
JAGUAR
PERFORMANCE MOTORS

OPERATIONS MANUAL

Revised 2022 v6

The information in this handbook provides guidelines and parameters under which Jaguar Performance Motors should be utilized. Any operations outside the limits are done so at the risk of the operator.

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HEADQUATERS

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INTRODUCTION

Fasdrill DIRECTIONAL SERVICES

FASDRILL PERFORMANCE MOTORS

Jaguar Performance Motors' built-for-purpose performance drilling will enable you to drill faster and safer, increasing your profits. Our mud motors, designed to stand up to the extremes of all drilling applications (vertical and directional), clearly out perform the competition. Jaguar performance mud motors are more robust, provide more torque, a high weight on bit (WOB) capacity and safety catch features that will help to complete your drilling project faster and more profitably.

OUR COMPANY

In 2003, Jaguar Performance Motors were created with the sole purpose of supplying the oil & gas industry with a series of high performance and highly dependable built-for-purpose performance mud motors. We designed a more reliable downhole motor series with a higher torque/speed ratio.

Jaguar Performance motors provide clear advantages for vertical drilling applications. They delivered an increased rate of penetration and better hole deviation control. Jaguar Performance Motors also reduced drilling string failure rate, casing and drill pipe wear, wear and tear of the swivel, Kelly and rotary drives and fuel cost because less energy is required to power a Jaguar mud motor. This means downhole performance motors can reduce your overall drilling costs and increase your drilling efficiency.

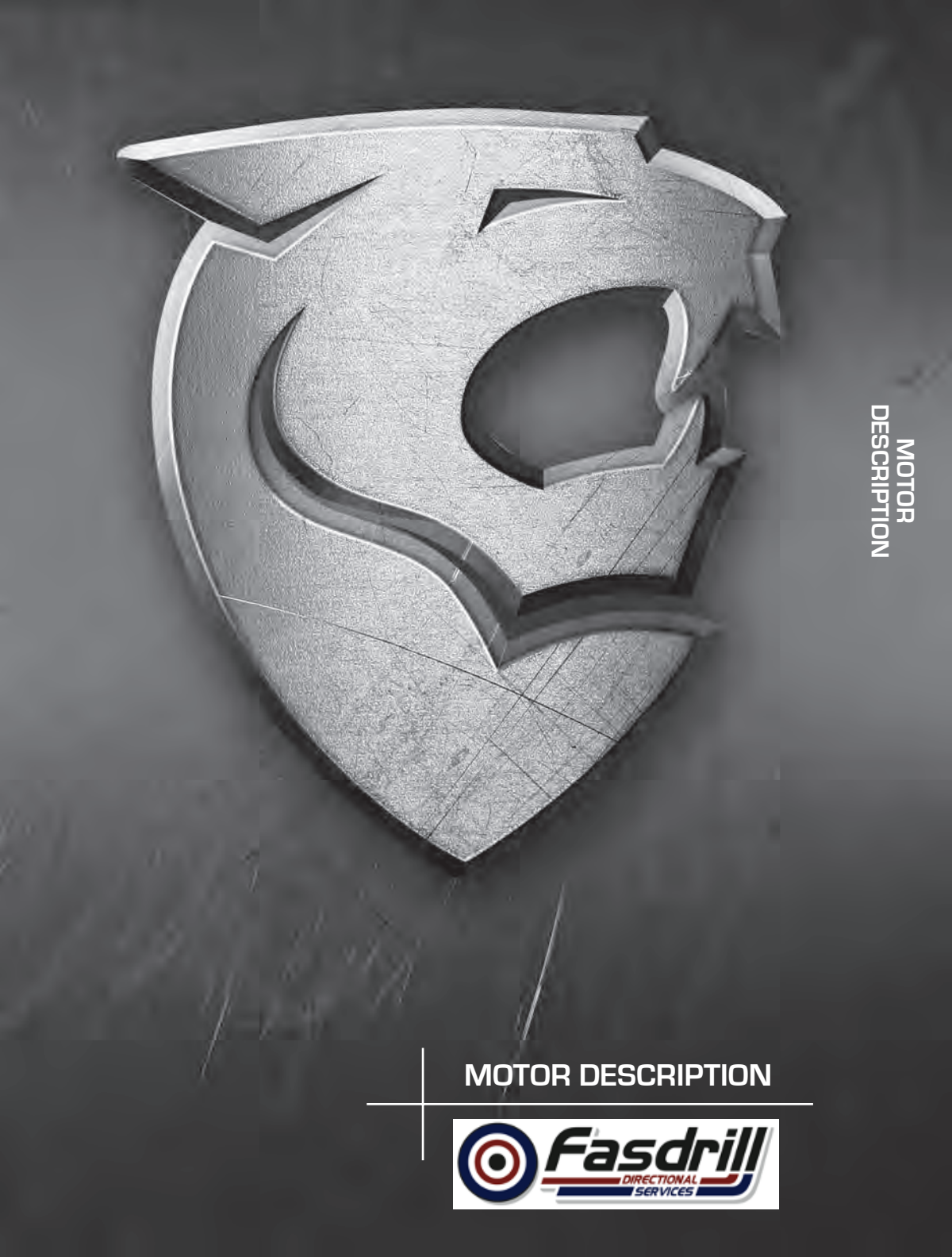
Jaguar's built-for-purpose straight hole drilling motor designed to accommodate the demands of high performance drilling operations, has grown to satisfy the directional drilling market as well. We have taken the simple, yet robust philosophy and created a line of directionally capable downhole motors with the same focus on power, reliability, and performance. If you look inside a Jaguar mud motor, you will see that the internal workings are more solidly designed in order to withstand the demands of a higher torque and weight on bit applications, especially in the driveline components.

Jaguar has proven our downhole motors' excellent performance capabilities in the onshore markets of the Gulf Coast, Permian Basin, and Rocky Mountains, with field and client record runs in each area. Not only does Jaguar supply a superior performance mud motor, but we supply the kind of customer service you need to perform to the best of your abilities. We will customize your drilling program in order to help you succeed. All Jaguar Performance Motors are built in-house, so Jaguar has control of the quality and workmanship that goes into building each piece of the mud motor. When you rent a Jaguar motor, you will also work with a customer service representative who will instruct your floor hands in how to run our downhole motor. Our experienced staff is available around-the-clock to answer your questions and assist you with your motor needs. If you need more direct attention, our representative will come to your site to work through the issue with you.

QUALITY CONTROL

Our dedication to quality has been one of the main factors in the success of our motors. Each aspect of quality control helps to ensure we provide a consistent and quality product to our clients.

- COMPONENT TRACEABILITY – All major components of the motors are serialized and their status closely tracked throughout their useful life.
- MP INSPECTION –After each field run, every motor is completely disassembled, prepped, and inspected using the wet Magnetic Particle inspection method. All internal/external connections and internal drive components are inspected for cracking and connection damage.
- VISUAL/DIMENSIONAL INSPECTION – Once subjected to the magnetic-particle inspection, each component then undergoes a visual and dimensional inspection to determine component reuse.
- SERVICE – Our experienced staff is available around-the-clock to answer your questions and assist you with your motor needs. We are certainly interested in hearing from you with your comments and recommendations regarding our products and services.



MOTOR DESCRIPTION

MOTOR DESCRIPTION

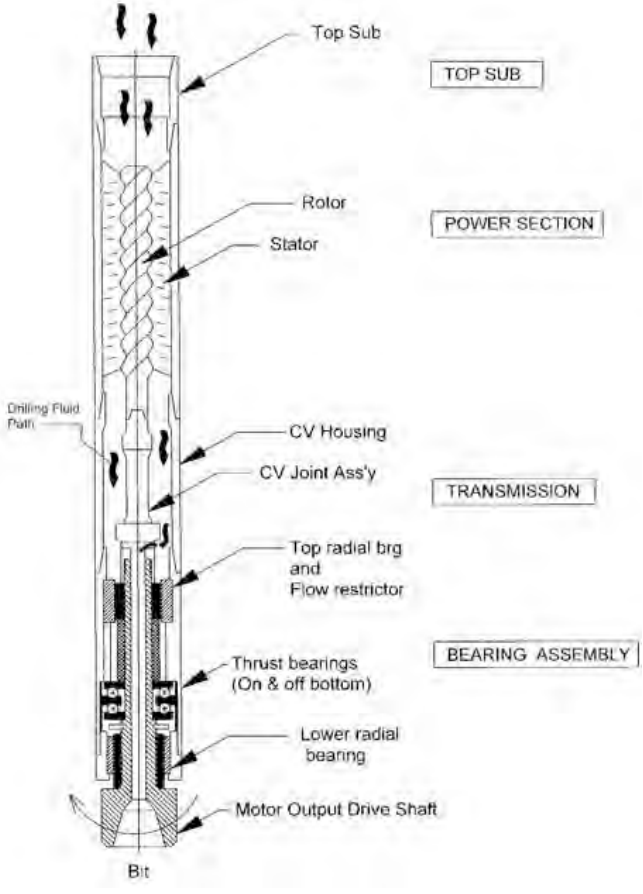
Fasdrill DIRECTIONAL SERVICES

MOTOR DESCRIPTION

This section of the handbook is designed to provide the operators with a general description of the Jaguar mud motor.

Although motors differ in size and performance characteristics, they share the same basic components.

- Top Sub
- Power Section
- Transmission Assembly
- Bearing Pack Assembly



TOP SUB – Jaguar's top sub provides three functions. Its primary use, serves as a crossover between the motor assembly and the drill string. It also allows for placement of a float valve, and includes part of the rotor catch system.

Rotor Catch Assembly – This is a safety feature that is incorporated into the design of all Jaguar Performance Motors. It serves as a retaining device in the event of an external connection failure in the motor.
The rotor catch offers the operator the ability to retrieve the broken motor assembly. Additionally, the rotor catch offers limited circulation capacity to operator while retrieving the motor.

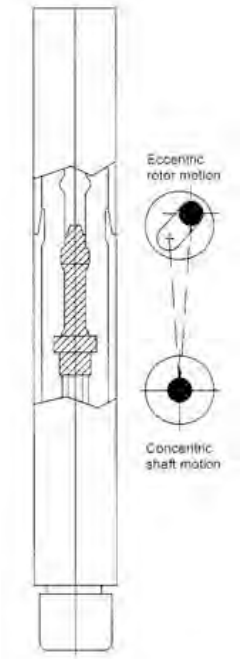
Figure: Rotor Catch Engaged

POWER SECTION – As with most downhole drilling motors, Jaguar utilizes a rotor and stator based on the Moineau principle. The Stator is a steel tube lined with a profiled elastomer. The rotor is a steel shaft with a helical profile, which runs inside the stator.

Drilling fluid is pumped downhole through the drill pipe at a given rate and pressure. Once the hydraulic energy of the drilling fluid reaches the motor, the fluid moving through the power section is converted into rotation and torque. This mechanical energy is transferred through the rest of the motor directly to the drill bit.

The power section have many different configurations available. The configurations vary on basis of torque and rpm requirements, as well as downhole conditions such as temperature and drilling fluids used.

TRANSMISSION ASSEMBLY – The Flexible Coupling is the link between the rotor and the bearing mandrel. This assembly is required to distribute the eccentric and rotary motion of the power section to the drill bit.



