

HYDRAULIC  
MOTORS  
LD | MD | HD

HYDRAULIC  
MOTOR | BRAKE  
UNITS

STEERING  
UNITS

HYDRAULIC  
BRAKES

HYDRAULIC  
PUMPS

FLOW  
DIVIDERS

# HYDRAULIC MOTORS

## Light Duty Series



Delivering The Power To Get Work Done



## TABLE OF CONTENTS

### TECHNICAL INFORMATION

Operating Recommendations .....	4-5
Motor Connections .....	5
Product Testing (Understanding the Performance Charts).....	6
Allowable Bearing & Shaft Loads .....	7
Vehicle Drive Calculations .....	8-9
Induced Side Loading.....	10
Hydraulic Equations.....	10
Shaft Nut Dimensions & Torque Specifications .....	11

### OPTIONAL MOTOR FEATURES

Speed Sensor Options .....	12-13
Freeturning Rotor Option.....	13
Valve Cavity Option .....	14
Slinger Seal Option.....	14

### LIGHT DUTY HYDRAULIC MOTORS

WM Product Line Introduction .....	15
WM Displacement Performance Charts .....	16-17
125 & 126 Series Housings .....	18
125 & 126 Series Shafts.....	19
125 & 126 Series Technical Information .....	19
125 & 126 Series Ordering Information .....	20
WD Product Line Introduction.....	21
WD Displacement Performance Charts.....	22-28
145 & 146 Series Housings.....	29-30
145 & 146 Series Technical Information .....	30
145 & 146 Series Shafts.....	31
145 & 146 Series Ordering Information .....	32
WP Product Line Introduction.....	33
WP Displacement Performance Charts .....	34-40
155 & 156 Series Housings.....	41-45
155 & 156 Series Technical Information .....	46
155 & 156 Series Shafts.....	47
155 & 156 Series Ordering Information .....	48
157 & 158 Series Housings.....	49
157 & 158 Series Technical Information .....	50
157 & 158 Series Shafts.....	51
157 & 158 Series Ordering Information .....	52
RS Product Line Introduction.....	53
RS Displacement Performance Charts.....	54-58
200 & 201 Series Housings .....	59-62
200 & 201 Series Technical Information .....	63
200 & 201 Series Shafts.....	64
200 & 201 Series Ordering Information .....	65
WR Product Line Introduction.....	66
WR Displacement Performance Charts.....	67-74
251 & 252 Series Housings.....	75-76
251 & 252 Series Technical Information .....	77
251 & 252 Series Shafts.....	78
251 & 252 Series Ordering Information .....	79
255 & 256 Series Housings.....	80-83
255 & 256 Series Technical Information .....	84
255 & 256 Series Shafts.....	85
255 & 256 Series Ordering Information .....	86

## OPERATING RECOMMENDATIONS

### OIL TYPE

Hydraulic oils with anti-wear, anti-foam and demulsifiers are recommended for systems incorporating White Drive Products motors. Straight oils can be used but may require VI (viscosity index) improvers depending on the operating temperature range of the system. Other water based and environmentally friendly oils may be used, but service life of the motor and other components in the system may be significantly shortened. Before using any type of fluid, consult the fluid requirements for all components in the system for compatibility. Testing under actual operating conditions is the only way to determine if acceptable service life will be achieved.

### FLUID VISCOSITY & FILTRATION

Fluids with a viscosity between 20 - 43 cSt [100 - 200 S.U.S.] at operating temperature is recommended. Fluid temperature should also be maintained below 85°C [180° F]. It is also suggested that the type of pump and its operating specifications be taken into account when choosing a fluid for the system. Fluids with high viscosity can cause cavitation at the inlet side of the pump. Systems that operate over a wide range of temperatures may require viscosity improvers to provide acceptable fluid performance.

White Drive Products recommends maintaining an oil cleanliness level of ISO 17-14 or better.

### INSTALLATION & START-UP

When installing a White Drive Products motor it is important that the mounting flange of the motor makes full contact with the mounting surface of the application. Mounting hardware of the appropriate grade and size must be used. Hubs, pulleys, sprockets and couplings must be properly aligned to avoid inducing excessive thrust or radial loads. Although the output device must fit the shaft snug, a hammer should never be used to install any type of output device onto the shaft. The port plugs should only be removed from the motor when the system connections are ready to be made. To avoid contamination, remove all matter from around the ports of the motor and the threads of the fittings. Once all system connections are made, it is recommended that the motor be run-in for 15-30 minutes at no load and half speed to remove air from the hydraulic system.

### MOTOR PROTECTION

Over-pressurization of a motor is one of the primary causes of motor failure. To prevent these situations, it is necessary to provide adequate relief protection for a motor based on the pressure ratings for that particular model. For systems that may experience overrunning conditions, special precautions must be taken. In an overrunning condition, the motor functions as a pump and attempts to convert kinetic energy into hydraulic energy. Unless the system is properly

configured for this condition, damage to the motor or system can occur. To protect against this condition a counterbalance valve or relief cartridge must be incorporated into the circuit to reduce the risk of overpressurization. If a relief cartridge is used, it must be installed upline of the motor, if not in the motor, to relieve the pressure created by the over-running motor. To provide proper motor protection for an over-running load application, the pressure setting of the pressure relief valve must not exceed the intermittent rating of the motor.

### HYDRAULIC MOTOR SAFETY PRECAUTION

A hydraulic motor must not be used to hold a suspended load. Due to the necessary internal tolerances, all hydraulic motors will experience some degree of creep when a load induced torque is applied to a motor at rest. All applications that require a load to be held must use some form of mechanical brake designed for that purpose.

### MOTOR/BRAKE PRECAUTION

**Caution!** - White Drive Products' motors/brakes are intended to operate as static or parking brakes. System circuitry must be designed to bring the load to a stop before applying the brake.

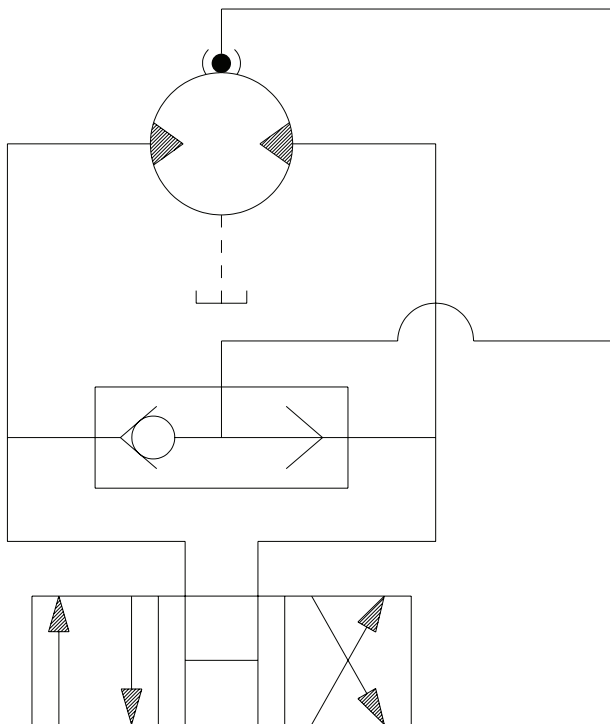
**Caution!** - Because it is possible for some large displacement motors to overpower the brake, it is critical that the maximum system pressure be limited for these applications. Failure to do so could cause serious injury or death. When choosing a motor/brake for an application, consult the performance chart for the series and displacement chosen for the application to verify that the maximum operating pressure of the system will not allow the motor to produce more torque than the maximum rating of the brake. Also, it is vital that the system relief be set low enough to insure that the motor is not able to overpower the brake.

To ensure proper operation of the brake, a separate case drain back to tank must be used. Use of the internal drain option is not recommended due to the possibility of return line pressure spikes. A simple schematic of a system utilizing a motor/brake is shown on page 4. Although maximum brake release pressure may be used for an application, a 34 bar [500 psi] pressure reducing valve is recommended to promote maximum life for the brake release piston seals. However, if a pressure reducing valve is used in a system which has case drain back pressure, the pressure reducing valve should be set to 34 bar [500 psi] over the expected case pressure to ensure full brake release. To achieve proper brake release operation, it is necessary to bleed out any trapped air and fill brake release cavity and hoses before all connections are tightened. To facilitate this operation, all motor/brakes feature two release ports. One or

## OPERATING RECOMMENDATIONS & MOTOR CONNECTIONS

### MOTOR/BRAKE PRECAUTION (continued)

both of these ports may be used to release the brake in the unit. Motor/brakes should be configured so that the release ports are near the top of the unit in the installed position.



TYPICAL MOTOR/BRAKE SCHEMATIC

Once all system connections are made, one release port must be opened to atmosphere and the brake release line carefully charged with fluid until all air is removed from the line and motor/brake release cavity. When this has been accomplished the port plug or secondary release line must be reinstalled. In the event of a pump or battery failure, an external pressure source may be connected to the brake release port to release the brake, allowing the machine to be moved.

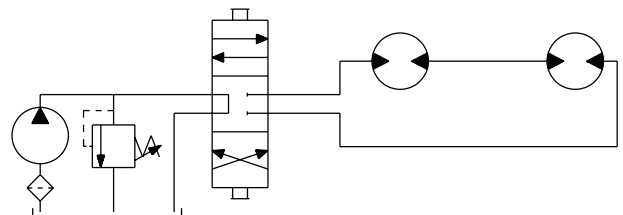
► NOTE: It is vital that all operating recommendations be followed. Failure to do so could result in injury or death.

### MOTOR CIRCUITS

There are two common types of circuits used for connecting multiple numbers of motors – series connection and parallel connection.

#### SERIES CONNECTION

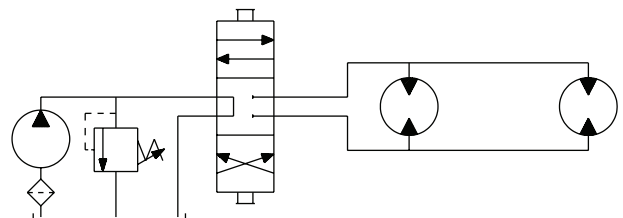
When motors are connected in series, the outlet of one motor is connected to the inlet of the next motor. This allows the full pump flow to go through each motor and provide maximum speed. Pressure and torque are distributed between the motors based on the load each motor is subjected to. The maximum system pressure must be no greater than the maximum inlet pressure of the first motor. The allowable back pressure rating for a motor must also be considered. In some series circuits the motors must have an external case drain connected. A series connection is desirable when it is important for all the motors to run the same speed such as on a long line conveyor.



SERIES CIRCUIT

#### PARALLEL CONNECTION

In a parallel connection all of the motor inlets are connected. This makes the maximum system pressure available to each motor allowing each motor to produce full torque at that pressure. The pump flow is split between the individual motors according to their loads and displacements. If one motor has no load, the oil will take the path of least resistance and all the flow will go to that one motor. The others will not turn. If this condition can occur, a flow divider is recommended to distribute the oil and act as a differential.

