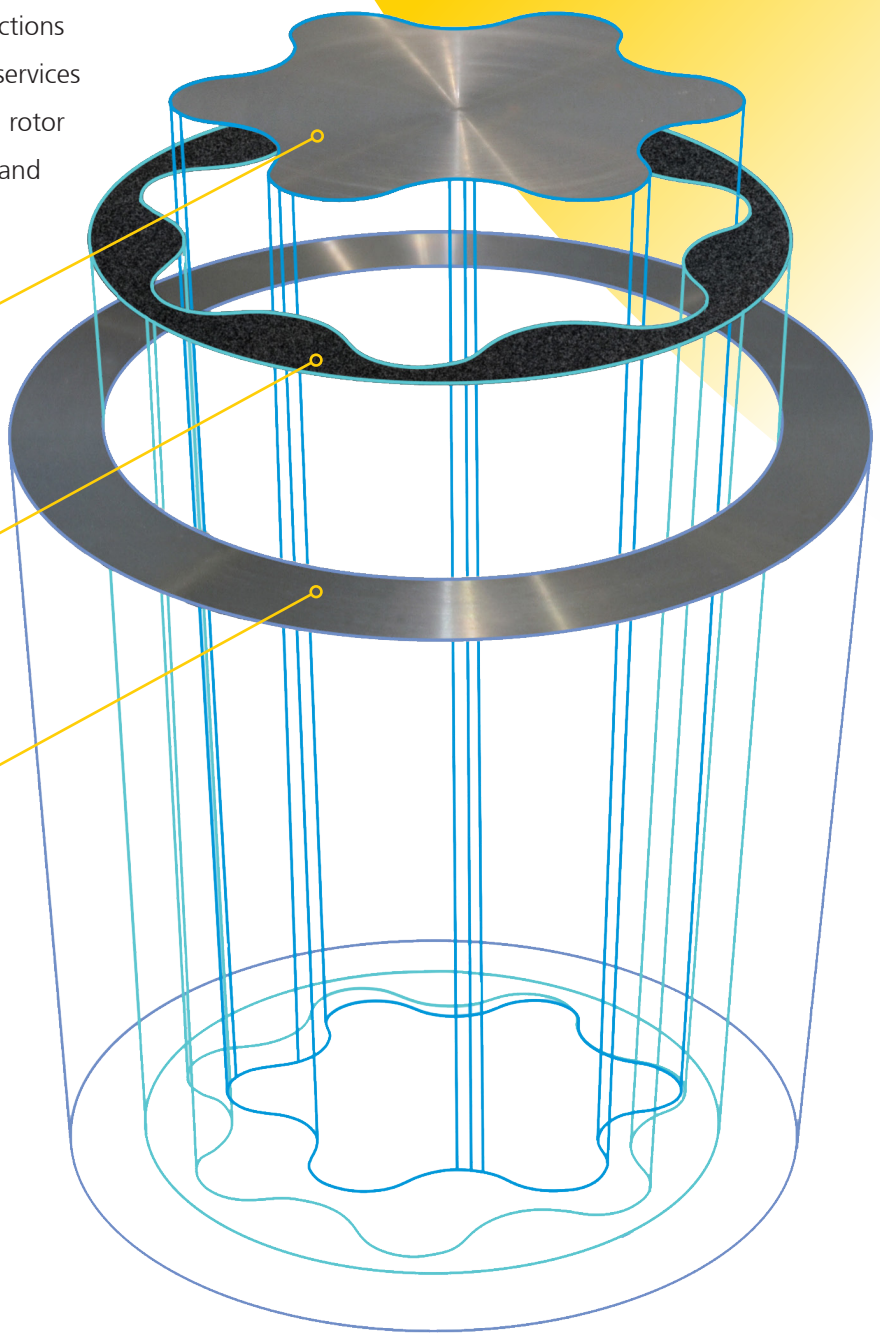
Precision that Powers Performance

Abaco Drilling Technologies is a leading technology-driven manufacturer of power sections for worldwide Oil & Gas drilling and thru-tubing operations. Our modern facilities, precision manufacturing capabilities, quality control, R&D, and engineering proficiency deliver ideal elastomer and power section solutions that increase efficiency, improve safety and maximize downhole performance. Our elite portfolio of elastomer technology increases durability and extends the lifecycle of our power sections. We manufacture a full range of power sections from 1-11/16 inch thru 11-1/4 inch diameter. Our services include state-of-the-art CNC manufacturing, CMM rotor measurement and repair, complete stator relining, and drilling fluid compatibility testing for mud motors.



ROTORS
CNC rotor tolerance to within +/- 0.003" and quality control CMM measuring with accuracy down to 0.0001"

ELASTOMERS
Application-specific elastomer technologies

STATORS
Diameters ranging from 1-11/16" thru 11-1/4"

Abaco
DRILLING TECHNOLOGIES

LEADING **POWER SECTION** TECHNOLOGY

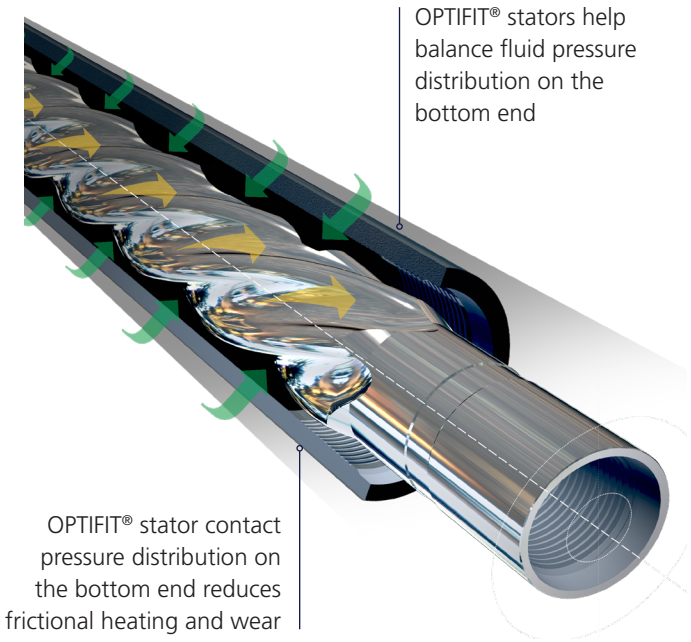
OPTIFIT®
APPLICATIONS

Abaco DRILLING TECHNOLOGIES

OPTIFIT® Stators increase reliability by addressing stresses and pressure on the power section lower end

The latest engineering innovation in Abaco stator technology, OPTIFIT® stators create an optimized fit for all drilling applications. These new single direction stators with deviated profiles address performance drilling stresses on the power section lower end.