BEARING PACK ASSEMBLY- The Bearing Pack Assembly is designed to accommodate the thrust and radial loading applied to the motor during operation.
The thrust loads can come from various sources, such as weight applied to the motor, hydraulic pressure drops across the drill bit and/or power section, and back-reaming operations.

The **Radial Bearings** rigidly support the bearing mandrel inside the bearing housing. They are designed to withstand the radial forces generated during drilling, while maintaining the bearing mandrel alignment and concentricity.
Additionally, the radial bearings govern the fluid flow that helps lubricate the thrust bearings. This bypass rate is controlled to a maximum of 15%.

The **Thrust Bearings** are designed to sustain the applied weight to the drill bit while on-bottom. They are also capable of bearing the downward hydraulic thrust load of the rotor while circulating off-bottom or drilling with underbalanced bit weight. A belleville spring is utilized to dampen any shock loading that may occur while the motor is drilling.

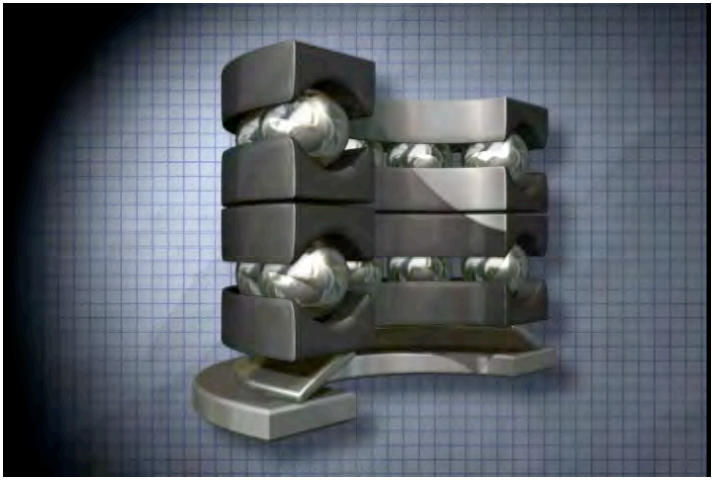


Figure: Thrust Bearing assembly with Belleville spring

MOTOR OPERATIONS

MOTOR OPERATIONS

Fasdrill DIRECTIONAL SERVICES

START UP OPERATIONS

Once the motor has reached just slightly off bottom; increase circulation to desired flow rate. Note the off-bottom standpipe pressure. This information will be required later to achieve optimum performance of the motor.

Slowly lower the motor to the bottom of the hole. Increase the weight on bit (WOB) in 2000-3000 pound increments for 1'-3'. This will help establish a bottom hole pattern for the bit. Once the bit has become seated, apply WOB and increase rotary speeds to the recommended parameters of the bit/motor. At this point, there will be an increase in standpipe pressure, once the motor has begun to drill ahead.

Motors are hydraulic based tools operating specifically off of fluid flow and pressure ratings. In order to effectively operate the Jaguar Mud Motor, flow rate and differential pressures must be known.

The On-bottom pressure can be subtracted from the Off-bottom pressure to obtain the differential pressure of the motor.

EXAMPLE

On-Bottom P.S.I. - Off-Bottom P.S.I = Differential PSI

2850 P.S.I. - 2200 P.S.I. = 650 P.S.I. diff.

CURVE INTERPRETATIONS

Performance is dependent on flow rates and pressure. The following examples break down the flow curves to approximate downhole motor performance.

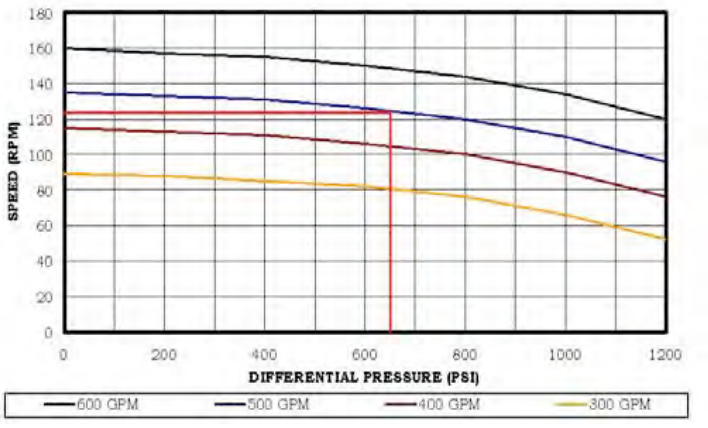
RPM Calculation

With the flow rate and differential pressure, the curve will determine both the motor RPM and Torque output. To determine bit speed, the bottom and left axis are used.

FLOW RATE: 500 GPM

DIFFERENTIAL PSI: 650 PSI

APPROXIMATE RPM: **125 RPM**



The motor will decrease in torque as flow rates and differential pressures increase. This is due to inherent design inefficiencies of the progressing cavity pump. At full load, the inefficiency of a mud motor is approximately 15%. The main loss in the RPM is caused by slippage in the sealing of the power section.

SPEED RATIO CALCULATION

To determine the speed ration of a power section, revolutions per gallon, use the following formula below.

Maximum speed (zero PSI)/Maximum Flow Rate =rev/gal

160 rpm/600 gpm=0.26 rev/gal

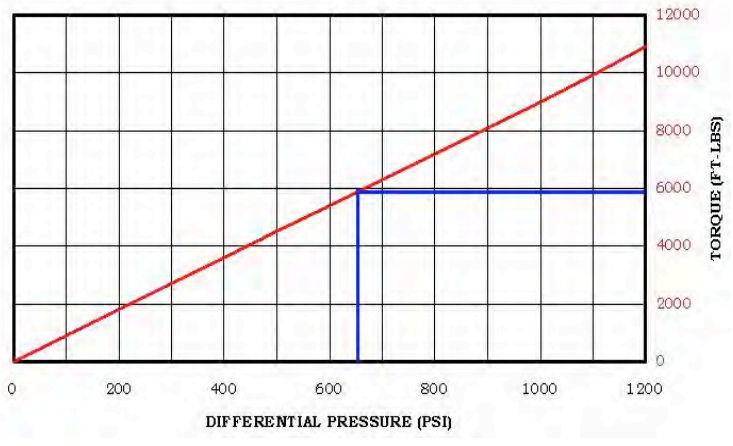
TORQUE CALCULATION

To determine torque output at the bit, use the right axis of the curve along with the differential pressure axis.

FLOW RATE: 500 GPM

DIFFERENTIAL PSI: 650 PSI

APPROXIMATE TORGUE: **6000 FT-LBS.**



Each power section design has an individual torque slope. The torque slope is a factor of ft-lbs./P.S.I. The given torque curve provided with the motor takes into account the inefficiencies discussed earlier.

OPERATIONAL PARAMETERS

INTRODUCTION

Drilling practices have evolved vastly over the years. The quality of the materials used in drilling, has increased in strength, corrosion resistance, mechanical loading and wear. However, despite how robust and durable products have become, the Laws of Physics remain the same. The negative effects of high fluid pressure, high velocity impacts of solids/sands, bending loads, and mechanical forces on steel and elastomers do not change. The advantages to designing a stronger and more durable component help extend the life of our product, but do not make it impervious to the extreme forces drilling equipment is subjected to. When operated within the parameters put forth in this manual, Jaguar motors will provide our clients with superior performance, reliability, and longevity. Operations in excess of these specifications, may negatively affect the performance and life of our product. We have intentionally put forth specific values in order to maintain customer satisfaction and excellent tool performance. It is at the operator's discretion and risk to exceed these parameters.

STALLING

When the operating parameters exceed the capability of the motor and/or bit, a stalling condition can occur. A sudden severe increase in standpipe pressure will be observed and ROP will cease. If the motor stalls while drilling, immediate steps must be taken to prevent potential damage to the motor.

To minimize the risk of connection back-off or stator elastomer damage, the following steps should be taken.

1. Stop the rotary table.
2. Reduce/stop pump pressure.
3. Slowly release the reactive torque in the drill string using the rotary brake.
4. Pull the bit off-bottom.
5. Resume initial drilling steps.

If the bit is picked up off-bottom while in a stalled condition, there is a potential for a connection back-off. This is caused when the reactive torque stored within the drill string is released. The reactive torque accumulates under standard rotary drilling operations.
Repeated or extended stalling can have detrimental effect on the stator elastomer, posing the risk of stator chunking. It is advised that differential pressure be reduced slightly (5-10%) to minimize future occurrences of stalling.

ROATARY DRILLING

Rotation of the drill string in performance drilling applications is a common practice. Rotary table speeds should not exceed 75 RPM. Motor operations with rotary table speeds above 75 RPM can result in excessive wear and tear. Higher rotary speeds may be necessary under some situations, but life expectancy of the motor and drill string can dramatically decrease. Increased cyclical fatigue and tool wear are potential concerns with higher rotary speeds.

SAND/SOLIDS CONTENT

It is important that the sand/solids percentages of the drilling fluid be maintained for the effective life and performance of our motors. Any deviation from the parameters specified below can result in excessive wear/tear on the motor, decreased life, and decreased power.

- Sand Contents should be kept at or below 0.5% concentration.
- Low Gravity Solids (fine abrasives) must be kept at or below 2%
- Total Solids Content must be kept at or below 5%

These conditions will be measured and considered in the event of damages or performance evaluations that are required by the client.

CHLORIDE CONTENT

It is understood some drilling programs require high chloride concentrations in their drilling fluids. Chloride concentrations above 30,000 PPM can result in excessive damage to rotor coatings and in addition ensuing damage to the stator elastomer can occur.

DOG LEG SEVERITY (DLS)

Operation in wellbores with more than 5 degrees/100' of DLS can result in excessive damages to the motor. The customer is advised to take this into consideration when choosing to operate a motor in this environment.

FOREIGN DEBRIS

No foreign debris should be cycled through a Jaguar Motor. In the event of such a scenario, resultant damages will be considered excessive wear and tear.

TRIPPING

Care should be taken when tripping in and out of the hole with a motor. The motor should be tripped slowly through areas of known restrictions. Potential damage to the motor and bit can occur if they impact key seats, ledges, casing shoes or the bottom of the hole.

Periodic circulation is recommended to prevent plugging the motor/ drill bit. Also, periodic circulation will help condition the motor if there are temperature concerns on the well.

REAMING

Should extend reaming operations by required the life expectancy of the motor can be severely decreased. Do not ream with a motor over intervals of more than 200 feet.

DOWNHOLE TEMPERATURES

Jaguar Mud motors can operate safely in drilling conditions with static downhole temperatures up to 250 degrees Fahrenheit using water based drilling fluids.

When downhole temperatures increase beyond 250 degrres Fahrenheit, the elastomer begins to undergo detrimental effects. Increased temperature has a negative two-fold effect upon the stator lining. The elastomer begins to swell as the downhole temperature rises. The swelling will begin to break down the mechanical properties of the stator elastomer. Additionally, the swelling will reduce the interference fir between the rator and stator. This increases the mechanic loading on the rubber.

LOST CIRCULATION MATERIAL (LCM)

IMPORTANT: Mix LCM very well and at a maximum of 17-21 pounds per barrel.