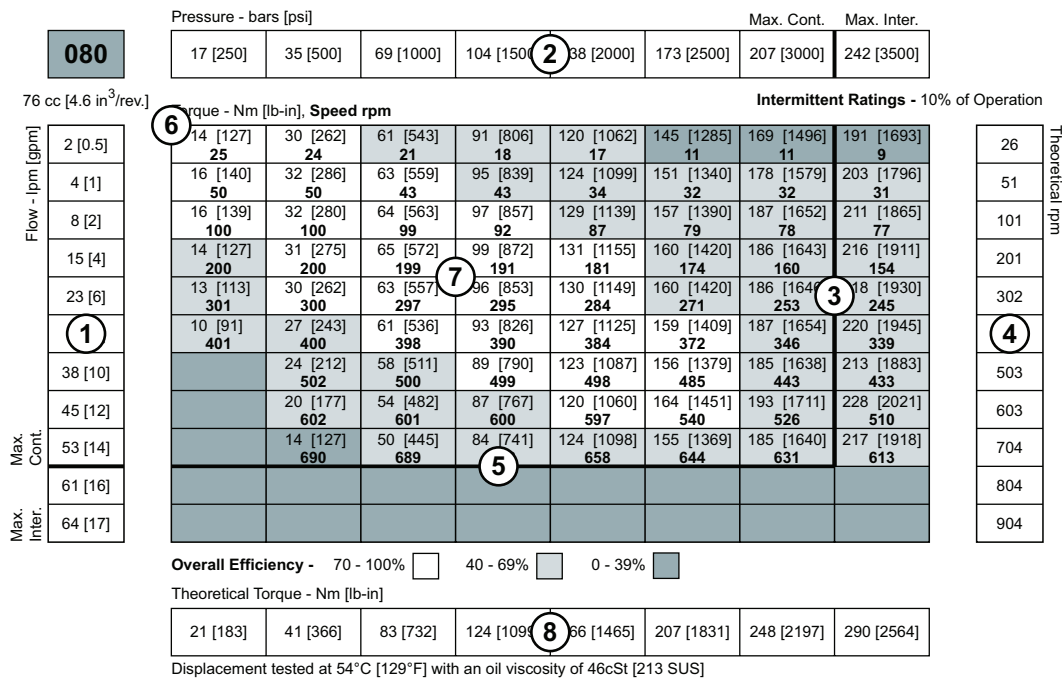


SERIES CIRCUIT

► NOTE: The motor circuits shown above are for illustration purposes only. Components and circuitry for actual applications may vary greatly and should be chosen based on the application.

## PRODUCT TESTING

Performance testing is the critical measure of a motor's ability to convert flow and pressure into speed and torque. All product testing is conducted using White Drive Products' state of the art test facility. This facility utilizes fully automated test equipment and custom designed software to provide accurate, reliable test data. Test routines are standardized, including test stand calibration and stabilization of fluid temperature and viscosity, to provide consistent data. The example below provides an explanation of the values pertaining to each heading on the performance chart.



- Flow represents the amount of fluid passing through the motor during each minute of the test.
- Pressure refers to the measured pressure differential between the inlet and return ports of the motor during the test.
- The maximum continuous pressure rating and maximum intermittent pressure rating of the motor are separated by the dark lines on the chart.
- Theoretical RPM represents the RPM that the motor would produce if it were 100% volumetrically efficient. Measured RPM divided by the theoretical RPM give the actual volumetric efficiency of the motor.
- The maximum continuous flow rating and maximum intermittent flow rating of the motor are separated by the dark line on the chart.
- Performance numbers represent the actual torque and speed generated by the motor based on the corresponding input pressure and flow. The numbers on the top row indicate torque as measured in Nm [lb-in], while the bottom number represents the speed of the output shaft.
- Areas within the white shading represent maximum motor efficiencies.
- Theoretical Torque represents the torque that the motor would produce if it were 100% mechanically efficient. Actual torque divided by the theoretical torque gives the actual mechanical efficiency of the motor.

## ALLOWABLE BEARING & SHAFT LOADING

This catalog provides curves showing allowable radial loads at points along the longitudinal axis of the motor. They are dimensioned from the mounting flange. Two capacity curves for the shaft and bearings are shown. A vertical line through the centerline of the load drawn to intersect the x-axis intersects the curves at the load capacity of the shaft and of the bearing.

In the example below the maximum radial load bearing rating is between the internal roller bearings illustrated with a solid line. The allowable shaft rating is shown with a dotted line.

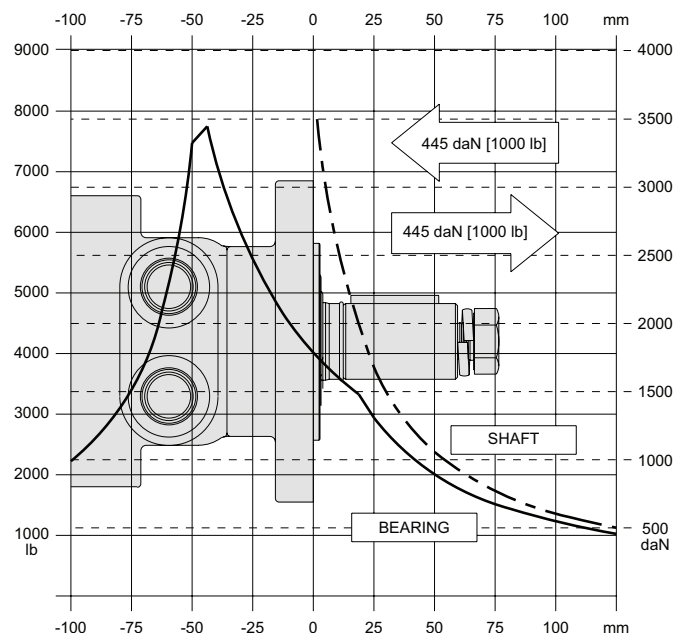
The bearing curves for each model are based on laboratory analysis and testing results constructed at White Drive Products. The shaft loading is based on a 3:1 safety factor and 330 Kpsi tensile strength. The allowable load is the lower of the curves at a given point. For instance, one inch in front of the mounting flange the bearing capacity is lower than the shaft capacity. In this case, the bearing is the limiting load. The motor user needs to determine which series of motor to use based on their application knowledge.

### ISO 281 RATINGS VS. MANUFACTURERS RATINGS

Published bearing curves can come from more than one type of analysis. The ISO 281 bearing rating is an international standard for the dynamic load rating of roller bearings. The rating is for a set load at a speed of 33 1/3 RPM for 500 hours (1 million revolutions). The standard was established to allow consistent comparisons of similar bearings between manufacturers. The ISO 281 bearing ratings are based solely on the physical characteristics of the bearings, removing any manufacturers specific safety factors or empirical data that influences the ratings.

Manufacturers' ratings are adjusted by diverse and systematic laboratory investigations, checked constantly with feedback from practical experience. Factors taken into account that affect bearing life are material, lubrication, cleanliness of the lubrication, speed, temperature, magnitude of the load and the bearing type.

The operating life of a bearing is the actual life achieved by the bearing and can be significantly different from the calculated life. Comparison with similar applications is the most accurate method for bearing life estimations.



### EXAMPLE LOAD RATING FOR MECHANICALLY RETAINED NEEDLE ROLLER BEARINGS

Bearing Life  $L_{10}$  =  $(C/P)^p$  [ $10^6$  revolutions]

$L_{10}$  = nominal rating life

$C$  = dynamic load rating

$P$  = equivalent dynamic load

Life Exponent  $P$  = 10/3 for needle bearings

BEARING LOAD MULTIPLICATION FACTOR TABLE			
RPM	FACTOR	RPM	FACTOR
50	1.23	500	0.62
100	1.00	600	0.58
200	0.81	700	0.56
300	0.72	800	0.50
400	0.66		



## VEHICLE DRIVE CALCULATIONS

When selecting a wheel drive motor for a mobile vehicle, a number of factors concerning the vehicle must be taken into consideration to determine the required maximum motor RPM, the maximum torque required and the maximum load each motor must support. The following sections contain the necessary equations to determine this criteria. An example is provided to illustrate the process.

### Sample application (vehicle design criteria)

vehicle description ..... 4 wheel vehicle  
 vehicle drive ..... 2 wheel drive  
 GVW ..... 1,500 lbs.  
 weight over each drive wheel ..... 425 lbs.  
 rolling radius of tires ..... 16 in.  
 desired acceleration ..... 0-5 mph in 10 sec.  
 top speed ..... 5 mph  
 gradability ..... 20%  
 worst working surface ..... poor asphalt

### To determine maximum motor speed

$$\text{RPM} = \frac{2.65 \times \text{KPH} \times G}{r_m} \quad \text{RPM} = \frac{168 \times \text{MPH} \times G}{r_i}$$

Where:

MPH = max. vehicle speed (miles/hr)

KPH = max. vehicle speed (kilometers/hr)

$r_i$  = rolling radius of tire (inches)

G = gear reduction ratio (if none, G = 1)

$r_m$  = rolling radius of tire (meters)

**Example**  $\text{RPM} = \frac{168 \times 5 \times 1}{16} = 52.5$

### To determine maximum torque requirement of motor

To choose a motor(s) capable of producing enough torque to propel the vehicle, it is necessary to determine the Total Tractive Effort (TE) requirement for the vehicle. To determine the total tractive effort, the following equation must be used:

$$\text{TE} = \text{RR} + \text{GR} + \text{FA} + \text{DP} \text{ (lbs or N)}$$

Where:

TE = Total tractive effort

RR = Force necessary to overcome rolling resistance

GR = Force required to climb a grade

FA = Force required to accelerate

DP = Drawbar pull required

The components for this equation may be determined using the following steps:

### Step One: Determine Rolling Resistance

Rolling Resistance (RR) is the force necessary to propel a vehicle over a particular surface. It is recommended that the worst possible surface type to be encountered by the vehicle be factored into the equation.

$$\text{RR} = \frac{\text{GVW}}{1000} \times R \text{ (lb or N)}$$

Where:

GVW = gross (loaded) vehicle weight (lb or kg)

R = surface friction (value from Table 1)

**Example**  $\text{RR} = \frac{1500}{1000} \times 22 \text{ lbs} = 33 \text{ lbs}$

Table 1

Rolling Resistance	
Concrete (excellent) .....	10
Concrete (good).....	15
Concrete (poor) .....	20
Asphalt (good) .....	12
Asphalt (fair) .....	17
Asphalt (poor).....	22
Macadam (good) .....	15
Macadam (fair) .....	22
Macadam (poor) .....	37
Cobbles (ordinary) .....	55
Cobbles (poor).....	37
Snow (2 inch).....	25
Snow (4 inch).....	37
Dirt (smooth).....	25
Dirt (sandy).....	37
Mud.....	37 to 150
Sand (soft).....	60 to 150
Sand (dune).....	160 to 300

### Step Two: Determine Grade Resistance

Grade Resistance (GR) is the amount of force necessary to move a vehicle up a hill or "grade." This calculation must be made using the maximum grade the vehicle will be expected to climb in normal operation.