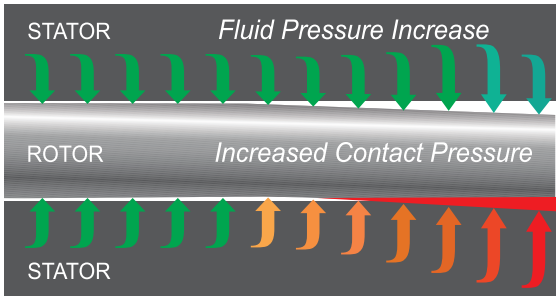
The variable fit of the rotor and stator reduces friction and overheating of the power section lower end. This results in greater power section reliability at high power and a reduction in field failure rates. Shop repair rates can also be minimized.



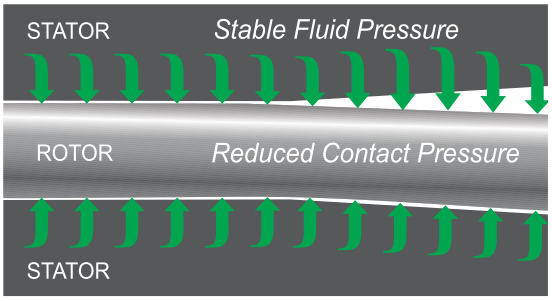
Benefits:

- Reduced frictional heating
- Greater reliability at high power
- Extended operating range
- Reduced field failure rates
- Available in all select sizes and fits

Standard Bottom End Contact Pressure



Optimized Bottom End Contact Pressure



CONVENTIONAL
APPLICATIONS

Abaco DRILLING TECHNOLOGIES

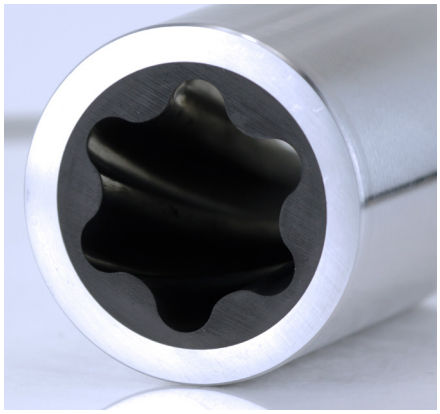
4-3/4” thru 11-1/4” Power Sections offer cost effective solutions with fast, convenient relining services

In addition to our OPTIFIT® stators, EVENTEK® one piece profile stators and Thru- Tubing power sections, Abaco Drilling Technologies offers a broad selection of reliable and durable conventional power sections ranging from 4-3/4 inch thru 11-1/4 inch diameter. Abaco’s conventional power section product line features our proprietary HPT™ (Temperature), HPO™ (Optimized) and HPW™ (Wear) elastomers. Our standard power sections can be teamed with mud motors ranging from 1-11/16 inch thru 11-1/4 inch diameter.

Cross Section

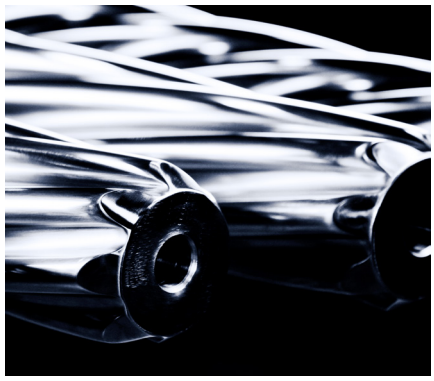
Fast, Convenient Reline Service

Stators in need of reline can be delivered to Abaco service centers in the USA, Canada and Dubai at your convenience. Our experienced personnel will address your reline concerns in a productive and highly cost-effective manner. We reduce the time needed for the reline process by days, even weeks. We have a proven, logistical network for priority freight delivery.



Stator

Rapid product delivery from our worldwide service centers in the United States, Canada, and UAE can help keep your operations up and running at peak efficiency. Abaco’s Drilling Technologies facility in Odessa, Texas house an updated inventory of our latest rotors and stators — in stock and ready for immediate delivery.



Rotor

THRU-TUBING
APPLICATIONS

Abaco DRILLING TECHNOLOGIES

Thru-Tubing Power Sections are equipped for the most technically challenging and demanding applications

Abaco is a leading technology-driven manufacturer of power sections for thru-tubing motors. Our power sections help increase drilling and well intervention efficiency in technically challenging environments.

Experienced personnel provide expert evaluation to support every phase of rotor and stator design, from engineering to manufacturing including in-house and field-proven testing.

When certain downhole environments require extremely durable elastomer, our conventional hard rubber elastomer delivers increased power with a new harder durometer formulation designed to increase torque output and durability and yield higher reliability.

Abaco stators are designed with the most advanced High Performance (HP) elastomers to meet your specific downhole challenges and perform well in nitrogen injection applications.

Our rotors are manufactured with a standard offering of 17-4 stainless steel (other materials available upon request). Rotor coating choices include chrome, carbide and carbide substitutes.

Cross Section

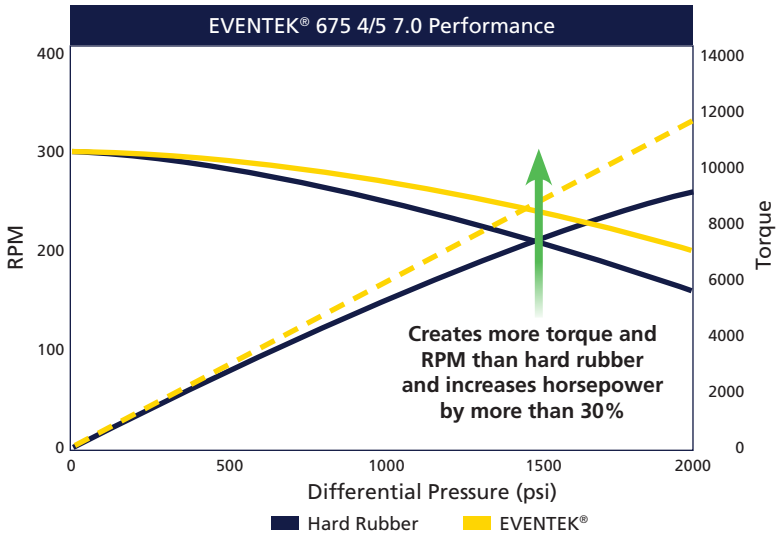
Rotor End View

EVENTEK®
APPLICATIONS

Abaco DRILLING TECHNOLOGIES

EVENTEK® Stators create more power and reduce the cost per foot drilled versus conventional power sections

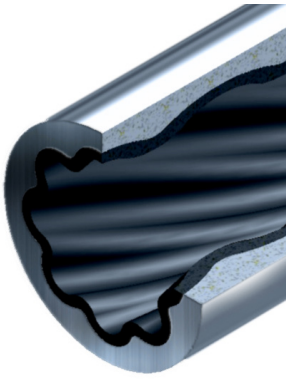
The highly programmable profile shaping allows for rapid design of new models and custom solutions for improving existing stator fleets. EVENTEK® creates 20-30% more power and reduces the cost-per-foot drilled over conventional power sections. These power sections reduce hysteresis, help eliminate stick-slip, and offer a better seal throughout the stator to deliver more consistent power to the bit.