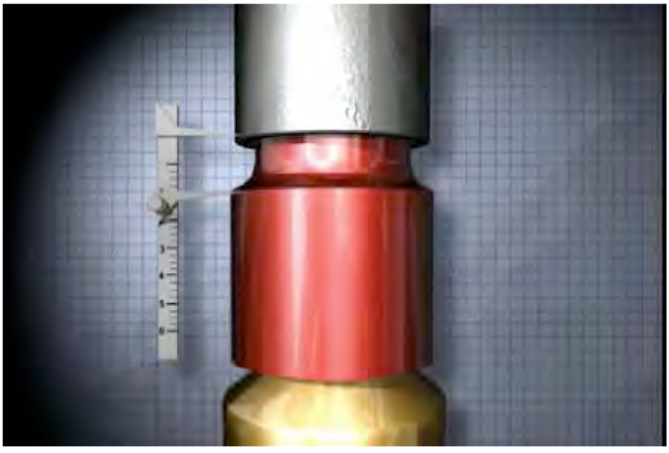
RIG-SITE EVALUATION

Each Jaguar bearing assembly can be evaluated on the rig site to assist in determining re-running of the motor. The operator can measure the distance from the bottom of the lower sub to the bit box.

To measure the wear in compression, apply weight to the motor on the rig floor and measure the distance as noted

To measure the wear in tension, lift the motor off of the rig floor and measure the distance as noted.

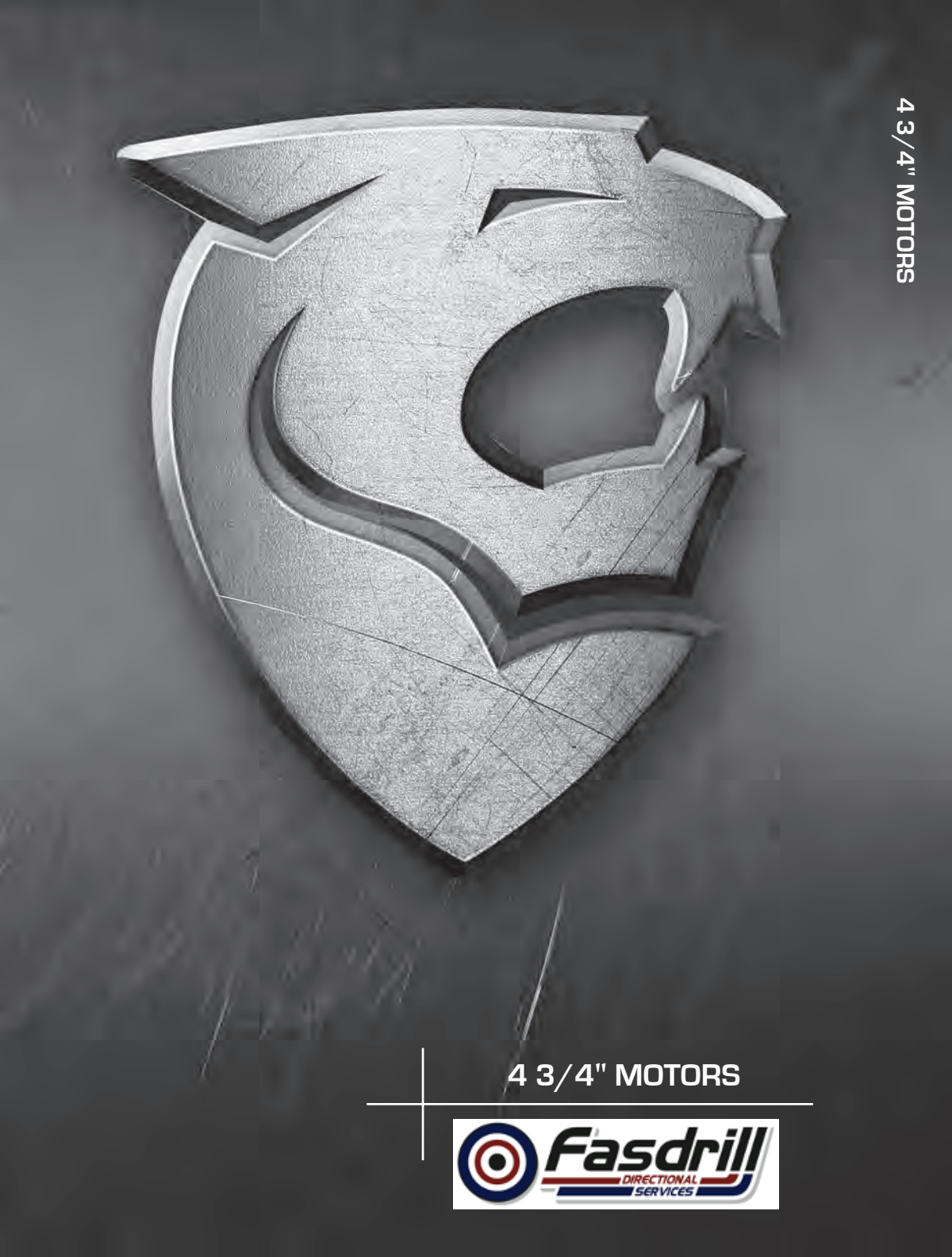
**each motor spec sheet has guidelines



JAGUAR
PERFORMANCE MOTORS

Fasdrill
DIRECTIONAL SERVICES

JAGUAR
PERFORMANCE
MOTORS



4 3/4" MOTORS

Fasdrill DIRECTIONAL SERVICES

JAGUAR
PERFORMANCE MOTORS

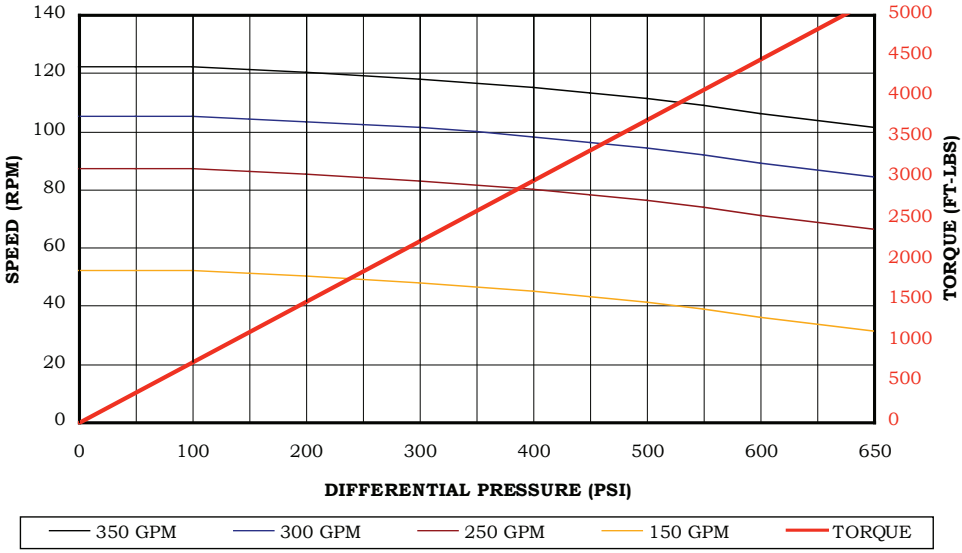
4-3/4”

LIGHTNING-SS PERFORMANCE MOTOR

Performance Data					
Flow Rate		150-350 GPM		Δ PSI	648 psi
	No Load	50% Load	100% Load	Torque Slope	7.44 ft-lb/psi
Speed Ratio	.35 rev/gal	.33 rev/gal	.28 rev/gal	Operating Torque (max)	4821 ft-lbs
RPM	52-122 rpm	46-116 rpm	31-101 rpm	Power	112 hp

Physical Data			
Overall Length	31’	Weight	1800#
Top Connection	3 1/2” I.F. Box	Bottom Connection	3-1/2” Reg. Box
Float Valve Bore	3 ½ IF Float	Bit Box Gap	1 7/8”(open) 1 3/8” (closed)

Operating Data		
	Operating	Maximum
WOB	30,000 lbs	70,000 lbs
Motor Overpull	133,000 lbs	331,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

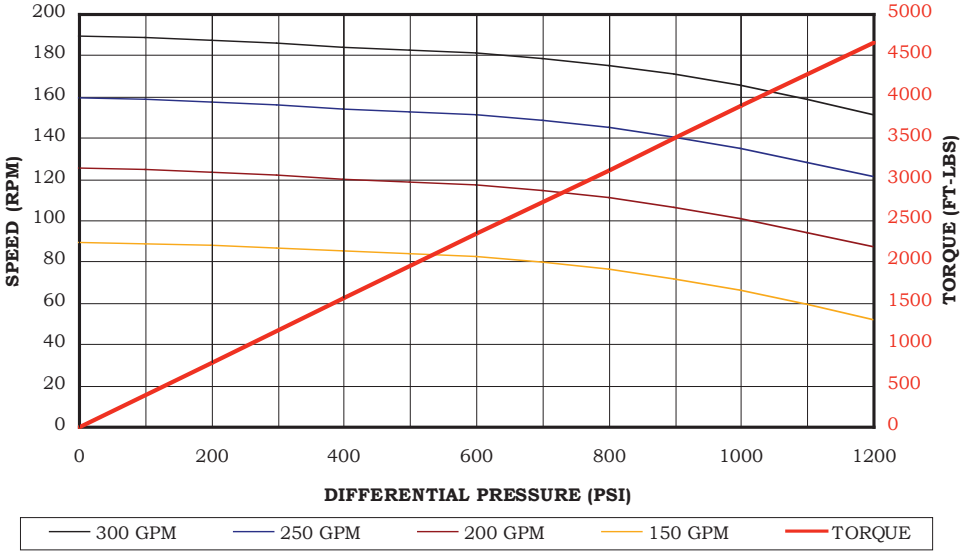
4-3/4”

LIGHTNING PERFORMANCE MOTOR

Performance Data					
Flow Rate		150-300 GPM		∆ PSI	1050 psi
	No Load	50% Load	100% Load	Torque Slope	3.65 ft-lb/psi
Speed Ratio	.63 rev/gal	.60 rev/gal	.56 rev/gal	Operating Torque (max)	4088 ft-lbs
RPM	95-189 rpm	90-180rpm	64-168 rpm	Power	123 hp

Physical Data			
Overall Length	31’	Weight	1800#
Top Connection	3 1/2” I.F. Box	Bottom Connection	3-1/2” Reg. Box
Float Valve Bore	3 ½ IF Float	Bit Box Gap	1 7/8”(open) 1 3/8” (closed)

Operating Data		
	Operating	Maximum
WOB	30,000 lbs	70,000 lbs
Motor Overpull	133,000 lbs	331,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