To convert incline degrees to % Grade:

$$\% \text{ Grade} = [\tan \text{ of angle (degrees)}] \times 100$$

$$\text{GR} = \frac{\% \text{ Grade}}{100} \times \text{GVW (lb or N)}$$

**Example**  $\text{GR} = \frac{20}{100} \times 1500 \text{ lbs} = 300 \text{ lbs}$

## VEHICLE DRIVE CALCULATIONS

### Step Three: Determine Acceleration Force

Acceleration Force (FA) is the force necessary to accelerate from a stop to maximum speed in a desired time.

$$FA = \frac{MPH \times GVW \text{ (lb)}}{22 \times t} \quad FA = \frac{KPH \times GVW \text{ (N)}}{35.32 \times t}$$

Where:

t = time to maximum speed (seconds)

**Example**  $FA = \frac{5 \times 1500 \text{ lbs}}{22 \times 10} = 34 \text{ lbs}$

### Step Four: Determine Drawbar Pull

Drawbar Pull (DP) is the additional force, if any, the vehicle will be required to generate if it is to be used to tow other equipment. If additional towing capacity is required for the equipment, repeat steps one through three for the towable equipment and sum the totals to determine DP.

### Step Five: Determine Total Tractive Effort

The Tractive Effort (TE) is the sum of the forces calculated in steps one through three above. On low speed vehicles, wind resistance can typically be neglected. However, friction in drive components may warrant the addition of 10% to the total tractive effort to insure acceptable vehicle performance.

$$TE = RR + GR + FA + DP \text{ (lb or N)}$$

**Example**  $TE = 33 + 300 + 34 + 0 \text{ (lbs)} = 367 \text{ lbs}$

### Step Six: Determine Motor Torque

The Motor Torque (T) required per motor is the Total Tractive Effort divided by the number of motors used on the machine. Gear reduction is also factored into account in this equation.

$$T = \frac{TE \times ri}{M \times G} \text{ lb-in per motor} \quad T = \frac{TE \times rm}{M \times G} \text{ Nm per motor}$$

Where:

M = number of driving motors

**Example**  $T = \frac{367 \times 16}{2 \times 1} \text{ lb-in/motor} = 2936 \text{ lb-in}$

### Step Seven: Determine Wheel Slip

To verify that the vehicle will perform as designed in regards to tractive effort and acceleration, it is necessary to calculate wheel slip (TS) for the vehicle. In special cases, wheel slip may actually be desirable to prevent hydraulic system overheating and component breakage should the vehicle become stalled.

$$TS = \frac{W \times f \times ri}{G} \quad TS = \frac{W \times f \times rm}{G}$$

(lb-in per motor) (N-m per motor)

Where:

f = coefficient of friction (see table 2)

W = loaded vehicle weight over driven wheel (lb or N)

**Example**  $TS = \frac{425 \times .06 \times 16}{1} \text{ lb-in/motor} = 4080 \text{ lbs}$

Table 2

Coefficient of friction (f)	
Steel on steel.....	0.3
Rubber tire on dirt.....	0.5
Rubber tire on a hard surface.....	0.6 - 0.8
Rubber tire on cement.....	0.7

### To determine radial load capacity requirement of motor

When a motor used to drive a vehicle has the wheel or hub attached directly to the motor shaft, it is critical that the radial load capabilities of the motor are sufficient to support the vehicle. After calculating the Total Radial Load (RL) acting on the motors, the result must be compared to the bearing/shaft load charts for the chosen motor to determine if the motor will provide acceptable load capacity and life.

$$RL = \sqrt{W^2 + \left(\frac{T}{ri}\right)^2} \text{ lb} \quad RL = \sqrt{W^2 + \left(\frac{T}{rm}\right)^2} \text{ kg}$$

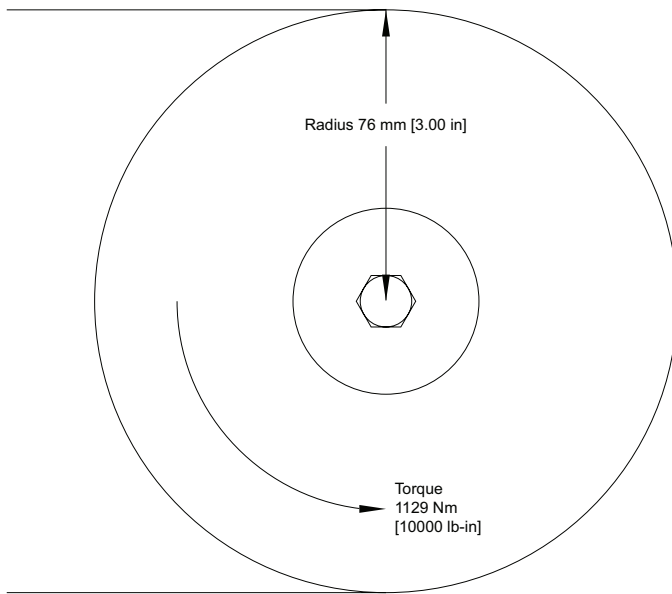
**Example**  $RL = \sqrt{425^2 + \left(\frac{2936}{16}\right)^2} = 463 \text{ lbs}$

Once the maximum motor RPM, maximum torque requirement, and the maximum load each motor must support have been determined, these figures may then be compared to the motor performance charts and to the bearing load curves to choose a series and displacement to fulfill the motor requirements for the application.



## INDUCED SIDE LOAD

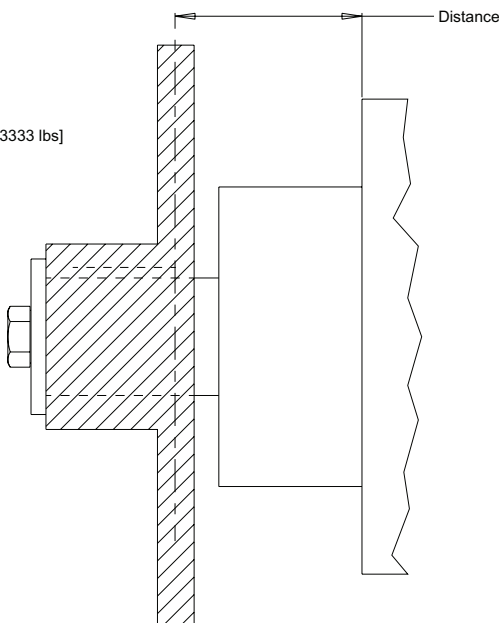
In many cases, pulleys or sprockets may be used to transmit the torque produced by the motor. Use of these components will create a torque induced side load on the motor shaft and bearings. It is important that this load be taken into consideration when choosing a motor with sufficient bearing and shaft capacity for the application.



To determine the side load, the motor torque and pulley or sprocket radius must be known. Side load may be calculated using the formula below. The distance from the pulley/sprocket centerline to the mounting flange of the motor must also be determined. These two figures may then be compared to the bearing and shaft load curve of the desired motor to determine if the side load falls within acceptable load ranges.

$$\text{Side Load} = \frac{\text{Torque}}{\text{Radius}}$$

$$\text{Side Load} = 14855 \text{ Nm [3333 lbs]}$$



## HYDRAULIC EQUATIONS

Multiplication Factor	Abbrev.	Prefix
$10^{12}$	T	tera
$10^9$	G	giga
$10^6$	M	mega
$10^3$	K	kilo
$10^2$	h	hecto
$10^1$	da	deka
$10^{-1}$	d	deci
$10^{-2}$	c	centi
$10^{-3}$	m	milli
$10^{-6}$	u	micro
$10^{-9}$	n	nano
$10^{-12}$	p	pico
$10^{-15}$	f	femto
$10^{-18}$	a	atto

Theo. Speed (RPM) =

$$\frac{1000 \times \text{LPM}}{\text{Displacement (cm}^3/\text{rev)}} \quad \text{or} \quad \frac{231 \times \text{GPM}}{\text{Displacement (in}^3/\text{rev)}}$$

Theo. Torque (lb-in) =

$$\frac{\text{Bar} \times \text{Disp. (cm}^3/\text{rev)}}{20 \pi} \quad \text{or} \quad \frac{\text{PSI} \times \text{Displacement (in}^3/\text{rev)}}{6.28}$$

Power In (HP) =

$$\frac{\text{Bar} \times \text{LPM}}{600} \quad \text{or} \quad \frac{\text{PSI} \times \text{GPM}}{1714}$$

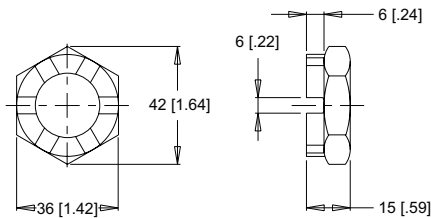
Power Out (HP) =

$$\frac{\text{Torque (Nm)} \times \text{RPM}}{9543} \quad \text{or} \quad \frac{\text{Torque (lb-in)} \times \text{RPM}}{63024}$$

## SHAFT NUT INFORMATION

### 35MM TAPERED SHAFTS M24 x 1.5 Thread

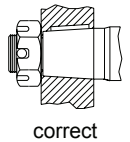
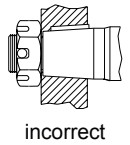
#### A Slotted Nut



Torque Specifications: 32.5 daNm [240 ft.lb.]

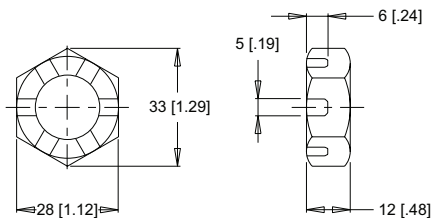
### PRECAUTION

The tightening torques listed with each nut should only be used as a guideline. Hubs may require higher or lower tightening torque depending on the material. Consult the hub manufacturer to obtain recommended tightening torque. To maximize torque transfer from the shaft to the hub, and to minimize the potential for shaft breakage, a hub with sufficient thickness must fully engage the taper length of the shaft.



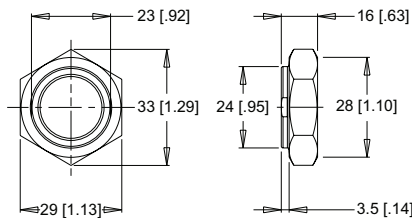
### 1" TAPERED SHAFTS 3/4-28 Thread

#### A Slotted Nut



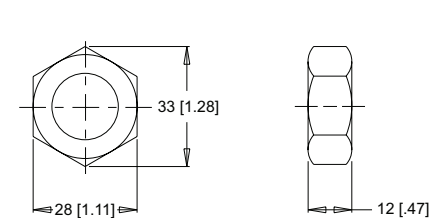
Torque Specifications: 20 - 23 daNm [150 - 170 ft.lb.]