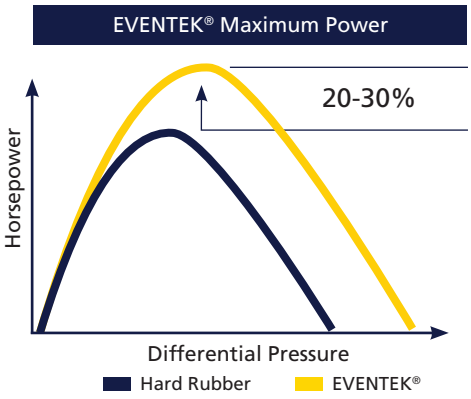


Maximum Power

- Highest power output possible
- Wider operating range due to lower rubber expansion
- Maintains high power output for the entire run
- Use existing conventional rotor fleet for most models
- Stiffer support to the rotor means less deviation from the nominal eccentricity resulting from the same pressure differential for less chance of leaking

Cross Section





Features:

- One piece steel construction
- High quality tubular alloy
- Excellent geometry control
- Multi reline capabilities
- Tubes can be straightened
- Potential cost advantage

HPO™ Elastomers are optimized for high torque and increased reliability in high solids drilling applications

Abaco's HPO™ high strength elastomers are designed to be combined with Abaco's proprietary OPTIFIT® technology and made for challenging drilling environments. When combined with OPTIFIT®, HPO™ provides the same power output as our HPW™, but greater reliability in high wear and higher temperature environments.

Features

- Designed to be run with OPTIFIT®
- Improved life in higher temperature environments
- Improved fluid resistance leading to less chunking incident

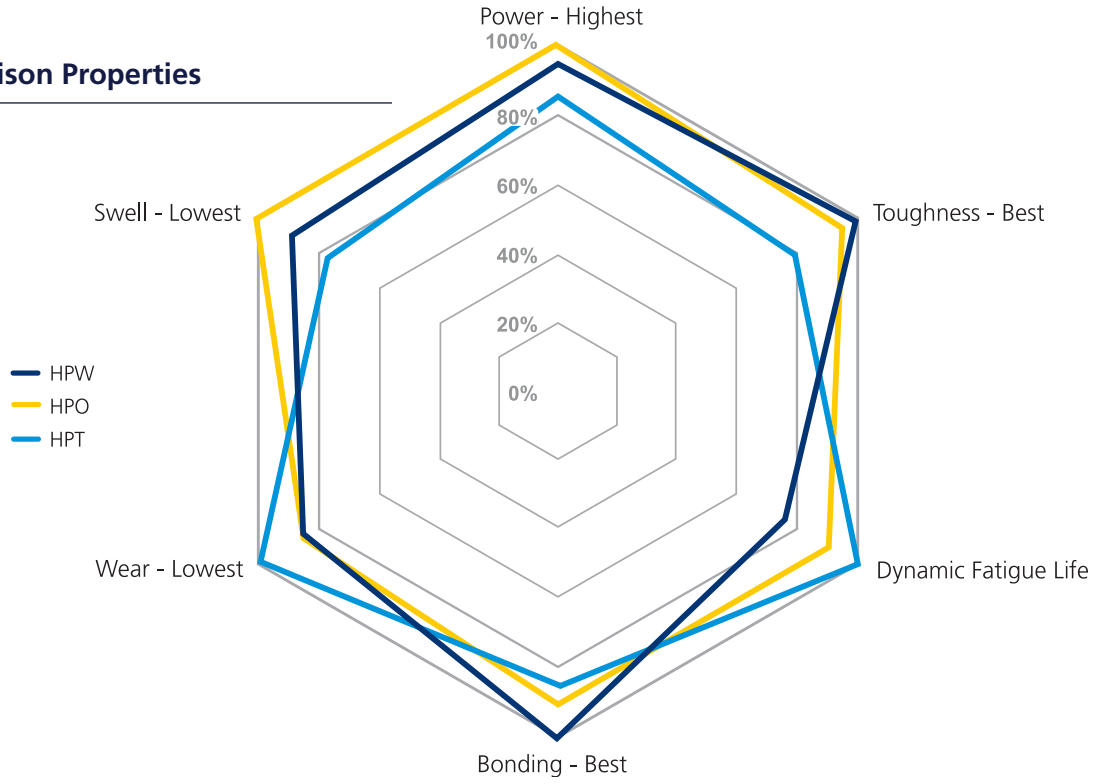
High Power Output Elastomer

HPO™ meets or exceeds the power output necessary for demanding drilling applications and customer expectations.

Increased Endurance at Steady Power Demand

- Capacity of rubber to survive repeated load cycle is increased
- Tested extensively in both WBM and OBM to refine load bearing capability
- 2x to 3x increase in life for heavily loaded steady state conditions

Elastomer Comparison Properties



HPW™ Elastomers address high-wear situations that occur in high-friction and/or high torque use

Abaco's HPW™ Elastomer is designed to improve power output and reliability of the power section in situations that occur in high wear and high temperature environments.

Features

- Hard rubber composition for high power output
- Maintains high power output by controlling wear
- High reliability in all mud types
- Higher power output than other hard rubber compositions at elevated temperatures