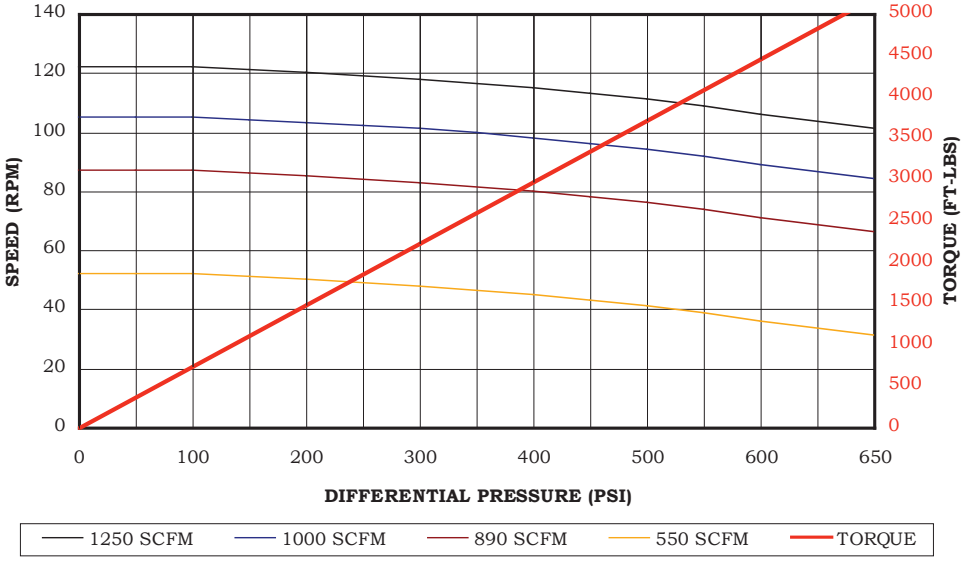
AIR 4-3/4”

LIGHTNING-SS PERFORMANCE MOTOR

Performance Data					
Flow Rate		550-1250 SCFM		Δ PSI	648 psi
	No Load	50% Load	100% Load	Torque Slope	7.44 ft-lb/psi
Speed Ratio	.35 rev/gal	.33 rev/gal	.28 rev/gal	Operating Torque (max)	4821 ft-lbs
RPM	52-122 rpm	46-116 rpm	31-101 rpm	Power	112 hp

Physical Data			
Overall Length	31’	Weight	1800#
Top Connection	3-1/2” I.F. Box	Bottom Connection	3-1/2” Reg. Box
Float Valve Bore	3 ½ IF Float	Bit Box Gap	1 7/8”(open) 1 3/8” (closed)

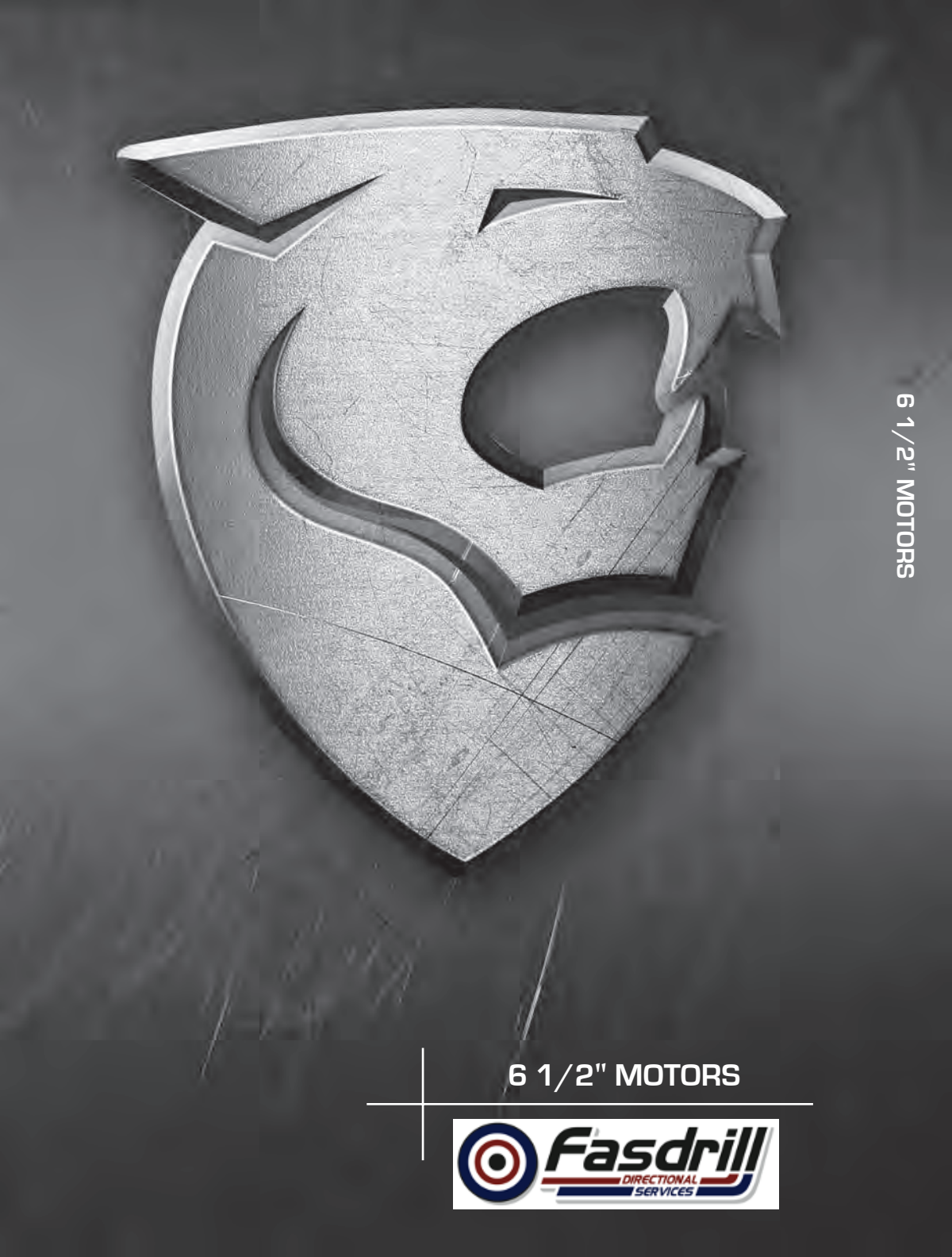
Operating Data		
	Operating	Maximum
WOB	30,000 lbs	70,000 lbs
Motor Overpull	133,000 lbs	331,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA



6 1/2" MOTORS

6 1/2" MOTORS

Fasdrill DIRECTIONAL SERVICES

JAGUAR
PERFORMANCE MOTORS

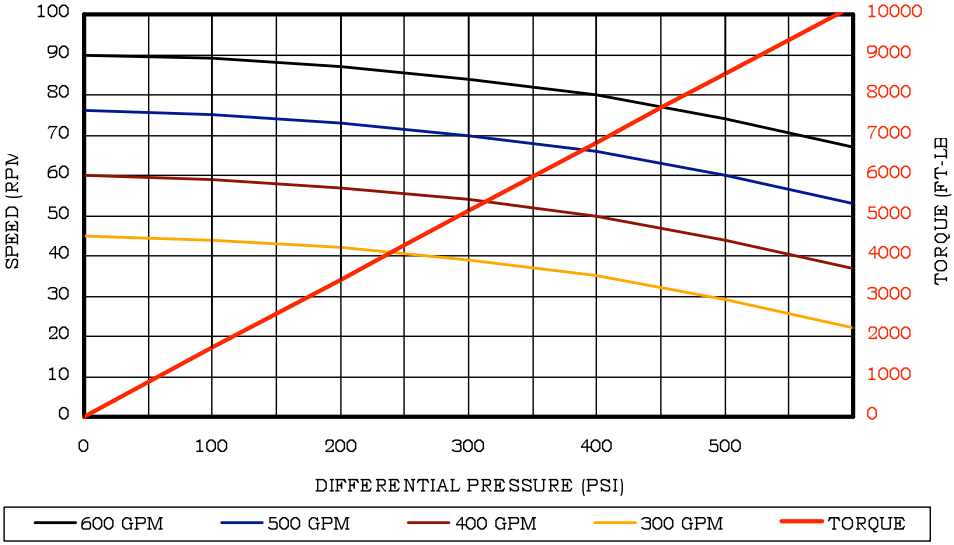
6-1/2”

LIGHTNING-SS PERFORMANCE MOTOR

Performance Data					
Flow Rate		300-600 GPM		Δ PSI	525 psi
	No Load	50% Load	100% Load	Torque Slope	17.02 ft-lb/psi
Speed Ratio	.15 rev/gal	.14 rev/gal	.12 rev/gal	Operating Torque (max)	8940 ft-lbs
RPM	45-90 rpm	40-85 rpm	27-72 rpm	Power	153 hp

Physical Data			
Overall Length	27’	Weight	2200#
Top Connection	4-1/2” XH Box	Bottom Connection	4-1/2” Reg. Box
Float Valve Bore	4R Float	Bit Box Gap	1¼”(open) 1” (closed)

Operating Data		
	Operating	Maximum
WOB	43,000 lbs	98,000 lbs
Motor Overpull	201,000 lbs	310,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

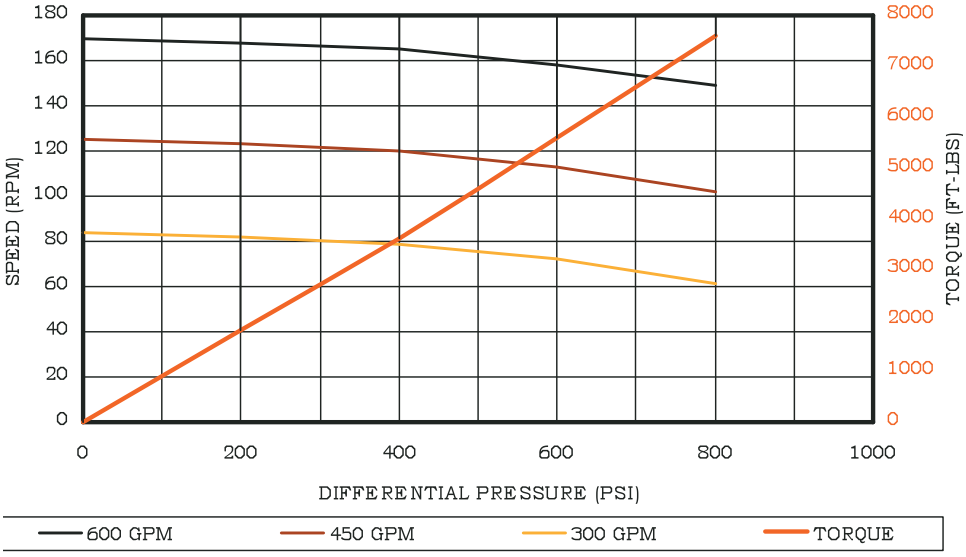
6-1/2”

JX PERFORMANCE MOTOR

Performance Data					
Flow Rate		300-600 GPM		∆ PSI	875 psi
	No Load	50% Load	100% Load	Torque Slope	8.32 ft-lb/psi
Speed Ratio	.29 rev/gal	.27 rev/gal	.23 rev/gal	Operating Torque (max)	7300 ft-lbs
RPM	87-174 rpm	77-163 rpm	52-140 rpm	Power	208 hp

Physical Data			
Overall Length	27’	Weight	2200#
Top Connection	4-1/2” XH Box	Bottom Connection	4-1/2” Reg. Box
Float Valve Bore	4R Float	Bit Box Gap	1¼”(open) 1” (closed)