#### B Lock Nut



Torque Specifications: 24 - 27 daNm [180 - 200 ft.lb.]

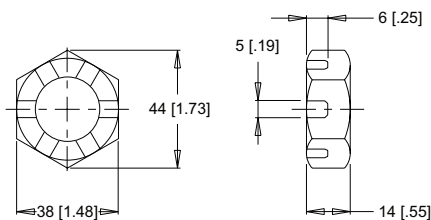
#### C Solid Nut



Torque Specifications: 20 - 23 daNm [150 - 170 ft.lb.]

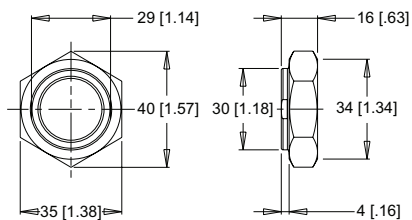
### 1-1/4" TAPERED SHAFTS 1-20 Thread

#### A Slotted Nut



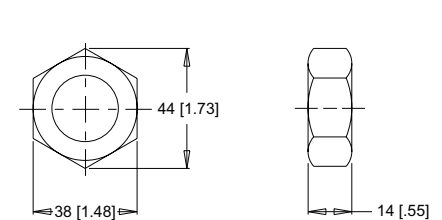
Torque Specifications: 38 daNm [280 ft.lb.] Max.

#### B Lock Nut



Torque Specifications: 33 - 42 daNm [240 - 310 ft.lb.]

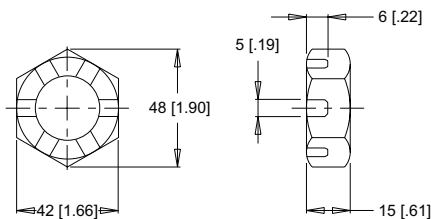
#### C Solid Nut



Torque Specifications: 38 daNm [280 ft.lb.] Max.

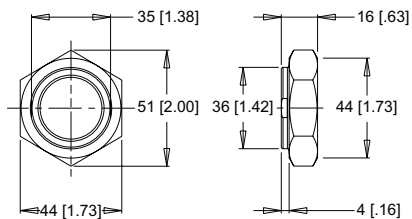
### 1-3/8" & 1-1/2" TAPERED SHAFTS 1 1/8-18 Thread

#### A Slotted Nut



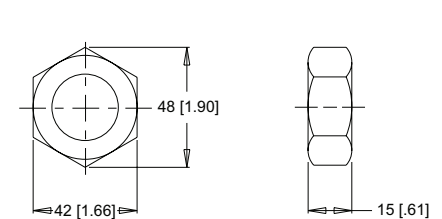
Torque Specifications: 41 - 54 daNm [300 - 400 ft.lb.]

#### B Lock Nut



Torque Specifications: 34 - 48 daNm [250 - 350 ft.lb.]

#### C Solid Nut



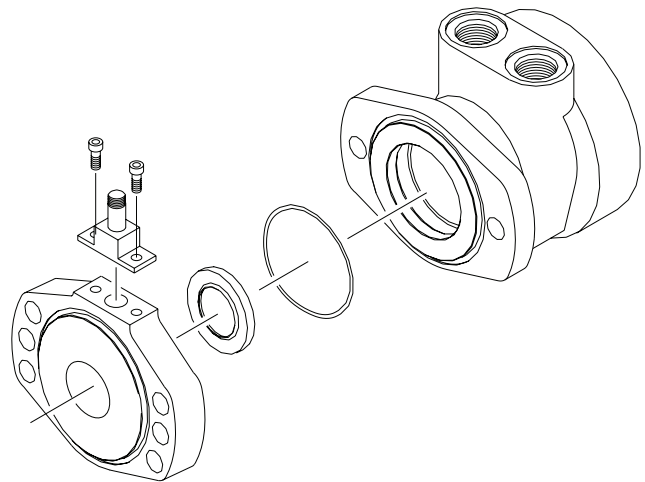
Torque Specifications: 41 - 54 daNm [300 - 400 ft.lb.]

## SPEED SENSORS

White Drive Products offers both single and dual element speed sensor options providing a number of benefits to users by incorporating the latest advancements in sensing technology and materials. The 700 & 800 series motors single element sensors provide 60 pulses per revolution with the dual element providing 120 pulses per revolution, with all other series providing 50 & 100 pulses respectively. Higher resolution is especially beneficial for slow speed applications, where more information is needed for smooth and accurate control. The dual sensor option also provides a direction signal allowing end-users to monitor the direction of shaft rotation .

Unlike competitive designs that breach the high pressure area of the motor to add the sensor, the White Drive Products speed sensor option utilizes an add-on flange to locate all sensor components outside the high pressure operating environment. This eliminates the potential leak point common to competitive designs. Many improvements were made to the sensor flange including changing the material from cast iron to acetal resin, incorporating a Buna-N shaft seal internal to the flange, and providing a grease zerk, which allows the user to fill the sensor cavity with grease. These improvements enable the flange to withstand the rigors of harsh environments.

Another important feature of the new sensor flange is that it is self-centering, which allows it to remain concentric to the magnet rotor. This produces a consistent mounting location



for the new sensor module, eliminating the need to adjust the air gap between the sensor and magnet rotor. The o-ring sealed sensor module attaches to the sensor flange with two small screws, allowing the sensor to be serviced or upgraded in the field in under one minute. This feature is especially valuable for mobile applications where machine downtime is costly. The sensor may also be serviced without exposing the hydraulic circuit to the atmosphere. Another advantage of the self-centering flange is that it allows users to rotate the sensor to a location best suited to their application. This feature is not available on competitive designs, which fix the sensor in one location in relationship to the motor mounting flange.

## FEATURES / BENEFITS

- Grease fitting allows sensor cavity to be filled with grease for additional protection.
- Internal extruder seal protects against environmental elements.
- M12 or weatherpack connectors provide installation flexibility.
- Dual element sensor provides up to 120 pulses per revolution and directional sensing.
- Modular sensor allows quick and easy servicing.
- Acetal resin flange is resistant to moisture, chemicals, oils, solvents and greases.
- Self-centering design eliminates need to set magnet-to-sensor air gap.
- Protection circuitry

## SENSOR OPTIONS

### Z - 4-pin M12 male connector

This option has 50 pulses per revolution on all series except the DT which has 60 pulses per revolution. This option will not detect direction.

### Y - 3-pin male weatherpack connector\*

This option has 50 pulses per revolution on all series except the DT which has 60 pulses per revolution. This option will not detect direction.

### X - 4-pin M12 male connector

This option has 100 pulses per revolution on all series except the DT which has 120 pulses per revolution. This option will detect direction.

### W - 4-pin male weatherpack connector\*

This option has 100 pulses per revolution on all series except the DT which has 120 pulses per revolution. This option will detect direction.

\*These options include a 610mm [2 ft] cable.

## SPEED SENSORS

### SINGLE ELEMENT SENSOR - Y & Z

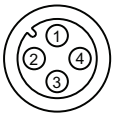
Supply voltages ..... 7.5-24 Vdc  
 Maximum output off voltage ..... 24 V  
 Maximum continuous output current ..... < 25 ma  
 Signal levels (low, high) ..... 0.8 to supply voltage  
 Operating Temp ..... -30°C to 83°C [-22°F to 181°F]

### DUAL ELEMENT SENSOR - X & W

Supply voltages ..... 7.5-18 Vdc  
 Maximum output off voltage ..... 18 V  
 Maximum continuous output current ..... < 20 ma  
 Signal levels (low, high) ..... 0.8 to supply voltage  
 Operating Temp ..... -30°C to 83°C [-22°F to 181°F]

### SENSOR CONNECTORS

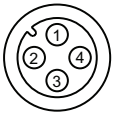
#### Z Option



#### PIN

1	positive	brown or red
2	n/a	white
3	negative	blue
4	pulse out	black

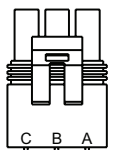
#### X Option



#### PIN

1	positive	brown or red
2	direction out	white
3	negative	blue
4	pulse out	black

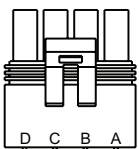
#### Y Option



#### PIN

A	positive	brown or red
B	negative	blue
C	pulse out	black
D	n/a	white

#### W Option



#### PIN

A	positive	brown or red
B	negative	blue
C	pulse out	black
D	direction out	white

### PROTECTION CIRCUITRY

The single element sensor has been improved and incorporates protection circuitry to avoid electrical damage caused by:

- reverse battery protection
- overvoltage due to power supply spikes and surges (60 Vdc max.)
- power applied to the output lead

The protection circuit feature will help “save” the sensor from damage mentioned above caused by:

- faulty installation wiring or system repair
- wiring harness shorts/opens due to equipment failure or harness damage resulting from accidental conditions (i.e. severed or grounded wire, ice, etc.)
- power supply spikes and surges caused by other electrical/electronic components that may be intermittent or damaged and “loading down” the system.

While no protection circuit can guarantee against any and all fault conditions. The single element sensor from White Drive Products with protection circuitry is designed to handle potential hazards commonly seen in real world applications.

Unprotected versions are also available for operation at lower voltages down to 4.5V.

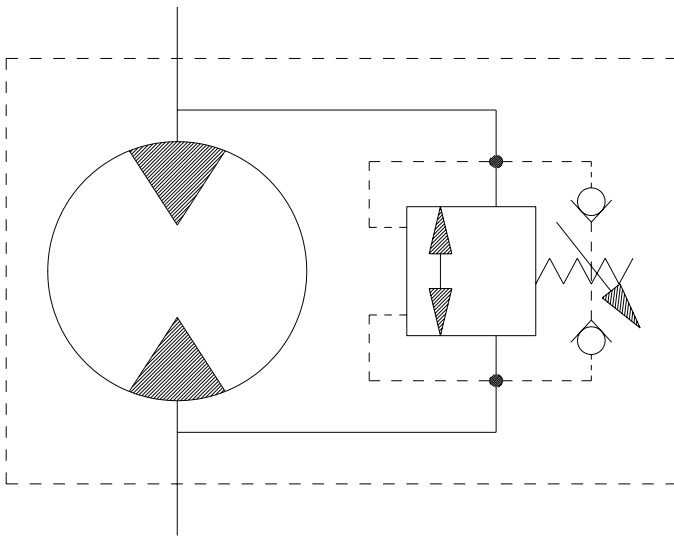
### FREE TURNING ROTOR

The ‘AC’ option or “Free turning” option refers to a specially prepared rotor assembly. This rotor assembly has increased clearance between the rotor tips and rollers allowing it to turn more freely than a standard rotor assembly. For spool valve motors, additional clearance is also provided between the shaft and housing bore. The ‘AC’ option is available for all motor series and displacements.