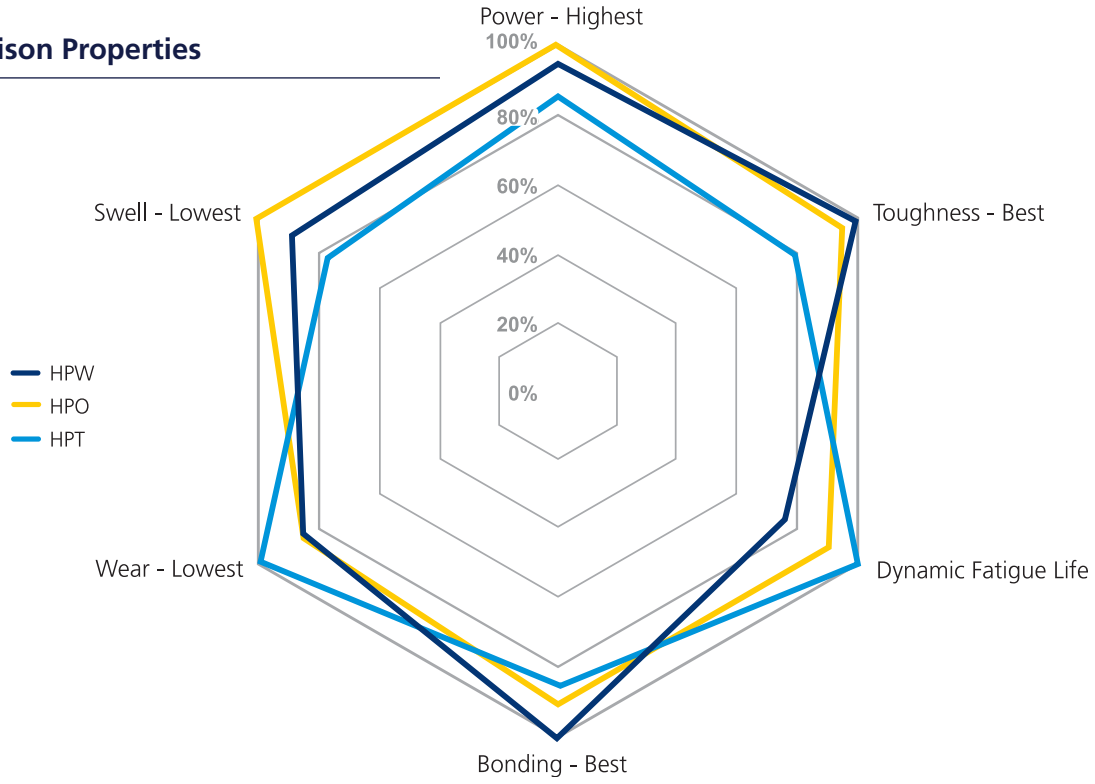
Wear Resistance Testing

HPW™ is specially formulated to give high hardness and stiffness but also have better wear resistance than other hard rubber formulas. In laboratory testing, HPW™ has shown to have 30% better wear resistance than a conventional hard rubber.

Higher Modulus Elastomer

HPW™ is highly reinforced and has 25% higher stiffness than conventional hard rubber resulting in a 5% to 10% higher horse power output potential.

Elastomer Comparison Properties



HPT™ (HNBR) Elastomers increase reliability in extreme environments and in high temperature situations

Extreme temperatures can affect performance of conventional elastomers in stators. Abaco is currently developing HPT™ elastomers to provide increased durability in elevated temperatures.

Features

- High temperature elastomer designed to operate at temperatures up to 375 °F
- Hard rubber composition for high power output
- Excellent adhesion at high temperature
- Excellent wear resistance in all applications

High Temperature Elastomer

- HPT™ is a hard rubber elastomer with high power output
- Power output is expected to be similar to HPW, which is a high wear elastomer designed to deliver increased durability in high performance drilling applications

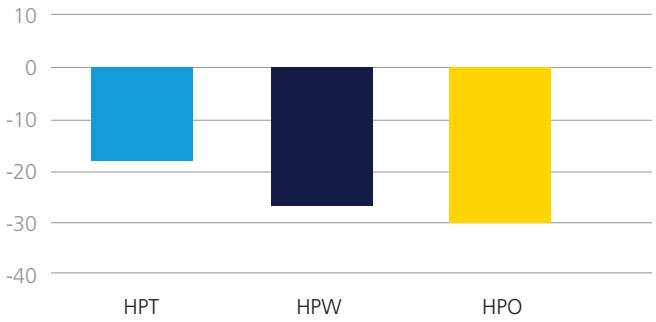
Adhesive Strength

- HPT™ maintains extremely high bond strength in OBM and WBM at temperatures above 300°F
- HPT™ also offers extended bond strength against fluids

Fluid Resistance

- HPT™ shows improved fluid resistance in both WBM and OBM at elevated temperature
- HPT™ fluid resistance also allows the elastomer to maintain its elasticity to improve durability in all applications

Relative Property Loss at 325°F



Technical Data
OVERVIEW

Abaco DRILLING TECHNOLOGIES

Power Section Rotor and Stator Geometry

Power Sections available in sizes 1-11/16 inch thru 11-1/4 inch diameter

Abaco Drilling Technologies brings together the latest technological advances in manufacturing, quality control, R&D, customer service and unparalleled engineering know-how to provide the highest quality power sections of rotors and stators to the mud motor drilling industry.

Our advancing elite portfolio of elastomer technology has led us to innovation that extends the life of our power sections while delivering increased efficiency and unmatched performance.

Our broad selection of reliable and durable power sections are compatible with drilling mud motors ranging from 1-11/16 inch thru 11-1/4 inch diameter to deliver the optimum solution in technically challenging environments.

Optimal design selection

Selecting the design and optimizing a power section is crucial to downhole performance and durability. Lobe configuration, stages and fit are key components to creating the right power section for each application.

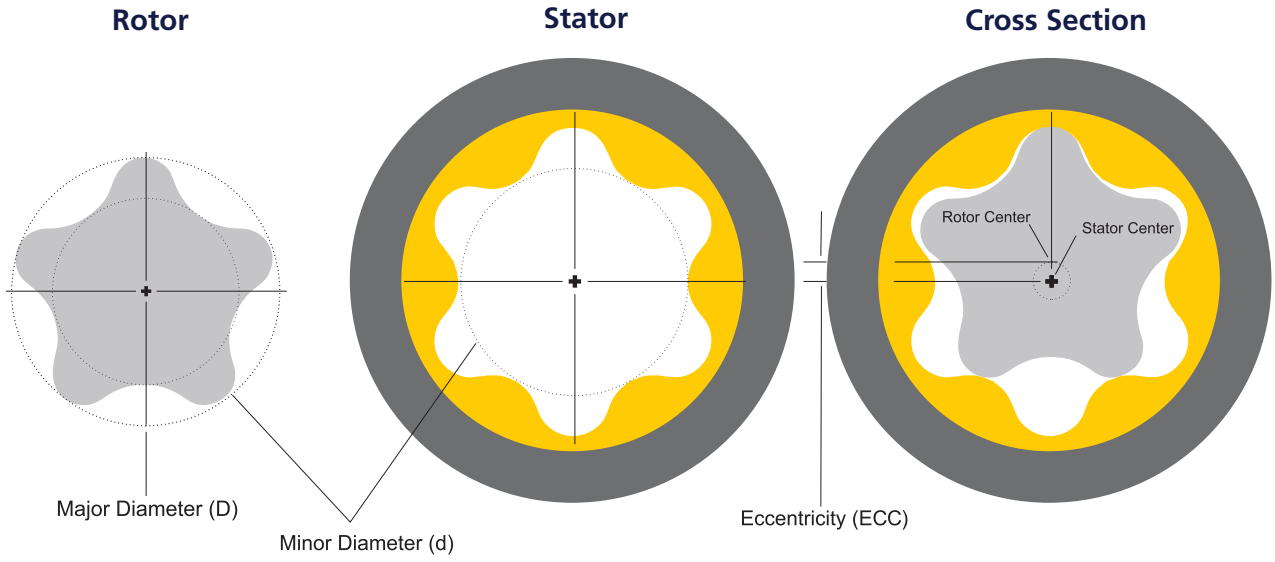
Rotor and stator maintenance

Proper maintenance ensures lasting performance and saves on capital replacement costs.