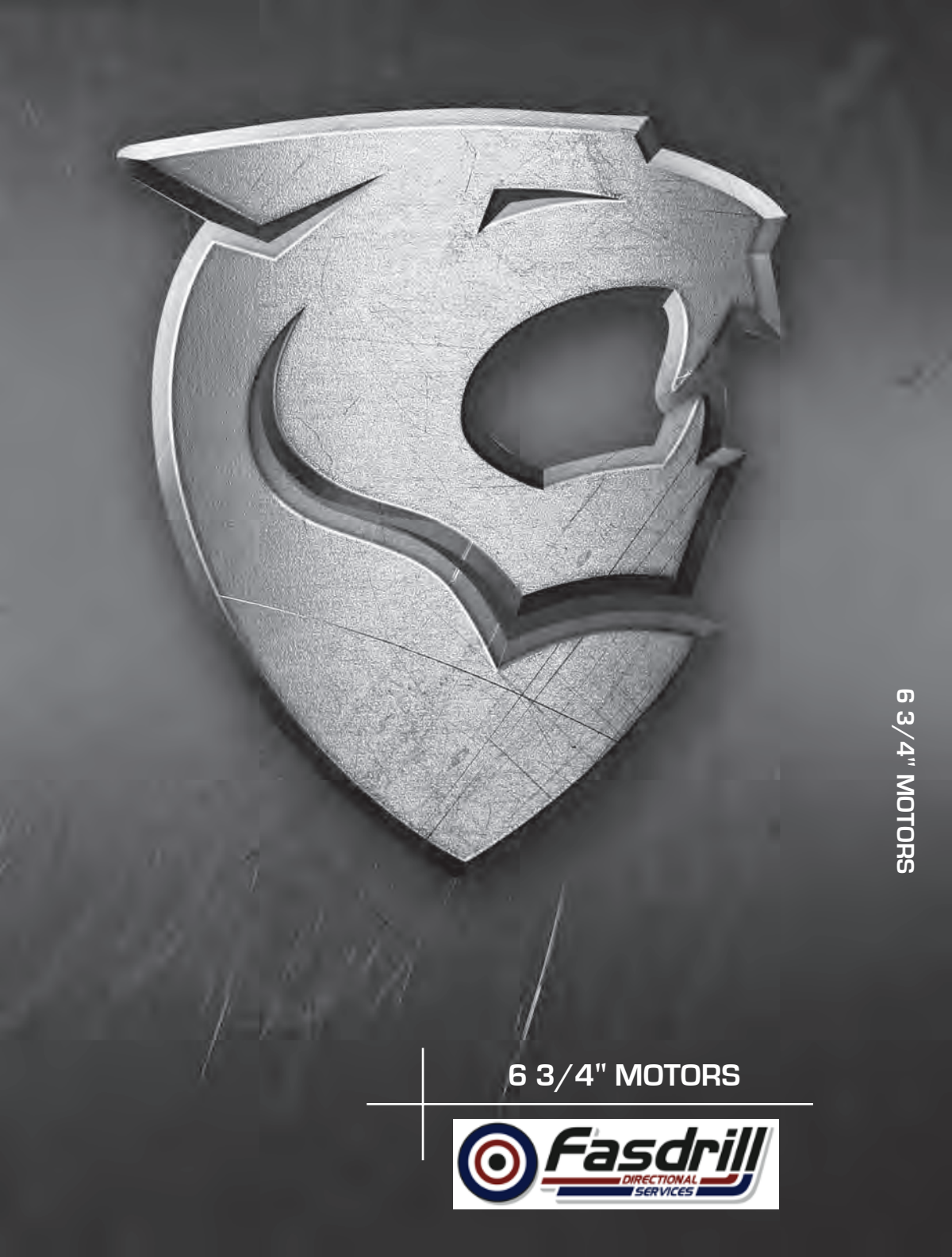
Operating Data		
	Operating	Maximum
WOB	43,000 lbs	98,000 lbs
Motor Overpull	201,000 lbs	310,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA



6 3/4" MOTORS

6 3/4" MOTORS

Fasdrill DIRECTIONAL SERVICES

JAGUAR
PERFORMANCE MOTORS

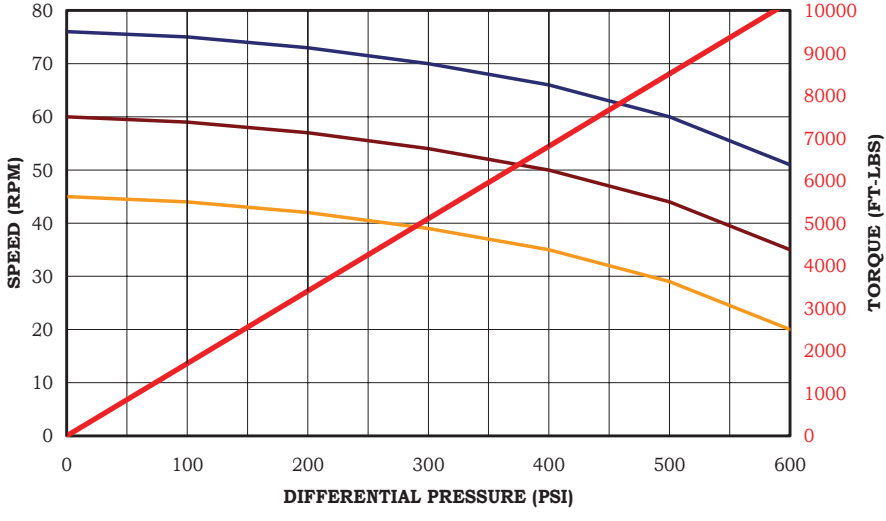
6-3/4”

USS-HT PERFORMANCE MOTOR

Performance Data					
Flow Rate	300 - 500 gpm			Δ PSI	600 psi
			100% Load	Torque Slope	15.49 ft-lb/psi
Speed Ratio			.07 rev/gal	Operating Torque (max)	10212 ft-lbs
RPM			22-53 rpm	Power	153 hp

Physical Data			
Overall Length	29’	Weight	2800#
Top Connection	4 1/2” X.H. Box	Bottom Connection	4-1/2” A.P.I. Reg. Box
Float Valve Bore	4R Float	Bit Box Gap	3-1/4”(open) 2-3/4”(closed)

Operating Data	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	672,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

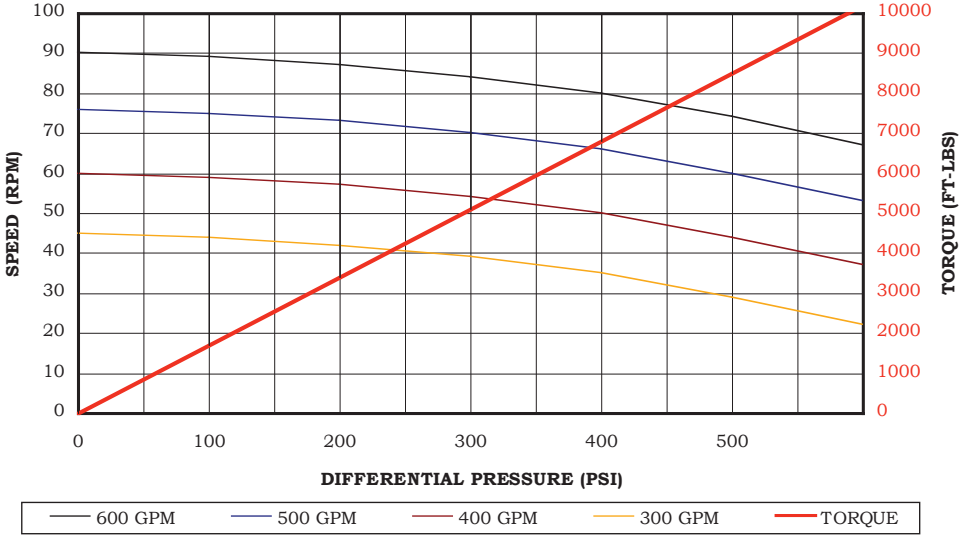
6-3/4”

LIGHTNING-SS PERFORMANCE MOTOR

Performance Data					
Flow Rate		300-600 GPM		Δ PSI	525 psi
	No Load	50% Load	100% Load	Torque Slope	17.02 ft-lb/psi
Speed Ratio	.15 rev/gal	.14 rev/gal	.12 rev/gal	Operating Torque (max)	8940 ft-lbs
RPM	45-90 rpm	40-85 rpm	27-72 rpm	Power	153 hp

Physical Data			
Overall Length	31’	Weight	2800#
Top Connection	4-1/2” X.H. Box	Bottom Connection	4-1/2” Reg. Box
Float Valve Bore	4R Float	Bit Box Gap	3 ¼”(open) 2 ¾ (closed)

Operating Data		
	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	672,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

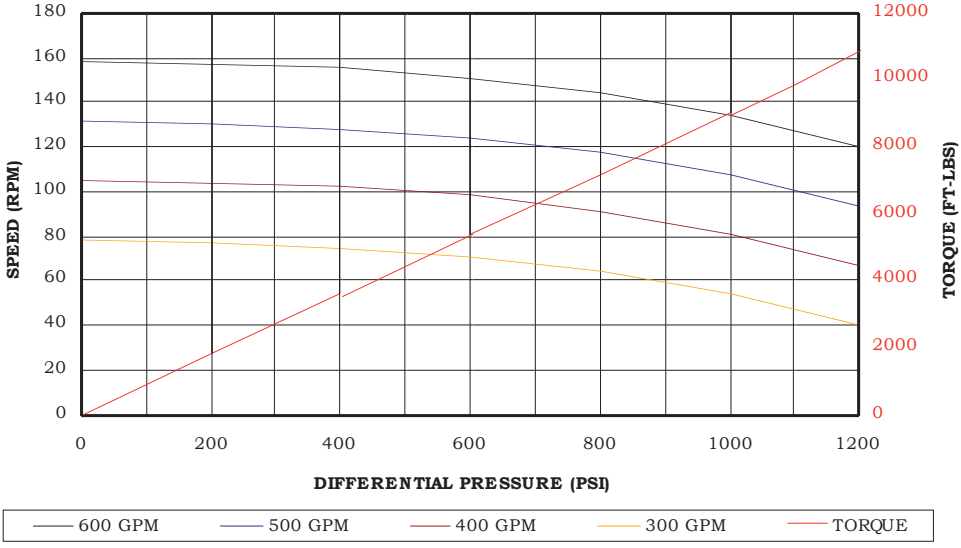
6-3/4”

LIGHTNING PERFORMANCE MOTOR

Performance Data					
Flow Rate		300-600 GPM		Δ PSI	1050 psi
	No Load	50% Load	100% Load	Torque Slope	9.07 ft-lb/psi
Speed Ratio	.26 rev/gal	.25 rev/gal	.22 rev/gal	Operating Torque (max)	9600 ft-lbs
RPM	78-157 rpm	75-150 rpm	54-134 rpm	Power	292 hp

Physical Data			
Overall Length	31’	Weight	2800#
Top Connection	4-1/2” X.H. Box	Bottom Connection	4-1/2” Reg. Box
Float Valve Bore	4R Float	Bit Box Gap	3 ¼”(open) 2 ¾ (closed)

Operating Data		
	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	672,000 lbs



