therefore, a reduction in the maximum recommended pressure drop across the power section is recommended to help prevent premature stator elastomer failure.

It is not required to lower the pressure drop if the temperature is at or below 140° F. However, as the temperature increases beyond 140° F, it is recommended to follow the differential reduction scale in the graph below.





Downhole Temperature

Note: Drilformance power sections are assembled to actual fits based on proposed downhole temperature and mud types. Simply using a standard fit stator for a low temperature environment is not considered good practice. The practice of assembling power sections by fit is primarily due to the tolerance swing of stator elastomer during the manufacturing process. Elastomer tolerances can range from ± 0.010 " to ± 0.015 " depending on stator manufacturer resulting in a 0.020 " - 0.030 " measurement swing. This could result in a power section that is too tight, or too loose - resulting in premature stator elastomer failure or reduced performance due to a weak motor.

Factors Affecting Power Section Life

The most common mode of failure in power sections is damage to the stator elastomer, also known as chunking. "Chunks", which consist of pieces of stator lobes, are torn or pulled away. This is caused by frictional forces between the rotor and stator rubber exceeding the tensile strength of the rubber.

There are ways to prevent premature damage and extend the life and performance of the power section.

- Never exceed the maximum operating differential pressure ratings specified in the motor specifications section for the motor.
- Never exceed the maximum recommended flow rates for the motor as specified in the motor specifications section for the motor.
- Ensure that the appropriate power section fit is selected for the drilling environment.
- When utilizing oil based drilling mud (OBM), consider the bottom hole operating temperatures (BHT) and aniline Point (AP).
- Keep mud system clean and clear of large debris

The AP (temperature) of an oil is an indication of its tendency to cause swelling of stator elastomer, and is a measure of the oil's aromatic content.

Low AP: The lower the AP, the greater the swelling tendency. Bond degradation generally increases when the AP is lower than 160.

High AP: At temperatures higher than the oil's AP, the aromatic portion of the oil tends to penetrate and swell the elastomer. This reduces the hardness and strength of the elastomer.



Drilling Fluid Selection

Selecting the appropriate drilling fluid is crucial to extend motor life, and is essential to delivering superior performance to drilling operations overall.

Chlorides

Drilling fluid containing chlorides, especially at elevated temperatures, can cause corrosion that greatly reduces rotor and stator life.

Although Drilformance's rotors are coated with industry leading and superior quality chrome and carbide coatings, chlorides can still be detrimental to the rotor's coating. Therefore it is recommended that chloride concentration never exceed 30,000 PPM when chrome rotors are in use.

Oil Based Mud

The Drilformance Performance Drilling Motor can be run in oil based mud (OBM), provided the operating temperature is less than the aniline point (AP) of the oil. The AP value gives an approximation of the oil's aromatic content.

Operating above the AP of the oil can cause swelling of stator elastomer. Oil based mud will degrade the stator elastomer making reline necessary after each run.

Mud Density

Drilling mud with a density greater than 16.0 PPG can cause irregular erosion of internal motor components including stator elastomer due to suspended materials in the mud.

Material Mud Density Guidelines:

- Ensure sand content in drilling fluids does not exceed 1.0%
- Corrected solids should not exceed 18.0%
- Low gravity solids (LGS) should not exceed 6.0%



Engineering Calculations

Horsepower

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

HP = Horsepower (hp)

T = Torque (lb-ft)

N = Rotational speed (RPM)

$$\text{Hydraulic HP} = \frac{P \times Q}{1714}$$

HP = Horsepower (hp)

P = Pressure drop (psi)

Q = Flow rate (GPM)

Pressure

$$\text{Across bit } P_b = \frac{Q^2 \times W}{10,858 \times A^2}$$

P_b = Bit pressure drop (psi)

Q = Flow rate (GPM)

W = Mud weight (PPG)

A = Total flow area (in²)

$$\text{Hydrostatic } P = 0.052 \times \text{TVD} \times W$$

P = Pressure (psi)

TVD = Total vertical depth (ft)

W = Mud weight (PPG)

Motor Efficiency

$$\text{Motor Efficiency \%} = \frac{32.64 \times T \times N}{Q \times P}$$

P = Pressure drop (psi)

Q = Flow rate (GPM)

T = Torque (lbs-ft)

N = Rotational speed (RPM)



Directional Drilling Formulas

- (BUR) Degrees built / Course Length = Degrees x 100' = BUR
- (Projecting to bit in curve) (Pres. Angle - Prev. Angle) / CL x O.S. + Pres. Angle
- (Measured depth to slide) Angle needed / BUR
- (Average Tool Face) BUR / DLS = (ACOS) = Avg. tool face
- (Calc. amount of angle or turn of slide) TF (COS) x BUR / 100' x Ft. of slide
- (Tool Face needed to get angle and or direction) TF + (COS) = percentage of BUR for angle
- (Above or Below Line) Dip (TAN) x VS = +/- KBTVD = TVD
- (Left or Right of Centerline) (Clos. Dir. - Prop. Dir.) = TAN x VS = Distance f/line (+= right - = left)
- (Displacement from Rig) Dip (TAN) x VS + in up dip, - in down dip = KBTVD
- (BUR Needed to land Curve) ((SIN) of angle @ EOC) - ((SIN) of pres. Angle) x 5730 / (EOC TVD - Pres TVD) = BUR needed
- (KBTVD) = Kelly bushing TVD for 0 VS
- (DLS Formula) (Pres. Ang. COS x Prev. Ang. COS) + (Pres. Ang. SIN x Prev. Ang. SIN) x Diff. of Pres. Az. & Prev. Az. COS) Inv COS x 100' / CL measured = DLS
- (Standard) 5730 = Radius of Curvature 5730 / BUR = RC 5730 / Distance of Radius = BUR

Build - Turn Formulas

- (Motor Yield) DLS (Decimal) x CL / ft of slide
- (Measured Depth to Slide) BUR needed / MY = (.95) = (/3) =
- (Project to Bit) TF(COS) = Percentage of Build x MY x CL Slide
- (Tool Face to Slide) BUR / DLS = (ACOS) = TF needed



Drill Collar Make Up Torque Specifications

Connection Type		Minimum Make Up Torque ² (lbs-ft) Bore of Drill Collar		
Type	OD (in)	2 13/16"	3 1/4"	3 1/2"
6-5/8 Reg	8"	53,346	46,936	42,456
	7.75"	53,346	46,936	42,456
4-1/2 IF	6.75"	32,277	26,675	
	6.50"	29,679	26,675	
4-1/2 XH	6.75"	22,426	17,306	
	6.50"	22,426	17,306	
	6.25"	22,426	17,306	
NC56	8"	48,221	42,058	38,174
	7.75"	48,221	42,058	38,174
3-1/2 IF	5"	8,315		
	4.75"	8,315		
4-1/2 Reg	7"	16,629	11,960	
	6.75"	16,629	11,960	
3-1/2 Reg	5"			