There are several applications and duty cycle conditions where ‘AC’ option performance characteristics can be beneficial. In continuous duty applications that require high flow/high rpm operation, the benefits are twofold. The additional clearance helps to minimize internal pressure drop at high flows. This clearance also provides a thicker oil film at metal to metal contact areas and can help extend the life of the motor in high rpm or even over speed conditions. The ‘AC’ option should be considered for applications that require continuous operation above 57 LPM [15 GPM] and/or 300 rpm. Applications that are subject to pressure spikes due to frequent reversals or shock loads can also benefit by specifying the ‘AC’ option. The additional clearance serves to act as a buffer against spikes, allowing them to be bypassed through the motor rather than being absorbed and transmitted through the drive link to the output shaft. The trade-off for achieving these benefits is a slight loss of volumetric efficiency at high pressures.

## VALVE CAVITY

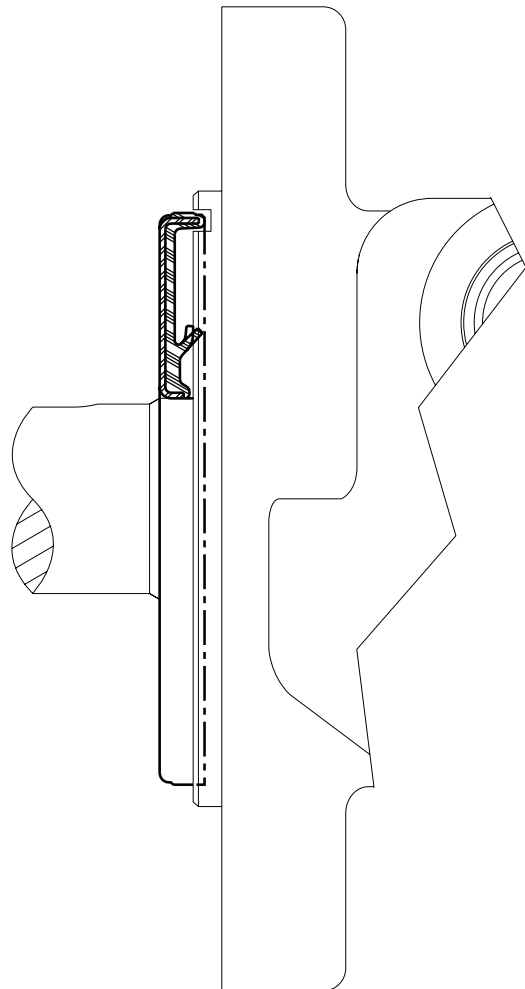
The valve cavity option provides a cost effective way to incorporate a variety of cartridge valves integral to the motor. The valve cavity is a standard 10 series (12 series on the 800 series motor) 2-way cavity that accepts numerous cartridge valves, including overrunning check valves, relief cartridges, flow control valves, pilot operated check valves, and high pressure shuttle valves. Installation of a relief cartridge into the cavity provides an extra margin of safety for applications encountering frequent pressure spikes. Relief cartridges from 69 to 207 bar [1000 to 3000 psi] may also be factory installed.



For basic systems with fixed displacement pumps, either manual or motorized flow control valves may be installed into the valve cavity to provide a simple method for controlling motor speed. It is also possible to incorporate the speed sensor option and a programmable logic controller with a motorized flow control valve to create a closed loop, fully automated speed control system. For motors with internal brakes, a shuttle valve cartridge may be installed into the cavity to provide a simple, fully integrated method for supplying release pressure to the pilot line to actuate an integral brake. To discuss other alternatives for the valve cavity option, contact an authorized White Drive Products distributor.

## SLINGER SEAL

Slinger seals are available on select series offered by White Drive Products. Slinger seals offer extended shaft/shaft seal protection by preventing a buildup of material around the circumference of the shaft which can lead to premature shaft seal failures. The White Drive slinger seals are designed to be larger in diameter than competitive products, providing greater surface speed and 'slinging action'.



Slinger seals are also available on 4-hole flange mounts on select series. Contact a White Drive Products Customer Service Representative for additional information.

## OVERVIEW

The WR Series motors incorporate the latest advances for smooth performance, efficiency and durability. Featuring an optimized Roller Stator<sup>®</sup> geometry with seven precision rollers to eliminate sliding friction and provide rolling contact between the rotor and stator, thus increasing motor efficiency. A three-zone spool valve, integral check valves and a provision for a case drain reduce pressure on internal seals to improve product life. A wide variety of mounting, shaft, motor displacement and porting options are available to meet all application needs.

## FEATURES / BENEFITS

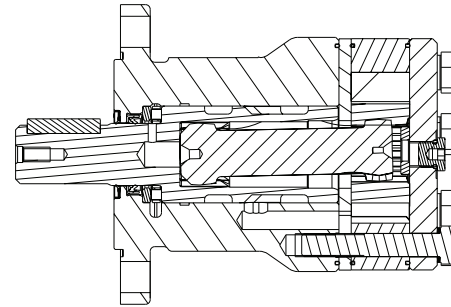
- A variety of mounts and shafts provides flexibility in application design.
- A high pressure shaft seal offers superior seal life and performance.
- The spool valve design gives superior performance and smooth operation over a wide speed and torque range.
- Built-in check valves (not shown) in the housing offer versatility and increased seal life.
- Optimized Roller Stator<sup>®</sup> geometry provides a smooth running high efficient product.

## TYPICAL APPLICATIONS

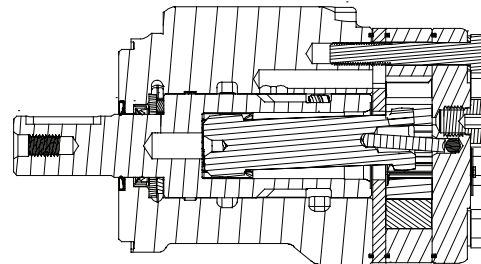
conveyors, carwashes, positioners, light-duty wheel drives, sweepers, food processing, grain augers, spreaders, feed rollers, screw drives, brush drives and more

## SERIES DESCRIPTIONS

**251/252** - Hydraulic Motor  
Standard



**255/256** - Hydraulic Motor  
Standard



## SPECIFICATIONS

CODE	Displacement cm <sup>3</sup> [in <sup>3</sup> /rev]	Max. Speed rpm		Max. Flow lpm [gpm]		Max. Torque Nm [lb-in]		Max. Pressure bar [psi]		
		cont.	inter.	cont.	inter.	cont.	inter.	cont.	inter.	peak
040	40 [2.5]	1116	1515	45 [12]	61 [16]	93 [823]	123 [1088]	155 [2250]	207 [3000]	224 [3250]
050	50 [3.1]	1058	1220	53 [14]	61 [16]	111 [982]	149 [1319]	155 [2250]	207 [3000]	224 [3250]
060	59 [3.6]	890	1142	53 [14]	68 [18]	138 [1221]	172 [1522]	155 [2250]	207 [3000]	224 [3250]
070	71 [4.3]	865	1078	61 [16]	76 [20]	176 [1558]	207 [1832]	172 [2500]	207 [3000]	241 [3500]
080	79 [4.9]	759	957	61 [16]	76 [20]	202 [1788]	243 [2150]	172 [2500]	207 [3000]	241 [3500]
090	88 [5.4]	691	864	61 [16]	76 [20]	222 [1965]	263 [2327]	172 [2500]	207 [3000]	241 [3500]
100	100 [6.1]	610	760	61 [16]	76 [20]	246 [2177]	289 [2558]	172 [2500]	207 [3000]	241 [3500]
115	113 [6.9]	539	672	61 [16]	76 [20]	284 [2513]	327 [2894]	172 [2500]	207 [3000]	241 [3500]
130	129 [7.9]	472	588	61 [16]	76 [20]	316 [2797]	375 [3319]	172 [2500]	207 [3000]	241 [3500]
160	160 [9.8]	379	469	61 [16]	76 [20]	400 [3540]	454 [4018]	172 [2500]	207 [3000]	241 [3500]
200	198 [12.1]	308	384	61 [16]	76 [20]	462 [4088]	544 [4814]	172 [2500]	207 [3000]	241 [3500]
240	236 [14.4]	249	315	61 [16]	76 [20]	548 [4850]	642 [5682]	172 [2500]	207 [3000]	224 [3250]
250	250 [15.3]	250	300	61 [16]	76 [20]	561 [4965]	624 [5522]	172 [2500]	207 [3000]	224 [3250]
290	291 [17.8]	210	256	61 [16]	76 [20]	526 [4655]	664 [5876]	138 [2000]	190 [2750]	207 [3000]
320	322 [19.6]	188	235	61 [16]	76 [20]	518 [4584]	690 [6106]	121 [1750]	172 [2500]	190 [2750]
400	400 [24.4]	152	190	61 [16]	76 [20]	551 [4873]	698 [6177]	104 [1500]	138 [2000]	155 [2250]

► Performance data is typical. Performance of production units varies slightly from one motor to another. Running at intermittent ratings should not exceed 10% of every minute of operation.