Fasdrill DIRECTIONAL SERVICES

JAGUAR PERFORMANCE MOTORS

MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

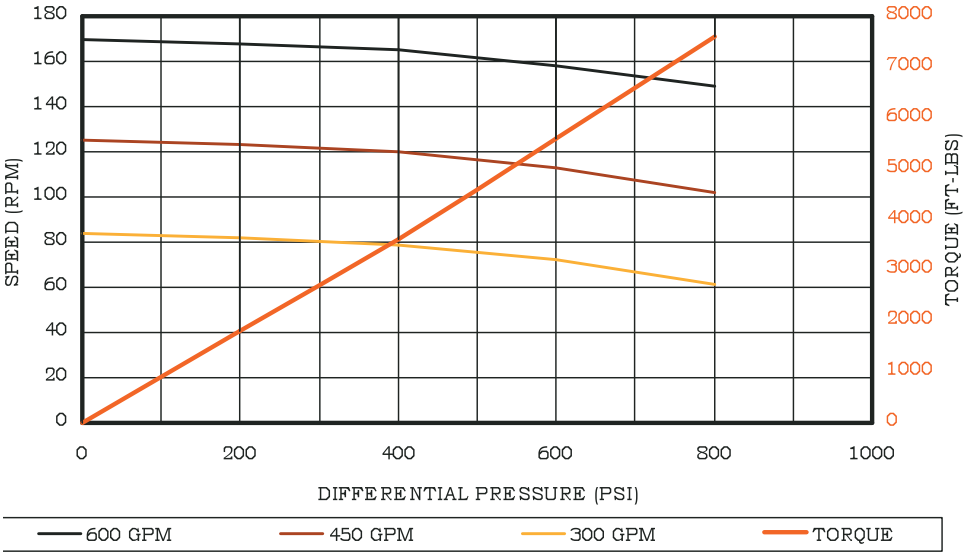
6-3/4”

JX PERFORMANCE MOTOR

Performance Data					
Flow Rate		300-600 GPM		Δ PSI	875 psi
	No Load	50% Load	100% Load	Torque Slope	8.32 ft-lb/psi
Speed Ratio	.29 rev/gal	.27 rev/gal	.23 rev/gal	Operating Torque (max)	7300 ft-lbs
RPM	87-174 rpm	77-163 rpm	52-140 rpm	Power	208 hp

Physical Data			
Overall Length	27’	Weight	2200#
Top Connection	4-1/2” XH Box	Bottom Connection	4-1/2” Reg. Box
Float Valve Bore	4R Float	Bit Box Gap	3 ¼”(open) 2-3/4”(closed)

Operating Data		
	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	672,000 lbs



Fasdrill DIRECTIONAL SERVICES
JAGUAR PERFORMANCE MOTORS
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JAGUAR
PERFORMANCE MOTORS

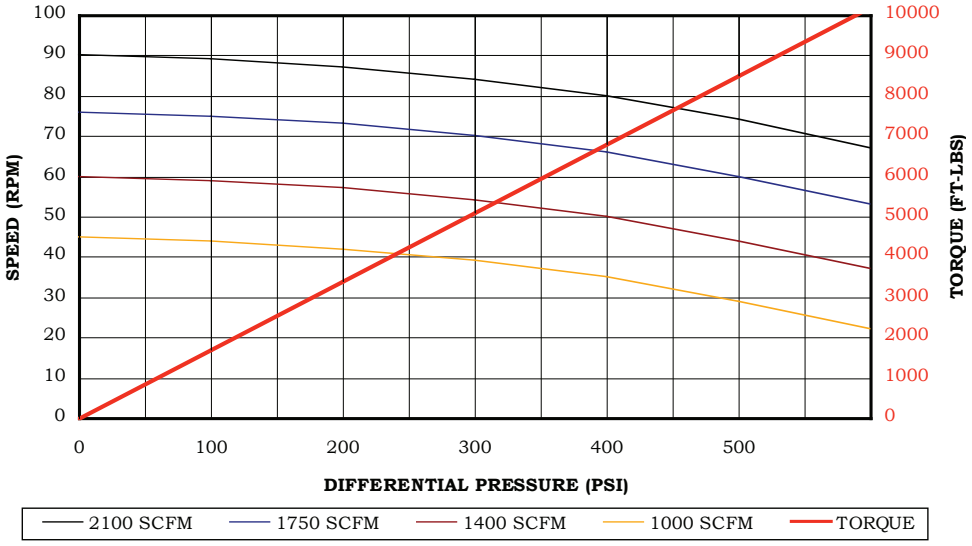
AIR 6-3/4”

LIGHTNING-SS PERFORMANCE MOTOR

Performance Data					
Flow Rate		1000-2100 SCFM		Δ PSI	525 psi
	No Load	50% Load	100% Load	Torque Slope	17.02 ft-lb/psi
Speed Ratio	.15 rev/gal	.14 rev/gal	.12 rev/gal	Operating Torque (max)	8940 ft-lbs
RPM	45-90 rpm	40-85 rpm	27-72 rpm	Power	153 hp

Physical Data			
Overall Length	31’	Weight	2800#
Top Connection	4-1/2” X.H. Box	Bottom Connection	4-1/2” Reg. Box
Float Valve Bore	4R Float	Bit Box Gap	3 ¼”(open) 2 ¾ (closed)

Operating Data		
	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	672,000 lbs



Fasdrill DIRECTIONAL SERVICES
JAGUAR PERFORMANCE MOTORS
MADE IN THE USA

8" MOTORS

Fasdrill DIRECTIONAL SERVICES

8" MOTORS

JAGUAR
PERFORMANCE MOTORS

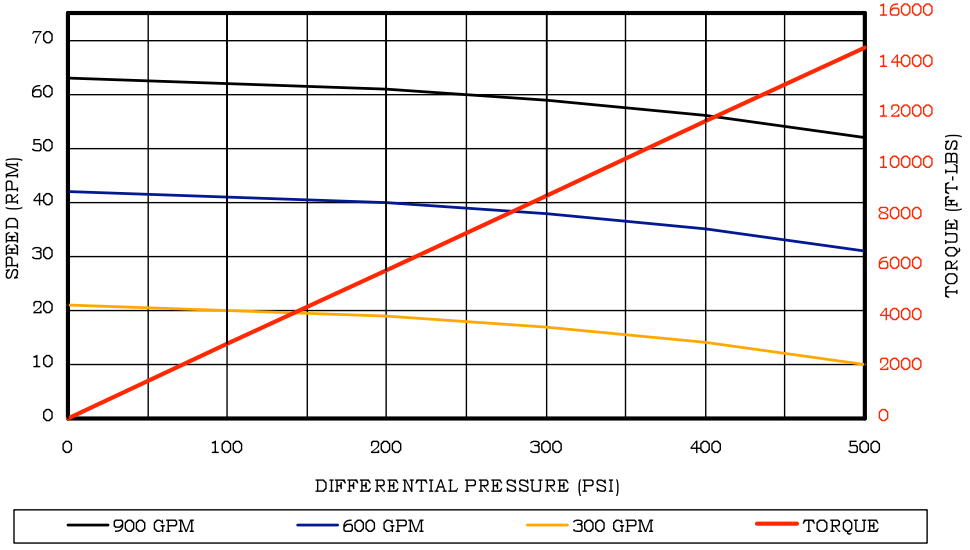
8”

LIGHTNING-USS PERFORMANCE MOTOR

Performance Data					
Flow Rate		300-900 GPM		Δ PSI	438 psi
	No Load	50% Load	100% Load	Torque Slope	29.3 ft-lb/psi
Speed Ratio	.07 rev/gal	.067 rev/gal	.062 rev/gal	Operating Torque (max)	12,816 ft-lbs
RPM	21-63	19-61	14-56	Power	161 hp

Physical Data			
Overall Length	32’	Weight	4000#
Top Connection	6-5/8” Reg. Box	Bottom Connection	6-5/8” Reg. Box
Float Valve Bore	6R Float	Bit Box Gap	2 ¼”(open) 1¾ (closed)

Operating Data		
	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	900,000 lbs



Fasdrill DIRECTIONAL SERVICES
JAGUAR PERFORMANCE MOTORS
MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

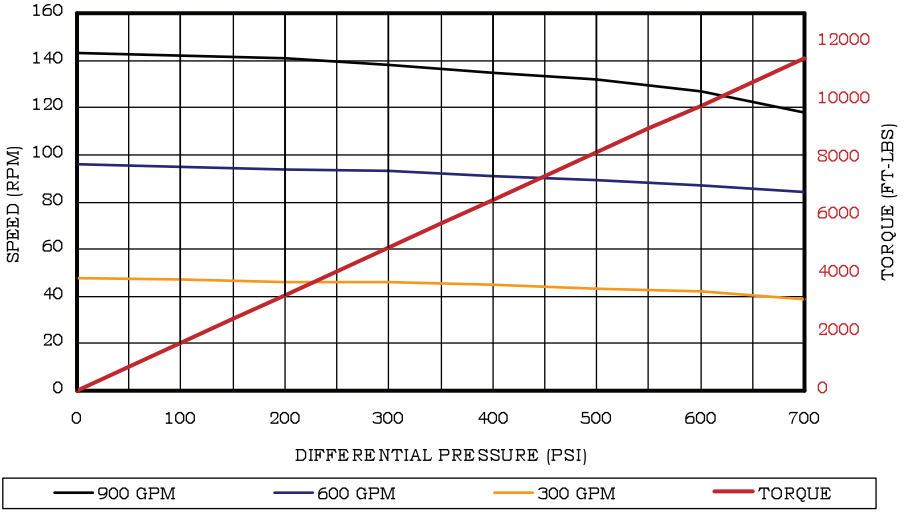
8”

LIGHTNING PERFORMANCE MOTOR

Performance Data					
Flow Rate		300-900 GPM		Torque Slope	16.38 ft-lb/psi
	No Load	50% Load	100% Load	Δ PSI (operating)	700 psi
Speed Ratio	.16 rev/gal	.14 rev/gal	.13 rev/gal	Torque (operating)	11,469 ft-lbs
RPM	48-143 rpm	42-126 rpm	39-118 rpm	Power	283 hp
		Stall Torque	*17,203 ft-lbs*	*Stall Δ PSI*	*1050 psi*

Physical Data			
Overall Length	31’	Weight	3200#
Top Connection	6-5/8” Reg. Box	Bottom Connection	6-5/8” Reg. Box
Float Valve Bore	6R Float	Bit Box Gap	3 ¼”(open) 2 ¾ (closed)

Operating Data		
	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	900,000 lbs