Rotors:	coating, handling, recoating, and measurement validation
Stators:	fit, storage, handling and measurement validation
Relines:	fluid exposure, fit validation, storage, handling, borescope records, and third party testing for steel integrity

Rotor and stator cutaways

Fitting the Power



Compression Fit Calculation = *rotor major - (eccentricity x 2) - stator minor*

The Compression Fit Calculation is depicted in the formula above or by simply subtracting your stator fit measurement from your rotor fit measurement.

- Rotor fit can be derived by the following formula:
  Rotor Fit = rotor major - (eccentricity x 2)

- An odd-lobed rotor can also be measured from the peak of a lobe to the valley of the opposing lobe.

$$\text{Comp fit} = \frac{\text{Drot} + \text{drot}}{2} - \text{Dsta}$$

Rotor/Stator Fit

Rotor and stator fit is a crucial aspect in power section operation and is the most common measurement motor companies make to adjust a power section for a specific application.

- Fit is often simplified to a clearance between the stator minor diameter and the rotor peak-to-valley.
- The method mentioned above does not take into account the tip radius, which is one of the most crucial aspects.
- Improper lobe fit due to damaged or recoated rotors can cause premature stator failure.

Power Section Sizes and Rotor / Stator Profiles

Stator and lobe configurations

Conventional Sizing

Abaco offers a wide selection of sizes and lobe counts to accommodate almost any customer demand. Most of the common configurations are available in 0.5 size fit increments from standard to 2.0 oversized fit which gives the customer the widest selection of fits. Our power sections can be teamed with mud motors ranging from 1-11/16 inch thru 11-1/4 inch diameter.

EVENTEK® Stators

Abaco's new EVENTEK® stators create more power and cost less per foot than conventional power sections. These innovative one-piece steel profile stators, with even rubber thickness, are available in sizes from 4-3/4 inch to 11-1/4" inch diameter.

OPTIFIT® Stators

The latest engineering innovation in Abaco stator technology, OPTIFIT® stators create an optimized fit for all drilling applications. These new single direction stators with deviated profiles address performance drilling stresses on the power section lower end.

The variable fit of the rotor and stator reduces friction and overheating of the power section lower end. This results in greater power section reliability at high power and a reduction in field failure rates. Shop repair rates can also be minimized.

CONVENTIONAL

- 4-3/4 inch thru 11-1/4 inch diameter

THRU-TUBING

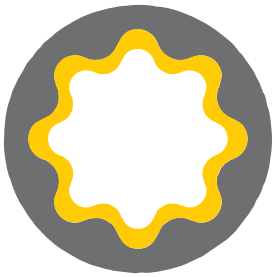
- 1-11/16 inch thru 3-3/4 inch diameter

EVENTEK® *(one piece profile)*

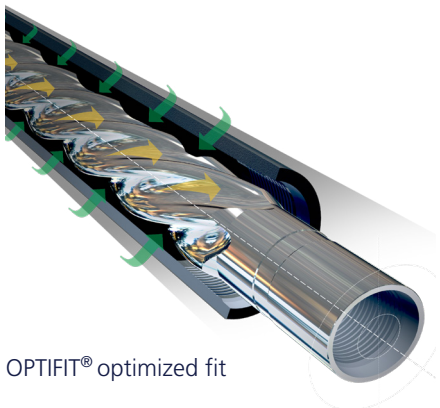
- 4-3/4 inch thru 11-1/4 inch diameter

OPTIFIT®

- Designed for models with high flow capability

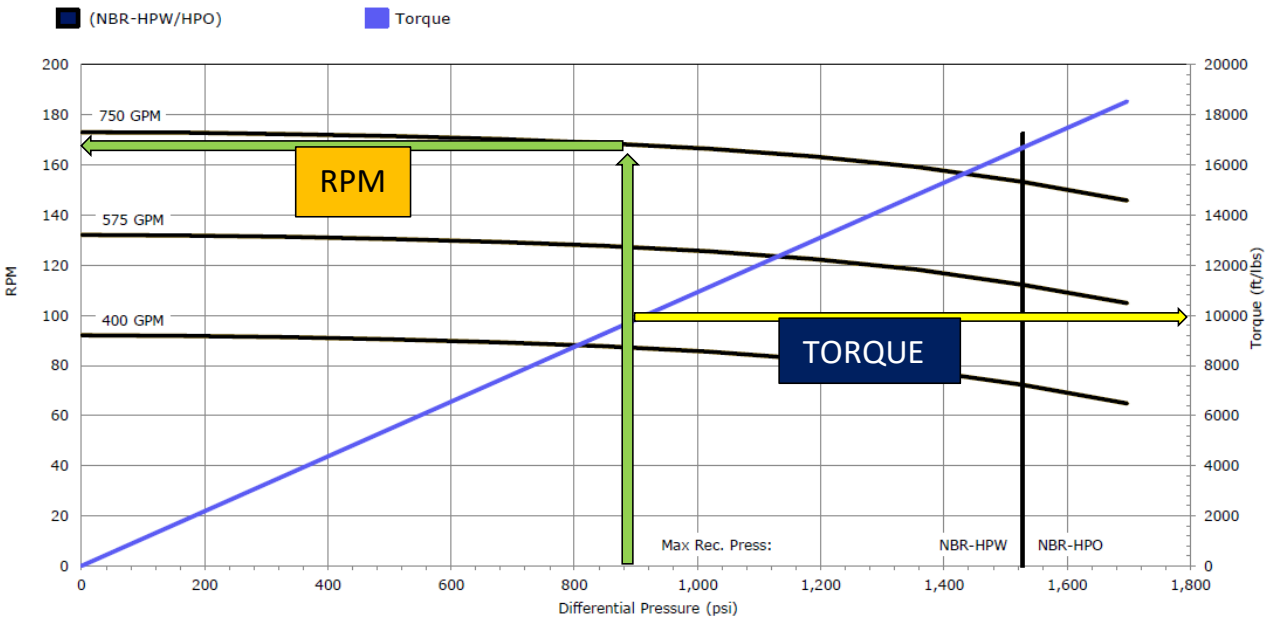


EVENTEK® one piece profile



OPTIFIT® optimized fit

Explanation of Specification Sheet Performance



- The definition of power section differential pressure is the difference between the "Off-Bottom" and the "On-Bottom" pressure
- Read the motor speed on the left axis by drawing a vertical line from the corresponding pressure differential value to the RPM value
- To read the torque output on the right axis, draw a vertical line from the pressure differential axis to the torque value
- The motor RPM can be interpolated for several GPM values that are shown on the chart
- The black line shows the recommended maximum pressure differential for HPW and HPO elastomers

Operating a power section above its recommended pressure results in frequent stalling of the motor and may cause premature stator failure.