## DISPLACEMENT PERFORMANCE

Pressure - bar [psi]												Max. Cont.	Max. Inter.
<b>040</b>												17 [250]	207 [3000]
40 cm <sup>3</sup> [2.5 in <sup>3</sup> ] / rev												155 [2250]	172 [2500]
Torque - Nm [lb-in], Speed rpm												Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	2 [0.5]	9 [80] 43	20 [177] 40	32 [283] 35	40 [354] 29	37 [327] 24							50
	4 [1]	10 [88] 95	21 [186] 91	30 [265] 82	42 [372] 73	52 [460] 62	62 [549] 51						100
	8 [2]	9 [80] 188	19 [168] 180	28 [248] 170	41 [363] 160	51 [451] 144	64 [566] 137	72 [637] 126	79 [699] 115	89 [788] 102	99 [876] 88		199
	15 [4]	7 [62] 365	18 [159] 355	27 [239] 343	40 [354] 324	49 [434] 312	62 [549] 295	73 [646] 293	83 [735] 275	93 [823] 257	102 [903] 237	121 [1071] 198	373
	23 [6]	6 [53] 560	17 [150] 548	26 [230] 532	39 [345] 515	48 [425] 502	61 [540] 485	70 [619] 471	82 [726] 451	90 [796] 432	101 [894] 444	122 [1080] 398	572
	30 [8]	6 [53] 728	16 [142] 716	25 [221] 706	37 [327] 684	47 [416] 667	59 [522] 648	68 [602] 634	81 [717] 629	88 [779] 618	99 [876] 601	123 [1088] 545	746
	38 [10]	5 [44] 942	14 [124] 936	22 [195] 927	35 [310] 918	45 [398] 904	57 [504] 890	68 [602] 874	78 [690] 852	86 [761] 835	97 [858] 812	118 [1044] 743	945
	45 [12]	3 [27] 1116	13 [115] 1113	21 [186] 1100	34 [301] 1082	43 [381] 1056	55 [487] 1028	67 [593] 1004	77 [681] 976	84 [743] 952	95 [841] 916	116 [1027] 870	1119
	53 [14]		10 [88] 1316	20 [177] 1301	31 [274] 1278	39 [345] 1253	52 [460] 1230	63 [558] 1206	75 [664] 1184	82 [726] 1154	93 [823] 1116	115 [1018] 1078	1318
	61 [16]		8 [71] 1515	19 [168] 1497	29 [257] 1469	38 [336] 1442	49 [434] 1415	60 [531] 1399	74 [655] 1378	80 [708] 1355	90 [796] 1330	113 [1000] 1298	1517
Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>													
Theoretical Torque - Nm [lb-in]													
Rotor Width													
8.1 [317]													
mm [in]													
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

Pressure - bar [psi]												Max. Cont.	Max. Inter.
<b>050</b>												17 [250]	207 [3000]
50 cm <sup>3</sup> [3.1 in <sup>3</sup> ] / rev												155 [2250]	172 [2500]
Torque - Nm [lb-in], Speed rpm												Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	4 [1]	11 [97] 77	24 [212] 75	37 [327] 74	49 [434] 69	61 [540] 63	74 [655] 52	82 [726] 41	91 [805] 36				80
	8 [2]	11 [97] 155	24 [212] 152	36 [319] 150	49 [434] 142	62 [548] 132	75 [664] 124	88 [779] 107	99 [876] 91	107 [947] 82			160
	15 [4]	9 [80] 295	23 [204] 291	36 [319] 283	49 [434] 272	62 [548] 267	75 [664] 248	88 [779] 231	99 [876] 215	110 [973] 199	123 [1088] 182	147 [1301] 164	300
	23 [6]	7 [62] 452	22 [195] 447	35 [310] 434	47 [416] 430	61 [540] 416	74 [655] 402	87 [770] 385	99 [876] 368	111 [982] 346	124 [1097] 324	149 [1319] 300	460
	30 [8]	5 [44] 594	21 [186] 589	34 [301] 577	45 [398] 566	60 [531] 546	74 [655] 528	86 [761] 509	99 [876] 489	111 [982] 468	125 [1106] 448	148 [1310] 426	600
	38 [10]	3 [27] 754	19 [168] 749	32 [283] 736	45 [398] 728	57 [504] 716	70 [619] 699	82 [726] 680	95 [841] 664	107 [947] 644	120 [1062] 624	142 [1257] 600	760
	45 [12]	2 [18] 896	17 [150] 892	30 [265] 875	43 [381] 873	55 [487] 861	68 [602] 843	80 [708] 827	92 [814] 812	105 [929] 794	116 [1027] 776	138 [1221] 752	900
	53 [14]		14 [124] 1058	27 [239] 1055	39 [345] 1052	51 [451] 1036	64 [566] 998	76 [673] 988	88 [779] 960	100 [885] 972	112 [991] 904	134 [1186] 860	1060
	61 [16]		11 [97] 1220	24 [212] 1216	35 [310] 1212	47 [416] 1210	60 [531] 1198	72 [637] 1160	84 [743] 1130	96 [850] 1112	108 [956] 1080	130 [1150] 1032	1220
Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>													
Theoretical Torque - Nm [lb-in]													
Rotor Width													
9.9 [389]													
mm [in]													
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

► Performance data is typical. Performance of production units varies slightly from one motor to another. Operating at maximum continuous pressure and maximum continuous flow simultaneously is not recommended. For additional information on product testing please refer to page 6.



## DISPLACEMENT PERFORMANCE

Pressure - bar [psi]										Max. Cont.		Max. Inter.									
080										17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
79 cm <sup>3</sup> [4.9 in <sup>3</sup> ] / rev										Intermittent Ratings - 10% of Operation											
Torque - Nm [lb-in], Speed rpm																					
Flow - lpm [gpm]	4 [1]	18 [159] 49	38 [336] 46	77 [681] 41	94 [832] 40																50
	8 [2]	18 [159] 99	39 [345] 98	76 [673] 89	98 [867] 83	120 [1062] 74	141 [1248] 68	159 [1407] 59	174 [1540] 50											100	
	15 [4]	17 [150] 189	38 [336] 187	76 [673] 177	98 [867] 170	120 [1062] 161	141 [1248] 151	160 [1416] 144	180 [1593] 131	199 [1761] 122	220 [1947] 112	240 [2124] 100							190		
	23 [6]	17 [150] 290	37 [327] 286	79 [690] 274	97 [858] 268	119 [1053] 259	140 [1239] 250	160 [1416] 240	182 [1611] 227	202 [1788] 214	222 [1965] 200	243 [2150] 185							291		
	30 [8]	14 [124] 374	35 [310] 368	75 [664] 357	96 [850] 349	117 [1035] 339	138 [1221] 330	159 [1407] 321	181 [1602] 307	200 [1770] 296	220 [1947] 284	241 [2133] 268							380		
	38 [10]	11 [97] 480	34 [301] 475	73 [646] 464	94 [832] 453	116 [1027] 442	138 [1221] 433	158 [1398] 423	177 [1566] 412	199 [1761] 398	218 [1929] 383	238 [2106] 370							481		
	45 [12]	8 [71] 568	31 [274] 562	72 [637] 548	93 [823] 543	114 [1009] 532	135 [1195] 525	155 [1372] 515	176 [1558] 501	196 [1735] 486	215 [1903] 472	235 [2080] 458							570		
	53 [14]	5 [44] 668	28 [248] 663	69 [611] 649	90 [796] 642	111 [982] 632	133 [1177] 624	152 [1345] 620	172 [1522] 600	193 [1708] 585	212 [1876] 570	232 [2053] 554							671		
	61 [16]		24 [212] 759	65 [575] 752	85 [752] 747	109 [965] 731	129 [1142] 722	148 [1310] 710	168 [1487] 703	187 [1655] 689	208 [1841] 675	228 [2018] 660							772		
	68 [18]		21 [186] 855	61 [540] 848	81 [717] 842	105 [929] 828	125 [1106] 818	143 [1265] 807	164 [1451] 800	182 [1611] 789	204 [1805] 776	223 [1973] 760							861		
76 [20]		18 [159] 957	56 [496] 952	76 [673] 944	100 [885] 932	120 [1062] 923	138 [1221] 912	159 [1407] 900	178 [1575] 886	199 [1761] 872	218 [1929] 858							962			
Rotor Width																					
15.7 [617]																					
mm [in]																					
Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>																					
Theoretical Torque - Nm [lb-in]																					
22 [192]										43 [384]											
87 [768]										108 [960]											
130 [1152]										152 [1344]											
174 [1536]										195 [1728]											
217 [1920]										239 [2112]											
260 [2304]																					
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]																					

Pressure - bar [psi]										Max. Cont.		Max. Inter.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
090										17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
88 cm³ [5.4 in³] / rev										Intermittent Ratings - 10% of Operation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Torque - Nm [lb-in], Speed rpm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Flow - lpm [gpm]	2 [0.5]	18 [159] 23	40 [354] 22	75 [664] 17																	23																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	4 [1]	20 [177] 45	44 [389] 42	88 [779] 35	112 [991] 31	118 [1044] 27	128 [1133] 21														45																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	8 [2]	22 [195] 91	44 [389] 88	87 [770] 81	114 [1009] 77	134 [1186] 72	158 [1398] 68	175 [1549] 60	198 [1752] 52	216 [1912] 42											91																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	15 [4]	20 [177] 169	44 [389] 166	88 [779] 160	112 [991] 156	134 [1186] 152	154 [1363] 146	182 [1611] 140	204 [1805] 130	222 [1965] 122	242 [2142] 110	262 [2319] 96									170																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	23 [6]	19 [168] 260	40 [354] 257	86 [761] 250	110 [974] 245	131 [1159] 238	152 [1345] 232	176 [1558] 225	196 [1735] 215	218 [1929] 205	242 [2142] 193	263 [2327] 186									260																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	30 [8]	17 [150] 339	38 [336] 336	83 [735] 328	108 [956] 324	126 [1115] 318	150 [1327] 308	173 [1531] 300	194 [1717] 292	216 [1912] 280	238 [2106] 270	258 [2283] 258									340																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	38 [10]	14 [124] 430	33 [292] 429	77 [681] 426	106 [938] 424	122 [1080] 417	146 [1292] 411	170 [1504] 402	188 [1664] 393	210 [1858] 380	232 [2053] 366	253 [2239] 354									430																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	45 [12]	9 [80] 510	30 [265] 508	73 [646] 504	103 [912] 500	120 [1062] 496	145 [1283] 488	164 [1451] 480	184 [1628] 472	206 [1823] 462	228 [2018] 448	246 [2177] 434									510																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	53 [14]	5 [44] 601	25 [221] 600	69 [611] 596	97 [856] 594	114 [1009] 591	140 [1239] 586	160 [1416] 578	178 [1575] 566	202 [1788] 552	226 [2000] 540	244 [2159] 528									601																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	61 [16]		20 [177] 691	66 [584] 688	90 [797] 684	109 [965] 678	134 [1186] 670	156 [1381] 664	173 [1531] 654	200 [1770] 642	220 [1947] 630	242 [2142] 610									692																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
68 [18]		16 [142] 772	63 [558] 770	84 [743] 768	105 [929] 766	128 [1133] 764	152 [1345] 754	168 [1487] 742	193 [1708] 722	214 [1894] 712	236 [2088] 700									772																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
76 [20]		10 [88] 864	58 [513] 863	79 [699] 858	100 [885] 848	121 [1071] 844	148 [1310] 835	163 [1442] 825	186 [1646] 812	205 [1814] 800	226 [2000] 778									864																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Rotor Width																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
17.3 [.682]																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
mm [in]																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Theoretical Torque - Nm [lb-in]																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
24 [215]										49 [429]										97 [859]										121 [1073]										146 [1288]										170 [1502]										194 [1717]										218 [1932]										243 [2146]										267 [2361]										291 [2576]																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