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JAGUAR PERFORMANCE MOTORS

MADE IN THE USA

JAGUAR
PERFORMANCE MOTORS

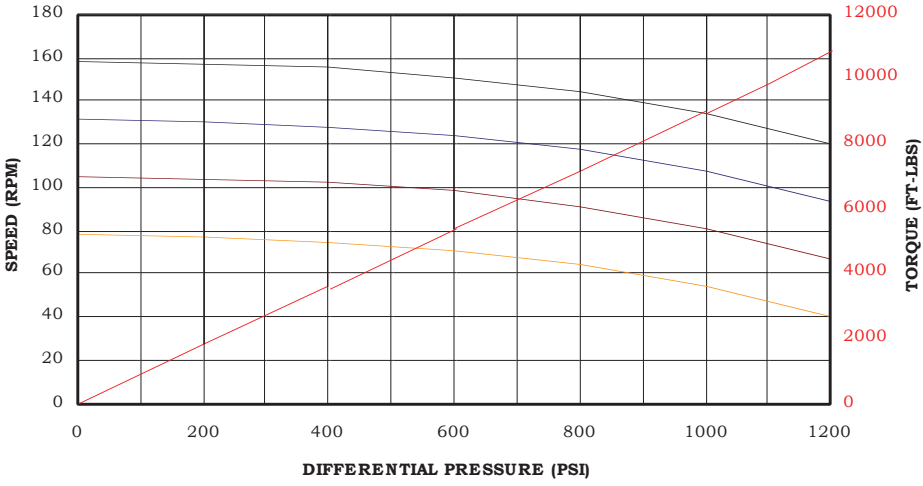
8”

LIGHTNING PERFORMANCE MOTOR
LOW FLOW

Performance Data					
Flow Rate		300-600 GPM		Δ PSI	1050 psi
	No Load	50% Load	100% Load	Torque Slope	9.07 ft-lb/psi
Speed Ratio	.26 rev/gal	.25 rev/gal	.22 rev/gal	Operating Torque (max)	9600 ft-lbs
RPM	78-157 rpm	75-150 rpm	54-134 rpm	Power	292 hp

Physical Data			
Overall Length	31’	Weight	3200#
Top Connection	6-5/8” Reg. Box	Bottom Connection	6-5/8” Reg. Box
Float Valve Bore	6R Float	Bit Box Gap	3 ¼”(open) 2 ¾ (closed)

Operating Data		
	Operating	Maximum
WOB	72,000 lbs	125,000 lbs
Motor Overpull	242,000 lbs	900,000 lbs



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JAGUAR PERFORMANCE MOTORS
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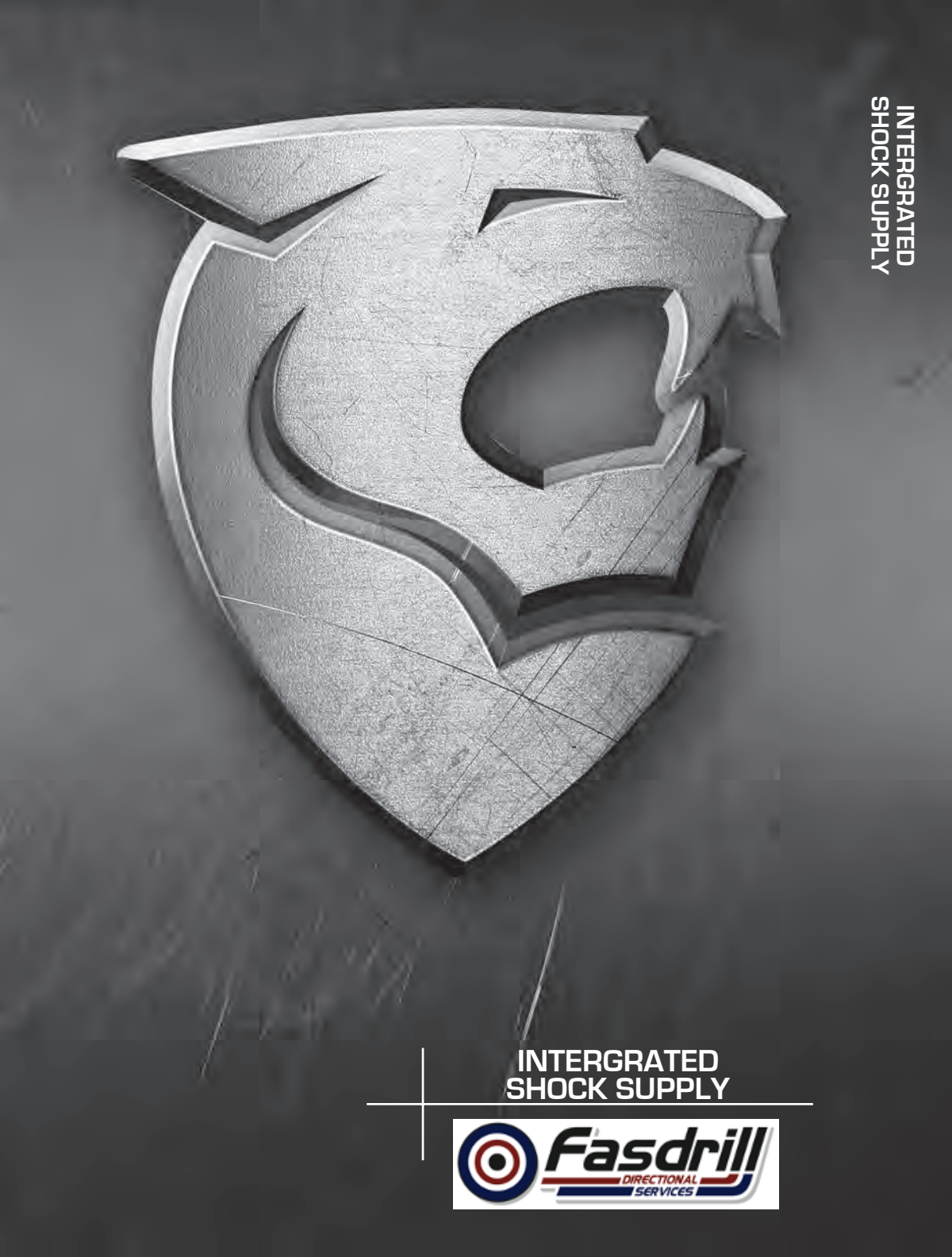
INTERGRATED
SHOCK SUPPLY
INTERGRATED
SHOCK SUPPLY
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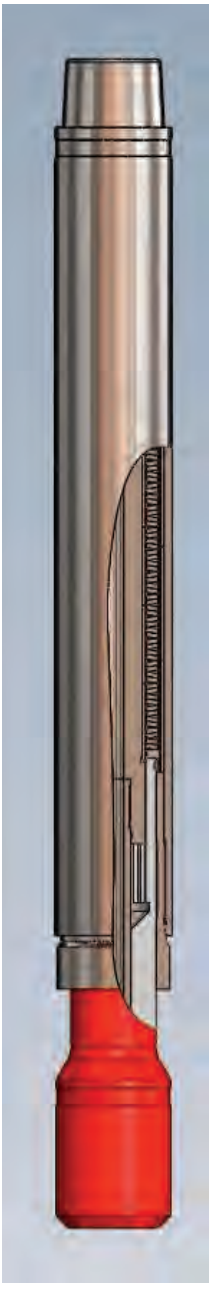
SERVICES

JAGUAR
PERFORMANCE MOTORS

Downhole Motor with Integrated Shock Assembly



Overview:

- 6 ¾" motor with an integrated shock sub
- Belleville spring stack allows 3" of travel
- Thrust loads up to 40,000 lbs
- Designed for PDC applications
- Splined connection between the upper and lower bearing mandrel
- Minimal Pump Open Force

Benefits:

- Reduces bit bounce
  - Extends bit life
  - Improves penetration rates (keeps the bit on bottom)
- Reduces BHA premature failures due to shock and vibration

	Operating WOB	Total Deflection
6.75" Shock Motor*	30,000 lbs	3.0"

*available with any 6-3/4" power section

DIRECTIONAL MOTORS

DIRECTIONAL MOTORS

Fasdrill DIRECTIONAL SERVICES

JAGUAR
PERFORMANCE MOTORS

4-3/4”

BUILD RATES - ABH

ADJUSTABLE MOTOR DATA	
Bit To Stabilizer	*N/A*
Bit To Bend	*60”*
Overall Length	*29’*

BUILD RATE (Degrees/100 ft.)			
Degree of Bend	Hole Size		
	6”	6-1/2”	6-3/4"
.39	.32		
.78	4.22	2.45	1.26
1.15	7.91	6.15	4.96
1.50*	11.41	9.64	8.45
1.83*	14.70	12.94	11.75
2.12*	17.59	15.83	14.64
2.38	20.20	18.42	17.23
2.6		20.62	19.43
2.77		22.31	21.12
2.89		23.51	22.32
2.97		24.30	23.11
3.0			23.41

** fixed bends available in these comparable angles*

JAGUAR
PERFORMANCE MOTORS

6-1/2”

BUILD RATES - ABH

ADJUSTABLE MOTOR DATA	
Bit To Stabilizer	22”
Bit To Bend	53”
Overall Length	24’

BUILD RATE (Degrees/100 ft.)			
Degree of Bend	Hole Size		
	7-7/8”	8-1/2”	8-3/4"
.39	1.13		
.78	5.63	1.69	0.10
1.15	9.89	5.95	4.37
1.50*	13.92	9.98	8.4
1.83*	17.71	13.78	12.20
2.12*	21.04	18.03	15.53
2.38	24.03	20.10	18.52
2.6		22.63	21.05
2.77		24.58	23.00
2.89		25.96	24.37
2.97		26.87	25.29
3.0		27.22	25.64

** fixed bends available in these comparable angles*

JAGUAR
PERFORMANCE MOTORS

6-3/4”

BUILD RATES - ABH

ADJUSTABLE MOTOR DATA	
Bit To Stabilizer	*22”*
Bit To Bend	*53”*
Overall Length	*24’*

BUILD RATE (Degrees/100 ft.)			
Degree of Bend	Hole Size		
	7-7/8”	8-1/2”	8-3/4"
.39	1.13		
.78	5.63	1.69	0.10
1.15	9.89	5.95	4.37
1.50*	13.92	9.98	8.4
1.83*	17.71	13.78	12.20
2.12*	21.04	18.03	15.53
2.38	24.03	20.10	18.52
2.6		22.63	21.05
2.77		24.58	23.00
2.89		25.96	24.37
2.97		26.87	25.29
3.0		27.22	25.64