Rotors

Optimal Contour Design

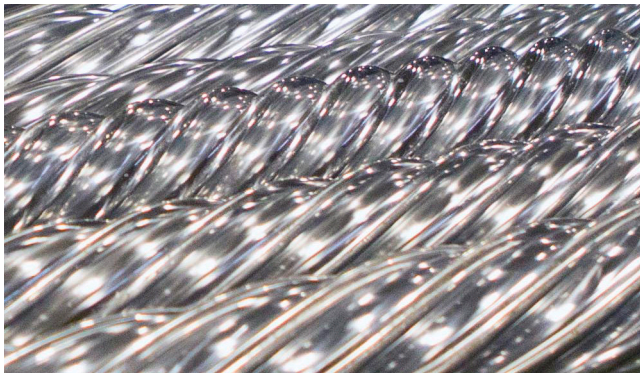
The latest technology is utilized to design the optimal power section for each application. Abaco rotor designs provide the smoothest possible profile to interact with the stator elastomer, drilling mud and lower end components. The rotor's contour fits perfectly throughout the length of the stator assuring the power section will provide the output expected in every run.

Chrome plating or a variety of thermal spray coatings are applied to protect the power section from adverse reactions with drilling fluids. High strength 17-4 PH stainless steel is used to deliver power to the lower end. Bored rotors are available which reduce the amount of load applied to the stator and can be used to divert flow from the power section.

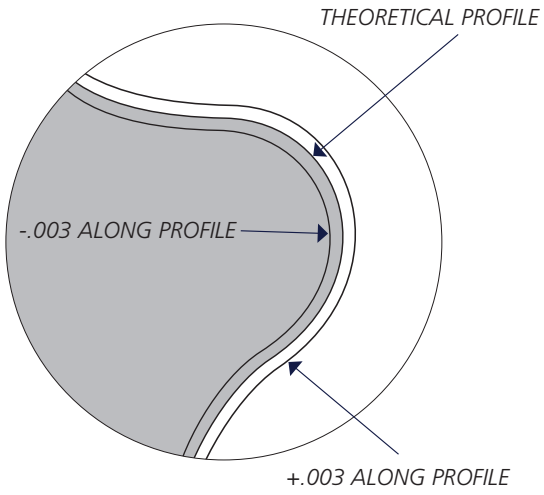
Precision Manufacturing

Rotors are manufactured from corrosion resistant steel with chrome or tungsten carbide coating. They are milled with the most sophisticated Weingartner milling equipment and are precisely contoured to various lengths and manufactured for specific project applications. We verify every rotor profile using a CMM and proprietary contour measurement software.

Each rotor is machined on high-end CNC equipment, and profiles consistently maintain a +/- .003 inch tolerance per side over the entire profile. After completion of each operation every rotor is measured on a CMM to ensure it meets Abaco's precise standards. Pitch length is also a critical dimension to maintain and is precisely measured to ensure each rotor pairs perfectly with an Abaco stator.



Chrome rotors



Precise measurement of a rotor profile

Rotor Coatings

Rotors are typically provided with a hard chrome plating or a tungsten carbide coating. Abaco also works with vendors who supply additional spray coatings such as chrome carbide for specialized environments. The coating types can be categorized by the environment they are used in.

Rotors are coated for reasons such as:

- Coating reduces the friction between the rotor and stator elastomer decreasing the amount of wear in each of these components.
- The amount of erosion seen on a rotor is reduced by the coating's hard surface.
- Coating protects the base material from impact damage and corrosion.
- Coating provides a smooth surface which allows for proper sealing between the rotor and stator elastomer.

Rotor coatings are applied to the base metal providing a hard wearing and corrosion resistant surface. The main cause of corrosion is the chloride content of the drilling fluid. While the severity and rate of corrosion can also be affected by temperature, pH level and pressure, the chloride content is the main factor used when determining what type of coating to select.

Chloride Content (ppm)	**Chrome**	**Tungsten Carbide**
0 - 30,000	Acceptable limits	Acceptable limits
30,000 - 65,000	Some corrosion can occur	Acceptable limits
65,000+	Not recommended	Acceptable limits

Hard Chrome

Hard chrome plating is widely used and is the most established type of plating available for rotors. Chrome plating is a hard wearing, engineered coating that gives good service life and is successfully used in many applications. This electroplated surface has a smooth finish (16 µin RA or better), is quite hard and is resistant to many corrosive environments. Although chrome has stood up as a dependable solution for rotor protection, there are environments it is not well-suited for. One standard characteristic in hard chrome is microscopic cracking which can allow agents in the drilling fluid to penetrate down into the base material. For example, at a certain level, chlorides are known to penetrate through the microscopic cracks and initiate a galvanic reaction which causes pitting and flaking of the plating. The chrome flakes and the resulting damaged rotor surface will tear the stator elastomer and lead to failure.

Chrome Carbide

Chrome carbide coating is designed to be an intermediary between hard chrome plating and tungsten carbide coating. Like tungsten carbide, this thermal spray coating provides less porosity, has a smoother finish (4 µin RA or better) and has more resistance to chlorides than hard chrome. Although this coating does not provide as much wear resistance as tungsten carbide, it does provide more wear resistance than hard chrome.

Tungsten Carbide

Tungsten carbide coating has less porosity and can be ground to a smoother finish (4 µin RA or better) than hard chrome and is the most favorable coating to apply to a rotor. This is a thermal sprayed coating that is applied using an HVOF process. Once polished to the specified surface finish, the hard coating is stator friendly and provides a very hard wearing and corrosion resistant surface. Any remaining porosity in the sprayed and polished coating is further reduced by a sealing process which decreases the amount of permeable voids within the surface and protects the base metal from operational wear.

Rotor and Stator Assembly

It is recommended that a non-hydrocarbon based lubricant is applied to the rotor prior to its insertion into the stator. This can be a simple soap and water solution or a lubricant such as a silicon or Teflon based grease. The rotor/stator fit will be looser at shop temperature and will tighten up downhole due to thermal expansion.

Care must be taken when assembling a rotor to a lower-end component so that the tong and wrench only interfaces with the non-plated head area.

When assembling or disassembling a motor, care must be taken so the contoured (coated) area is not used for torquing a connection.

Rotor Handling

The rotor coatings are hard wearing but can be chipped or cracked if the rotor is roughly handled. This damage can initiate localized coating failure and lead to subsequent rotor and stator damage. Fabric slings are recommended when picking up rotors and care should be taken when moving rotors around so they do not bang into other equipment. The use of chains will damage the coating. The rotor profile should also not be held in the jaws of the break-out unit as this could damage both the coating and the rotor profile.

Damaged rotors

Cross section of power section

Contour Damage

Damaged contours can adversely affect the life expectancy of a stator as chipped rotor coating has sharp edges that can cut and damage the softer elastomer material. Dented, dinged, washed-out or otherwise inconsistent profiles do not allow for proper sealing between the rotor and stator and inevitably lead to premature stator failure.

Similarly, worn profiles do not allow for proper sealing or fit between the rotor and stator. Measurements taken from a worn rotor can be misleading and appear to provide an appropriate rotor/stator fit when in fact it does not provide an appropriate fit.

Alignment Check

Periodically, rotors need to be checked for straightness and contour damage. Abaco supplies rotors straight to .040 inch tolerance. Bent rotors do not fit properly inside stators and will cause premature chunking due to excess loading on the elastomer.