## DISPLACEMENT PERFORMANCE

		Pressure - bar [psi]										Max. Cont.	Max. Inter.
100		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
100 cm³ [6.1 in³] / rev													
Torque - Nm [lb-in], Speed rpm													
Intermittent Ratings - 10% of Operation													
Flow - lpm [gpm]	2 [0.5]	18 [159] 17	37 [327] 13	77 [681] 12	91 [805] 11								20
	4 [1]	26 [230] 38	49 [434] 37	84 [743] 33	106 [938] 31	120 [1062] 29	140 [1239] 15	160 [1416] 7					40
	8 [2]	25 [221] 80	50 [442] 78	98 [867] 75	125 [1106] 70	150 [1327] 68	175 [1549] 65	199 [1761] 61	189 [1673] 20				80
	15 [4]	26 [230] 150	46 [407] 148	97 [858] 142	124 [1097] 139	148 [1310] 136	175 [1549] 131	198 [1752] 128	224 [1982] 122	245 [2168] 118	267 [2363] 111	289 [2558] 85	150
	23 [6]	23 [203] 229	48 [425] 226	96 [850] 221	123 [1088] 218	148 [1310] 215	173 [1531] 212	200 [1770] 208	223 [1973] 201	246 [2177] 197	269 [2381] 189	286 [2531] 162	230
	30 [8]	21 [186] 296	45 [398] 292	93 [823] 285	121 [1071] 282	146 [1292] 280	168 [1487] 280	195 [1726] 274	221 [1956] 270	244 [2159] 265	265 [2345] 255	284 [2513] 208	300
	38 [10]	17 [150] 378	41 [363] 375	91 [805] 367	115 [1018] 370	141 [1248] 367	165 [1460] 364	189 [1673] 363	215 [1903] 361	238 [2106] 353	264 [2336] 338	282 [2496] 310	380
	45 [12]	14 [123] 450	36 [319] 448	89 [788] 442	116 [1027] 438	140 [1239] 433	162 [1434] 426	188 [1664] 420	210 [1858] 412	234 [2071] 404	258 [2283] 390	280 [2478] 355	450
	53 [14]	12 [106] 528	34 [301] 526	83 [735] 520	109 [965] 518	134 [1186] 514	158 [1389] 508	181 [1602] 500	205 [1814] 490	228 [2017] 480	256 [2265] 468	278 [2460] 440	530
	61 [16]	10 [88] 610	28 [248] 608	79 [699] 600	103 [912] 596	129 [1142] 590	152 [1345] 582	172 [1522] 576	198 [1752] 568	223 [1973] 556	254 [2248] 542	276 [2443] 525	610
Max. Cont.	68 [18]	6 [53] 680	21 [186] 677	71 [628] 666	94 [832] 660	121 [1071] 653	146 [1292] 645	169 [1496] 635	192 [1699] 624	215 [1903] 610	251 [2221] 594	272 [2407] 574	680
	76 [20]		15 [133] 760	63 [558] 754	85 [752] 750	112 [991] 742	133 [1177] 730	160 [1416] 715	185 [1637] 702	202 [1788] 688	248 [2195] 666	267 [2363] 636	760
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>											
19.7 [7.77]		Theoretical Torque - Nm [lb-in]											
mm [in]		27 [239]	56 [496]	110 [974]	137 [1212]	166 [1469]	193 [1708]	220 [1947]	247 [2186]	275 [2434]	303 [2682]	330 [2921]	
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

		Pressure - bar [psi]										Max. Cont.		Max. Inter.	
115		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]			
113 cm³ [6.9 in³] / rev														Intermittent Ratings - 10% of Operation	
		Torque - Nm [lb-in], Speed rpm													
Flow - lpm [gpm]	2 [0.5]	23 [204] 17	53 [469] 12											18	
	4 [1]	25 [221] 35	56 [496] 34	95 [841] 30	118 [1044] 19									35	
	8 [2]	25 [221] 70	59 [522] 69	117 [1035] 65	144 [1274] 62	172 [1522] 60	202 [1788] 56							71	
	15 [4]	24 [212] 130	58 [513] 129	112 [991] 127	144 [1274] 125	173 [1531] 122	202 [1788] 117	225 [1991] 114	251 [2221] 108					133	
	23 [6]	22 [195] 200	51 [451] 199	111 [982] 197	140 [1239] 194	171 [1513] 191	201 [1779] 186	224 [1982] 183	251 [2221] 176	284 [2513] 170	307 [2717] 153			204	
	30 [8]	21 [186] 264	53 [469] 262	108 [956] 258	134 [1186] 256	167 [1478] 254	196 [1735] 251	222 [1965] 248	251 [2221] 240	278 [2460] 232	305 [2699] 226	327 [2894] 210		265	
	38 [10]	16 [142] 336	46 [407] 334	105 [929] 330	131 [1159] 326	164 [1451] 323	191 [1690] 318	217 [1920] 312	247 [2186] 306	271 [2398] 300	299 [2646] 292	327 [2894] 281		336	
	45 [12]	12 [106] 397	43 [381] 396	101 [894] 390	132 [1168] 387	161 [1425] 382	187 [1655] 379	218 [1929] 371	239 [2115] 363	269 [2381] 355	290 [2566] 344	319 [2823] 339		398	
	53 [14]	6 [53] 468	35 [310] 464	97 [858] 456	125 [1106] 452	157 [1389] 448	179 [1584] 444	207 [1832] 442	237 [2097] 436	259 [2292] 430	289 [2558] 422	315 [2788] 415		469	
	61 [16]		34 [301] 539	90 [796] 534	118 [1044] 531	149 [1319] 524	174 [1540] 521	200 [1770] 518	233 [2062] 506	254 [2248] 498	285 [2522] 495	314 [2779] 479		540	
Max. Inter.	68 [18]		29 [257] 601	84 [743] 596	114 [1009] 594	140 [1239] 589	172 [1522] 583	202 [1788] 572	221 [1956] 566	253 [2239] 557	282 [2496] 547	299 [2646] 544		602	
	76 [20]		17 [150] 672	73 [646] 668	103 [912] 664	132 [1168] 658	161 [1425] 655	186 [1646] 648	214 [1894] 638	240 [2124] 627	266 [2354] 621	293 [2593] 607		673	
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>													
		Theoretical Torque - Nm [lb-in]													
22.1 [872]		31 [274]	62 [549]	124 [1097]	155 [1372]	186 [1646]	217 [1920]	248 [2195]	279 [2469]	310 [2743]	341 [3018]	372 [3292]			
mm [in]		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

► Performance data is typical. Performance of production units varies slightly from one motor to another. Operating at maximum continuous pressure and maximum continuous flow simultaneously is not recommended. For additional information on product testing please refer to page 6.

## DISPLACEMENT PERFORMANCE

		Pressure - bar [psi]								Max. Cont.	Max. Inter.		
130		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
129 cm³ [7.9 in³] / rev													
Torque - Nm [lb-in], Speed rpm													
Intermittent Ratings - 10% of Operation													
Flow - lpm [gpm]	2 [0.5]	34 [301] 15	60 [531] 6										15
	4 [1]	32 [283] 30	64 [566] 29	124 [1097] 18	140 [1239] 10	185 [1637] 6							30
	8 [2]	31 [274] 59	65 [575] 58	126 [1115] 51	144 [1274] 46	198 [1752] 38	223 [1974] 32	248 [2195] 25					59
	15 [4]	31 [274] 115	66 [584] 112	130 [1151] 106	164 [1451] 102	195 [1726] 97	221 [1956] 92	255 [2257] 86	285 [2522] 80	312 [2761] 74	345 [3053] 66		118
	23 [6]	30 [266] 177	65 [575] 175	130 [1151] 167	162 [1434] 163	196 [1735] 157	230 [2036] 152	265 [2345] 142	289 [2558] 138	316 [2797] 132	352 [3115] 121	375 [3319] 114	177
	30 [8]	28 [248] 232	64 [566] 227	128 [1133] 218	157 [1389] 213	192 [1699] 208	223 [1974] 200	259 [2292] 189	284 [2513] 184	313 [2770] 176	343 [3036] 168	374 [3310] 162	235
	38 [10]	20 [177] 294	60 [531] 289	125 [1106] 280	157 [1389] 275	188 [1664] 268	222 [1965] 260	254 [2248] 251	282 [2496] 243	313 [2770] 234	349 [3089] 221	370 [3275] 214	294
	45 [12]	15 [133] 353	55 [487] 351	120 [1062] 343	152 [1345] 338	186 [1646] 331	216 [1912] 321	244 [2159] 311	281 [2487] 299	307 [2717] 289	341 [3018] 277	369 [3266] 264	353
	53 [14]	13 [115] 411	47 [416] 408	117 [1035] 398	150 [1328] 392	181 [1602] 386	212 [1876] 378	247 [2186] 366	273 [2416] 357	310 [2744] 347	335 [2965] 335	363 [3213] 325	411
	61 [16]	7 [62] 472	42 [372] 470	106 [938] 465	140 [1239] 462	170 [1505] 456	207 [1832] 447	239 [2115] 435	265 [2345] 426	296 [2620] 409	328 [2903] 396	361 [3195] 388	472
Max. Inter.	68 [18]		36 [319] 529	102 [903] 522	132 [1168] 517	166 [1469] 507	198 [1752] 500	224 [1982] 489	262 [2319] 482	292 [2584] 468	323 [2859] 445	351 [3106] 430	529
	76 [20]		32 [283] 588	94 [832] 585	123 [1089] 580	158 [1398] 570	190 [1682] 562	219 [1938] 550	254 [2248] 535	282 [2496] 520	308 [2726] 510	347 [3071] 490	588
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>											
		Theoretical Torque - Nm [lb-in]											
25.4 [1.002] mm [in]		35 [310]	71 [628]	142 [1257]	177 [1566]	212 [1876]	248 [2195]	283 [2504]	318 [2814]	354 [3133]	389 [3442]	425 [3761]	
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