** fixed bends available in these comparable angles*

JAGUAR
PERFORMANCE MOTORS

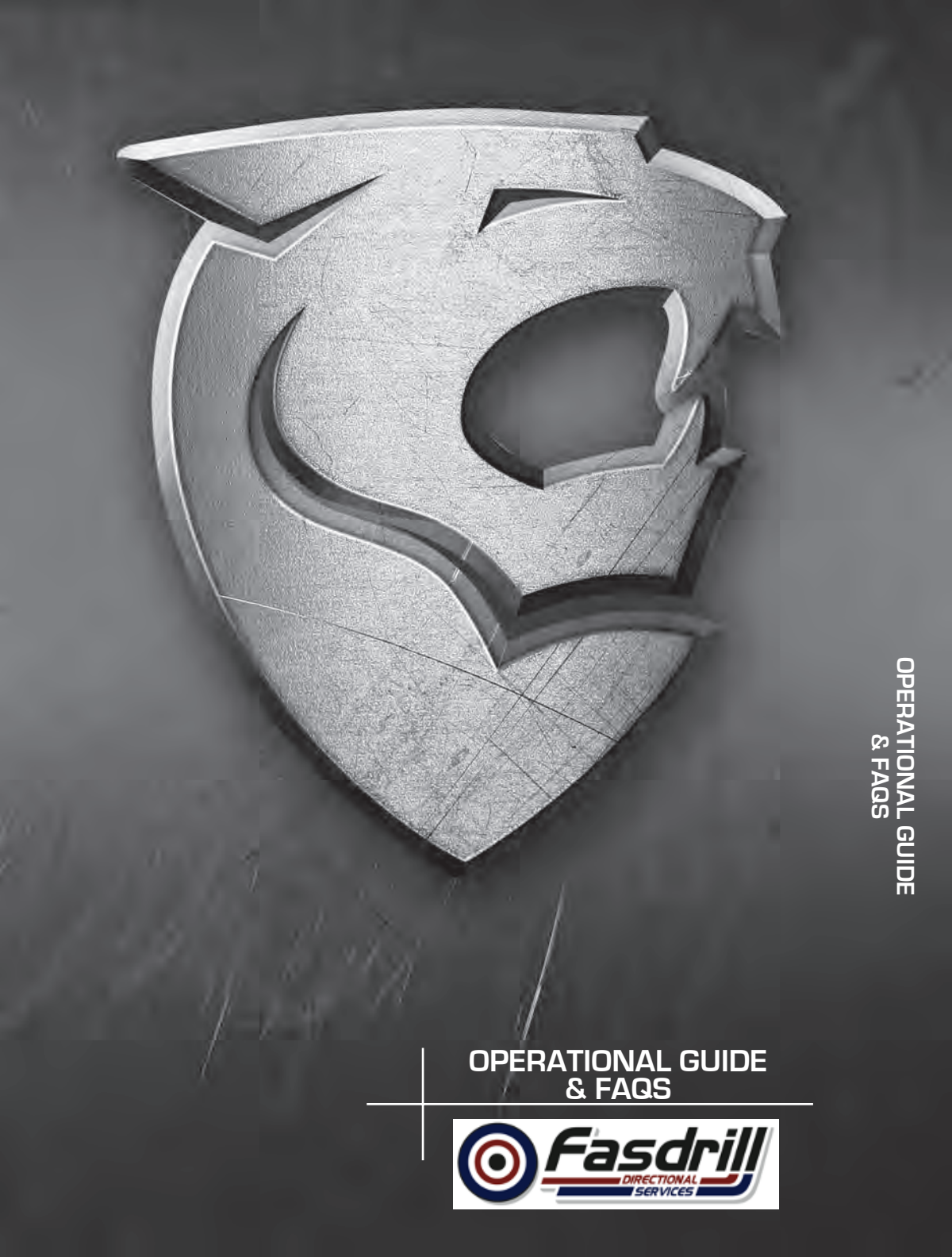
8”

BUILD RATES – ABH

ADJUSTABLE MOTOR DATA	
Bit To Stabilizer	N/A
Bit To Bend	83”
Overall Length	28’

BUILD RATE (Degrees/100 ft.)			
Degree of Bend	Hole Size		
	9-5/8”	10-7/8”	12-1/4"
.39			
.78	1.87		
1.15	4.54	1.43	
1.50*	7.07	3.95	.54
1.83*	9.45	6.33	2.92
2.12*	11.54	8.45	5.01
2.38	13.41	10.30	6.89
2.6	15.00	11.89	8.48
2.77		13.11	9.70
2.89		13.98	10.57
2.97		14.55	11.14
3.0		14.77	11.36

** fixed bends available in these comparable angles*



OPERATIONAL GUIDE
& FAQS

OPERATIONAL GUIDE
& FAQS

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JAGUAR
PERFORMANCE MOTORS

	PROBLEM	CAUSE	SOLUTION
1	Pressure decreases below expected level when off bottom and increases when on bottom with very light bitweight.	Catastropic connection failure - The pressure fluctutation is the result of the top sub catch being sealed and un-seated inside the top sub.	Trip out the hole carefully, keep pumps off if possible.
2	ROP decreases while pressure increases, ROP fails to respond to increased WOB.	Possible bit balling.	Pick up off bottom, reciprocate string, increase flow, to clean bit face, if necessary place bit just off bottom while circulating, resume drilling operations if pressure returns to expected levels.
3	ROP slows while torque increases, WOB normal.	Stabilizers hanging,or bit may be going under gage.	Work pipe, note tight spots, ream out if possible, return to drilling, if problem persist, bit may be going under gage.
4	ROP and pressure decrease while WOB and torque remain normal.	Possible washout in string and or formation change.	Pick up off bottom, perform drill pipe washout checks, if washout detected POOH, if not verify off bottom PSI for change and verify fluid returns.
5	ROP decreases while rotary torque and pressure are irregular.	Junk in hole, non-homogeneous formation, cone locking, or PDC going under gage side loading.	Pick up off bottom to wash junk out of the way, if torque and pressure do not stabilize, POOH.
6	Pressure increases and decreases with normal WOB and unchanged flow and torque.	String ID obstructed, or stator chucking plugging bit with rubber and washing thru bit.	Check off bottom pressure, recycle pumps, reciprocate string.
7	Pressure decreases with normal WOB and unchanged flow and torque, pumps strokes increase.	Probable washout in string.	Pick up off bottom, perform drill pipe washout checks, if washout detected POOH.
8	No differential pressure with normal WOB, flow and pressure.	1. Formation change to very hard or 2. Stabilizers or drill string hanging up or 3. Dull bit, look for gradual loss of pressure and ROP or 4. Possible power transmission failure (has never happened to a Jaguar motor).	1. Check off bottom pressure, recycle pumps, slow RPM's or 2. Pick up off bottom, rotate string at various RPM's whil applying WOB gradually, POOH if unsuccessful or 3. Check off bottom pressure for chnages, attempt to restore differential pressure, POOH if unsuccssful or 4. If attempts are not successful restoring differential pressure POOH.
9	Sudden increase in standpipe pressure.	Catastropic stator failure, or bearing locking up due to excessive bouncing of motor breaking down races and bearings.	Stop rotating, shut off or slow pumps by 50% lift off bottom work pipe - POOH if pressure is not relieved.
10	Slow drop in standpipe and or differential pressure and ROP, WOB normal.	Possible OD bit wear or damage.	POOH for bit change if necessary.
11	Differential pressure increases above expected levels with normal WOB.	Possible stator wear - resulting in a WEAK Motor.	Continue drilling with lower WOB's, if not satisified with ROP POOH for new motor- NOTE: can be caused by excessive LG Solids or sand in mud.

FAQS

How do I know what type of float valve goes with my mud motor?
The Lightning Series 4 ¾" mud motor utilizes a 3 ½ IF float valve, the Lightning Series 6 ¾" mud motor utilizes a 4R float valve and the Lightning Series 8" mud motor utilizes a 6R float valve.

How do I figure the motor/bit RPM and rotary RPM for a total RPM?
Off Bottom RPG x GPM Pumped + Rotary Speed = Total RPM Off Bottom

How does a Jaguar performance mud motor turn the bit?
Each Jaguar performance mud motor utilizes a rotor and stator that is based on the Moineau principle. Drilling fluid is pumped downhole through the drill pipe and is converted into rotation and torque. This mechanical energy is transferred through the rest of the performance mud motor directly to the drill bit.

Do you have hard rubber in your stators?
Jaguar can provide a hard rubber at an additional cost, should a customer request it. Considerations should be made for availability and reduced life expectancy of the stator profile.

How much LCM can your motor handle?
If pre-mixed, anywhere from 17-21 lbs per bbl.

Do your downhole motors use a sealed bearing pack?
No, Jaguar Performace Motors use a mud lubricated bearing pack.

What is stage in motor?
The number of stages in a motor power section is the number of times the rotor makes a 360 degree revolution within the length of the power section.

GLOSSARY

Fasdrill DIRECTIONAL SERVICES

Glossary

Aniline Point	The lowest temperature at which oil can be thoroughly mixed with aniline. The lower the aniline point of oil, the more damaging it is to stator rubber.
Aromatic	A major group of highly reactive hydrocarbons that tend to degrade and soften rubber. Drilling fluids with higher aromatic contents are more damaging to rubber. The drilling fluid's aniline point can be used to predict the probability of rubber damage due to the fluid's aromatic content.
Back Reaming	Operation of a motor while pulling the motor off-bottom for the purpose of smoothing irregularities in the well bore. Although dynamic motor loads may be less than when on-bottom drilling, back reaming can place high loads on the bearing assembly because hydraulic thrust load applied by the drill bit.
Balanced Weight on Bit	A weight on bit that will equal the hydraulic thrust loads placed on the bearing assembly by the bit and motor differential pressures.
Bit Box Gap	The clearance between the motor's rotating bit box and the stationary housing above it.
Bit Over Pull	An axial load applied in tension to a motor's drive shaft. This load can be applied to the drive shaft when the drill bit is stuck in the hole and the drill string is pulled upward.
Bit Over Pull-Continuous Operation	The maximum axial load that can be applied in tension to the motor's drive shaft before the motor may experience internal damage and should be laid down.

Bit Over Pull-Ultimate Loading	The maximum axial load that can be applied in tension to the motor's drive shaft before it fails and physically separates.
Body Over Pull	An axial load applied in tension to a motor's housing. This load can be applied when part of a motor housing is stuck in the hole and the drill string is pulled upward.
Body Over Pull-Continuous Operation	The maximum load that can be applied in tension to the motor's housing before the motor may experience connection damage and should be laid down.
Body Over Pull-Ultimate Loading	The maximum axial load that can be applied in tension to a motor's housing before it fails and physically separates.
Compression of the Stator	The amount of stator rubber deformation due to the dimensional interference between the stator and mating rotor. Sometimes called interference.
Interference of the Power Section	The amount of dimensional overlap of the major and minor diameters power section's rotor and stator. This interference will vary depending upon the type of motor. (e.g. standard, high temperature or air drill), and will also change as the stator and rotor wear during use. Also referred to as compression.
Hydraulic Thrust	A load created by a pressure differential acting over an area.
LCM	Any of a wide range of drilling fluid additives whose purpose is to prevent the loss of drilling fluid to the formation. LCM is an acronym for lost circulation material.
Lobes	Rounded projections on both the rotor and stator. They act like teeth on a gear to modulate the speed output of the power section.

Minor Diameter	For the stator, this is the size of the largest cylinder that could be placed into the stator. For the rotor, this is the diameter of the rotor if the lobes were completely removed.
Major Diameter	For the stator, this is the size of the largest cylinder that could be placed inside of the stator if the stator lobes were completely removed. For the rotor, this is the inside diameter of the smallest cylinder that can be placed over the rotor lobes.
Body Over Pull-Ultimate Loading	The maximum axial load that can be applied in tension to a motor's housing before it fails and physically separates.
Motor Stall	A motor condition of zero rpm output caused by overloading the motor.
Motor Over Speed	A motor condition wherein the output motor rpm exceeds rated limits.
Motor Differential Pressure	The pressure consumed by the motor's power section when loaded. It is seen on the rig floor as the difference between on and off-bottom standpipe pressures.
Stage	One 360 spiral of the power section's stator. Sometimes referred to as pitch.
Under Balanced Drilling	A drilling method in which the formation's pore pressure exceeds that of the drilling fluid's hydrostatic pressure. The resulting differential pressure eliminates the "chip hold down" effect and cuttings are free to lift off of the bottom of the hole.
WOB	The weight applied to the bit while drilling.


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