It is important that when using a straightening press on a rotor that the press uses soft components such as brass to interact with the contoured (coated) area of the rotor to avoid damage to the rotor. Jaws, chucks and vices also need to be avoided. If additional turning operations are necessary, soft jaws are required.

Transport and Storage

Rotors should always be stored, handled and transferred in a way that protects the coating as the coating can be easily chipped if not handled properly. Rotors in-transit or placed on a rack together can roll against each other causing damage. Abaco supplies each rotor in a wooden box to protect it from damage, and it is recommended to always ship rotors in the same fashion.

Use soft slings only when lifting rotors

For storage, if the rotor must be taken out of its shipping container, it is recommended to place the rotor on soft surfaces such as wooden beams or racks with rubber and/or plastic surfaces. Care must be taken so that the coated area of a rotor does not contact another metallic surface.

Other precautions to avoid rotor damage include:

- Fork lift arms should incorporate a soft surface such as wood so as a rotor rolls on the arm it is not damaged. It is also recommended to not move more than one unprotected rotor with a forklift at a time.
- Metal racks should incorporate soft surfaces so the rack does not damage the coating.
- Keep rotors at a safe distance from each other or place a soft buffer between rotors so they do not hit one another if moved.
- Chain slings, tongs and wrenches are to be avoided at all times. A soft sling is required when lifting a rotor.

Rotor Service and Repairs

Typical rotor service issues include:

- Abrasive wear - high sand content, cuttings recirculation, and others
- Poor handling issues - shop dents and cracks
- Foreign object damage - hard objects pumped down the drill string and through the power section
- Fishing damage - severe damage caused by fishing tool operations
- Corrosion - high chloride, acid damage, etc.

Both chrome plating and tungsten carbide can be removed from the rotor base material and reapplied. This means that if the damage is not too severe, the rotor can be repaired and taken back into service.

After the coating has been stripped from the rotor, the base metal is typically weld repaired with rods that are compatible with the base metal.

Once the damaged areas are repaired to spec, they are polished down to align with the original contour. The coating is then reapplied until the finished profile tolerance is met.

Removing the worn coating involves chemical stripping which removes some base material; therefore, the rotor will need a thicker coating in order to restore the profile to its original design specifications.

Reworked rotors are never quite the same as new rotors because profiles typically cannot be remanufactured to the original tolerances. If the power section performance is to be maintained, it is strongly recommended that the finished sizes of a repaired rotor are the same as the manufacturer's original specification.

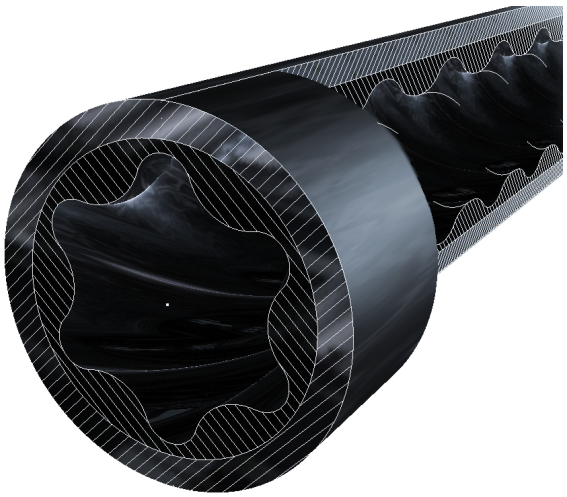
Abaco will work with customers to ensure their rotor fleets are maintained properly and can provide the assistance needed to evaluate individual parts and make recommendations on damaged rotors.

Abaco Stators and Elastomers

Our stators are available with the most advanced Nitrile Butadiene Rubber (NBR) or High Performance (HP) elastomers. The material process is monitored carefully at each stage of manufacturing to ensure parts of the highest quality. Quality control testing is performed on all elastomer batches using standard ASTM testing for rheometry, specific gravity and tensile properties. Additional testing such as tearing energy, bond testing, etc. are performed on a regular basis.

Using the latest in advanced materials and manufacturing technologies, Abaco's HP series of elastomers provide superior performance in various drilling environments.

Elastomer testing



Elastomer cutaway

HPT™

Elastomers are designed to increase reliability in extreme high temperature environments up to 375°F. Extreme temperatures can affect performance of conventional elastomers in stators and these elastomers are engineered to deliver increased durability in elevated temperatures. Features include hard rubber composition for high power output and excellent adhesion at high temperature resulting in excellent wear resistance in all applications.

HPW™

Elastomers address high-wear situations that occur in high-friction and/or high torque use. HPW elastomers are highly reinforced and have 25 percent more stiffness than conventional hard rubber. This results in a 5 to 10 percent higher horsepower output potential. HPW is designed to improve power output and reliability of the power section in high wear and high temperature environments.

HPO™

Elastomers are engineered for increased durability and maximized performance in high flow, high solids drilling applications. Abaco's HPO™ elastomers are designed to be combined with Abaco's proprietary OPTIFIT® technology and are made for challenging drilling environments requiring greater reliability in high wear and higher temperature environments.

Storage Recommendations for New or Relined Stators

Elastomers age when exposed to heat, light, ozone, oxygen and radiation. Aging causes degradation of mechanical properties, which leads to loss of performance and decreased life. Hardening of the elastomer as well as cracks indicate degradation. Internal inspection of the stator with strong backlighting or a borescope may be used to view internal condition of the stator prior to use.

The recommended shelf life for new or newly relined stators stored with the ends covered are:

- 24 months - If stator is stored inside in moderate conditions (up to 100°F / 38°C)
- 18 months - if stator is stored outside
- 6 months - if stator is run in Water-Based Mud (WBM) or brine and bottom hole temperature is under 240°F

Stators stored outside should be located out of direct sunlight if possible. Stators should be relined after each run when used with invert or Oil-Based Muds (OBM) and/or bottom hole temperature exceeds 240°F.

Re-running used stators will dramatically shorten shelf life. Used stators should be flushed out with clean water before being laid down. Do not store the rotors inside the stators.

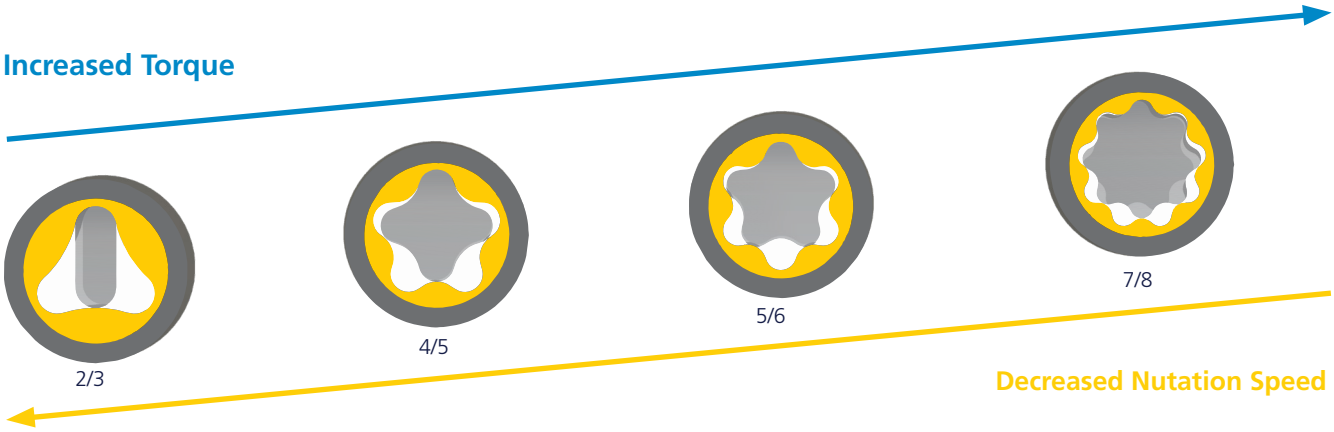
Relined stator

Store relined stators flat

Optimizing
POWER SECTIONS

Abaco DRILLING TECHNOLOGIES

Selecting the Optimal Design



Model Nomenclature

Model names are based on outer diameter, lobe configuration and number of stages as shown below:

Model 675457.0 = 6.75 4/5 7.0

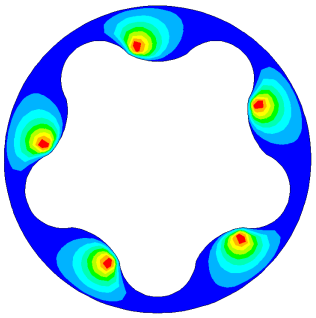
- OD of the stator tube is 6-3/4”
- 4 lobed rotor and 5 lobed stator
- 7.0 stages

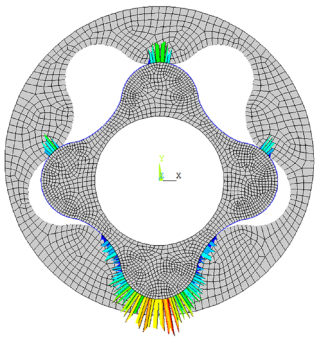
Lobe Count Selection

The lobe count determines number of cycles to get one forward rotation of the drill bit. Higher lobe count delivers more torque.

Lobe count chosen affects:

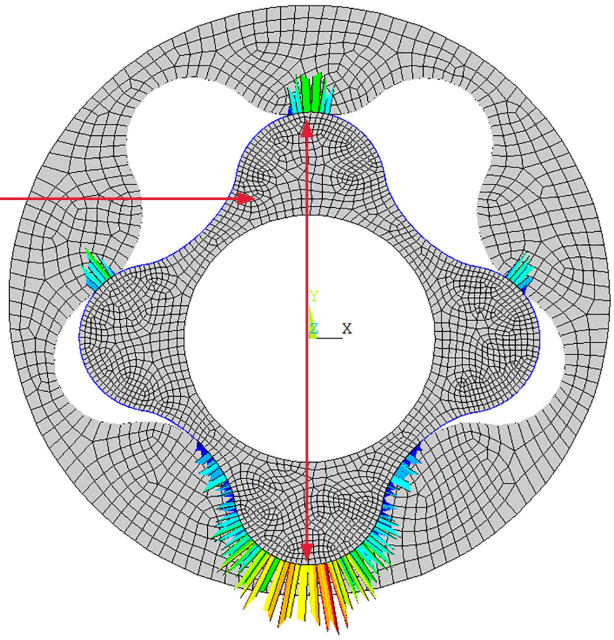
- Optimum flow capability
- Bit speed range
- Rotor nuation speed





Nuation is the loading frequency of the stator lobes. Lower nuation is better for decreasing hysteretic heating.

Thermal Considerations



Diametral Fit

Thermal expansion is primary adjustment
- Example (0.5 OS = .040)
- High parameters add to expansion

Fluid swell and wear are secondary adjustments
- Example (.010 to .020" are typical)

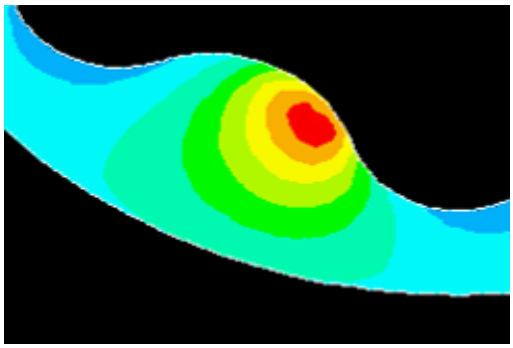
Optimal Power Section Temperature

Abaco						
6.75" 7/8 5.0 6.75" 7/8 5.0 0.27 REV/GAL 300-600 GPM NBR-HPX NBR-HPW ELASTOMER	**STD** 3.986 0.022	75° (24C) +.022	90° (32C) +.027	OPTIMAL RANGE	125° (52C) +.038	170° (77C) +.053
	0.5 O/S 3.998 0.010	105° (41C) +.020	130° (54C) +.028	OPTIMAL RANGE	165° (74C) +.039	210° (99C) +.053
	1.0 O/S 4.010 0.002	145° (63C) +.021	170° (77C) +.029	OPTIMAL RANGE	200° (93C) +.022	245° (118C) +.053
	1.5 O/S 4.023 0.015	185° (85C) +.021	210° (99C) +.029	OPTIMAL RANGE	240° (116C) +.038	285° (141C) +.053
	2.0 O/S 4.036 0.028	230° (110C) +.022	255° (121C) +.030	OPTIMAL RANGE	280° (138C) +.038	315° (157C) +.054
	2.5 O/S	**FIT NOT AVAILABLE**				

Fit Interaction Considerations

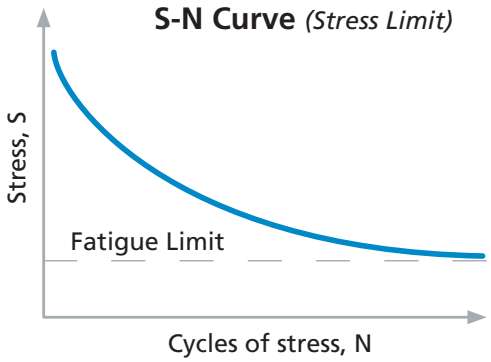
High Parameters

- Hysteretic heating may require loose fit
- Heating beyond circulating temperature by 50 to 200°F



Length of Interval

- How much power for how long?
- Optimum fit and power to achieve max ROP and reliability
- Reduced fit and power is used for multi-run drilling



Fluid and Temperature Interactions

- Additional clearance for Oil Based Mud and additive swelling
- Aggressive fluids reduce rubber strength and limit lifecycle

HPW Relative Swell