		Pressure - bar [psi]								Max. Cont.		Max. Inter.	
160		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
160 cm³ [9.8 in³] / rev													
Torque - Nm [lb-in], Speed rpm													
Intermittent Ratings - 10% of Operation													
Flow - lpm [gpm]	2 [0.5]	30 [266] 12	66 [584] 11	109 [965] 5									13
	4 [1]	32 [283] 24	70 [620] 23	136 [1204] 21	164 [1451] 20	182 [1611] 14	250 [2213] 6						25
	8 [2]	38 [336] 48	76 [673] 47	157 [1389] 42	181 [1602] 38	202 [1788] 34	265 [2345] 28	290 [2567] 22					50
	15 [4]	39 [345] 92	78 [690] 89	166 [1469] 84	205 [1814] 82	242 [2142] 77	275 [2434] 73	317 [2805] 70	358 [3169] 67	400 [3540] 62			94
	23 [6]	40 [354] 140	79 [699] 137	160 [1416] 132	203 [1797] 128	246 [2177] 123	290 [2567] 118	320 [2832] 114	354 [3133] 110	396 [3505] 106	404 [3575] 100	440 [3894] 94	144
	30 [8]	34 [301] 184	73 [646] 178	164 [1451] 172	200 [1770] 170	245 [2168] 164	288 [2549] 160	316 [2797] 152	350 [3098] 147	388 [3434] 142	428 [3788] 134	448 [3965] 129	188
	38 [10]	32 [283] 235	72 [637] 230	156 [1381] 222	196 [1735] 218	240 [2124] 212	282 [2496] 208	312 [2761] 200	347 [3071] 192	389 [3443] 184	422 [3735] 178	454 [4018] 172	238
	45 [12]	24 [212] 278	70 [620] 272	151 [1336] 264	192 [1699] 259	236 [2089] 253	278 [2460] 247	310 [2744] 242	344 [3044] 235	382 [3381] 227	419 [3708] 216	450 [3983] 210	281
	53 [14]	20 [177] 327	60 [531] 322	144 [1274] 312	186 [1646] 306	232 [2053] 300	266 [2354] 295	306 [2708] 289	338 [2991] 281	374 [3310] 276	420 [3717] 267	448 [3965] 258	331
	61 [16]	12 [106] 379	52 [460] 374	134 [1186] 360	178 [1575] 355	218 [1929] 350	254 [2248] 342	297 [2628] 338	334 [2956] 333	371 [3283] 323	401 [3549] 316	442 [3912] 308	381
Max. Inter.	68 [18]		46 [407] 420	130 [1151] 409	171 [1513] 400	215 [1903] 394	248 [2195] 387	291 [2575] 380	326 [2885] 374	361 [3195] 368	393 [3478] 358	428 [3788] 346	425
	76 [20]		38 [336] 469	120 [1062] 453	162 [1434] 448	199 [1760] 442	240 [2124] 435	278 [2460] 428	324 [2867] 421	357 [3159] 412	390 [3452] 401	425 [3761] 392	475
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>											
		Theoretical Torque - Nm [lb-in]											
31.8 [1.252]		43 [383]	89 [789]	176 [1556]	219 [1939]	265 [2345]	308 [2728]	352 [3111]	395 [3495]	441 [3901]	484 [4284]	527 [4667]	
mm [in]		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]											

► Performance data is typical. Performance of production units varies slightly from one motor to another. Operating at maximum continuous pressure and maximum continuous flow simultaneously is not recommended. For additional information on product testing please refer to page 6.

## DISPLACEMENT PERFORMANCE

		Pressure - bar [psi]										Max. Cont.	Max. Inter.
200		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
198 cm³ [12.1 in³] / rev													
Torque - Nm [lb-in], Speed rpm												Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	2 [0.5]	38 [336] 10	87 [770] 8	172 [1522] 6	201 [1779] 5								
	4 [1]	47 [416] 20	103 [912] 19	164 [1451] 14	201 [1779] 12	244 [2159] 9	295 [2611] 6	328 [2903] 3					
	8 [2]	46 [407] 39	96 [850] 38	192 [1699] 36	241 [2133] 35	286 [2531] 34	330 [2920] 28	372 [3292] 25	417 [3690] 22	428 [3788] 17			
	15 [4]	44 [389] 75	95 [841] 73	194 [1717] 70	241 [2133] 68	286 [2531] 65	333 [2947] 63	376 [3319] 59	419 [3708] 57	461 [4080] 52	498 [4407] 50	544 [4814] 40	
	23 [6]	40 [354] 113	92 [814] 111	192 [1699] 109	240 [2124] 106	288 [2549] 103	333 [2947] 99	375 [3319] 96	421 [3726] 94	461 [4080] 89	505 [4469] 84	544 [4814] 78	
	30 [8]	33 [292] 150	87 [770] 147	187 [1655] 142	236 [2088] 140	284 [2513] 135	330 [2920] 131	374 [3327] 126	421 [3726] 124	462 [4088] 117	504 [4460] 112	542 [4796] 106	
	38 [10]	23 [204] 192	80 [708] 190	180 [1593] 185	230 [2035] 182	278 [2460] 177	325 [2876] 172	371 [3283] 167	415 [3673] 160	459 [4062] 154	498 [4407] 146	540 [4779] 140	
	45 [12]	21 [186] 227	73 [646] 226	173 [1531] 221	223 [1973] 219	271 [2398] 212	318 [2814] 207	364 [3221] 201	409 [3619] 194	453 [4009] 186	491 [4345] 179	533 [4717] 174	
	53 [14]	10 [88] 268	64 [566] 266	165 [1460] 260	214 [1894] 256	262 [2319] 251	309 [2735] 245	356 [3150] 240	400 [3540] 233	444 [3929] 227	483 [4274] 217	525 [4646] 210	
	61 [16]		55 [487] 308	155 [1372] 300	204 [1805] 298	253 [2239] 291	300 [2655] 286	346 [3062] 279	391 [3460] 271	434 [3841] 264	472 [4177] 255	514 [4549] 248	
Max. Cont.	68 [18]	46 [407] 343	143 [1265] 332	191 [1690] 330	240 [2124] 322	287 [2540] 316	332 [2938] 310	377 [3336] 302	420 [3717] 296	457 [4044] 286	484 [4283] 276		
	76 [20]	30 [265] 384	130 [1150] 374	179 [1584] 367	227 [2009] 363	275 [2434] 355	321 [2841] 349	365 [3230] 343	409 [3619] 333	430 [3805] 324	468 [4142] 314		
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>											
39.4 [1.553]		Theoretical Torque - Nm [lb-in]											
		54 [481]	109 [963]	218 [1929]	272 [2407]	326 [2888]	381 [3369]	435 [3850]	489 [4332]	544 [4813]	598 [5294]	653 [5776]	
mm [in]		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]											



## DISPLACEMENT PERFORMANCE

Pressure - bar [psi]												Max. Cont.	Max. Inter.
<b>250</b>													
250 cm <sup>3</sup> [15.3 in <sup>3</sup> ] / rev													
Torque - Nm [lb-in], Speed rpm												Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	8 [2]	49 [434] 31	112 [991] 31										32
	15 [4]	49 [434] 59	115 [1018] 60	237 [2097] 56	295 [2611] 53	356 [3150] 48							60
	23 [6]	45 [398] 91	112 [991] 90	233 [2062] 88	301 [2664] 85	360 [3186] 81	418 [3699] 74	471 [4168] 69	521 [4611] 64	561 [4965] 61			92
	30 [8]	41 [363] 119	107 [947] 118	235 [2080] 116	285 [2522] 113	352 [3115] 107	399 [3531] 103	441 [3903] 99	511 [4522] 92	559 [4947] 87	598 [5292] 84	624 [5522] 82	120
	38 [10]	33 [292] 151	97 [858] 150	219 [1938] 148	273 [2416] 144	330 [2920] 139	390 [3451] 134	434 [3841] 132	484 [4283] 129	529 [4681] 124	578 [5115] 119	618 [5469] 116	152
	45 [12]	22 [195] 179	81 [717] 178	198 [1752] 177	254 [2248] 174	312 [2761] 171	368 [3257] 168	410 [3628] 163	474 [4195] 158	500 [4425] 156	588 [5204] 148	605 [5354] 148	180
	53 [14]	14 [124] 211	75 [664] 210	196 [1735] 205	249 [2204] 201	307 [2717] 193	357 [3159] 188	414 [3664] 180	467 [4133] 171	512 [4531] 162	561 [4965] 158	610 [5398] 150	212
	61 [16]		62 [549] 250	178 [1575] 241	235 [2080] 234	292 [2584] 231	347 [3071] 223	400 [3540] 214	454 [4020] 211	501 [4434] 201	543 [4805] 193	602 [5327] 185	244
	68 [18]		50 [442] 271	160 [1416] 268	223 [1973] 263	276 [2442] 255	335 [2965] 244	386 [3416] 232	442 [3912] 221	490 [4336] 210	530 [4690] 200	590 [5221] 192	272
	76 [20]		38 [336] 300	142 [1257] 296	210 [1858] 290	260 [2301] 281	324 [2867] 273	372 [3292] 263	430 [3805] 252	478 [4230] 242	514 [4549] 230	580 [5133] 220	304
Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>													
Theoretical Torque - Nm [lb-in]													
<div> <div>49.2 [1.938]</div> <div>mm [in]</div> </div>													
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

Pressure - bar [psi]												Max. Cont.	Max. Inter.
<b>290</b>													
291 cm <sup>3</sup> [17.8 in <sup>3</sup> ] / rev													
Torque - Nm [lb-in], Speed rpm												Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	2 [0.5]	60 [531] 7	115 [1018] 6	185 [1637] 5	260 [2301] 4	292 [2584] 3							7
	4 [1]	62 [549] 13	122 [1080] 12	187 [1655] 10	265 [2345] 8	304 [2690] 6	365 [2330] 4						14
	8 [2]	60 [531] 26	128 [1133] 24	190 [1682] 22	272 [2407] 20	325 [2876] 18	372 [3292] 15	456 [4036] 12	512 [4531] 8	570 [5045] 4			27
	15 [4]	58 [513] 50	133 [1177] 49	195 [1726] 46	270 [2390] 44	328 [2903] 40	376 [3328] 36	458 [4053] 32	522 [4620] 24	574 [5080] 16	630 [5576] 9	664 [5876] 3	52
	23 [6]	56 [496] 76	124 [1097] 74	200 [1770] 71	268 [2372] 68	331 [2929] 64	396 [3505] 61	462 [4089] 57	525 [4646] 55	566 [5009] 52	625 [5531] 48	660 [5841] 40	79
	30 [8]	50 [442] 100	120 [1062] 96	197 [1743] 90	264 [2336] 85	326 [2885] 80	394 [3487] 76	465 [4115] 72	526 [4655] 70	568 [5027] 68	620 [5487] 65	655 [5797] 62	103
	38 [10]	45 [398] 129	114 [1009] 126	190 [1682] 122	258 [2283] 118	320 [2832] 116	392 [3469] 112	460 [4071] 106	521 [4611] 92	559 [4947] 92	615 [5443] 82	645 [5708] 74	130
	45 [12]	38 [336] 153	104 [920] 150	180 [1593] 146	252 [2230] 142	314 [2779] 138	390 [3452] 133	458 [4053] 127	511 [4522] 120	550 [4868] 106	610 [5399] 100	636 [5629] 95	155
	53 [14]	25 [221] 182	93 [823] 174	170 [1505] 166	236 [2089] 158	306 [2708] 150	382 [3381] 142	452 [4000] 134	500 [4425] 128	542 [4797] 122	606 [5363] 118	625 [5531] 114	182
	61 [16]	12 [106] 210	82 [726] 202	155 [1372] 193	225 [1991] 184	294 [2602] 175	375 [3319] 166	445 [3938] 160	488 [4319] 152	535 [4735] 145	595 [5266] 140	615 [5443] 136	210
Max. Inter.	68 [18]		66 [581] 230	140 [1239] 226	218 [1929] 218	280 [2478] 210	365 [3230] 202	435 [3850] 192	479 [4239] 182	526 [4655] 174	588 [5204] 164	604 [5345] 158	234
	76 [20]		55 [487] 256	128 [1133] 246	198 [1752] 237	270 [2390] 226	350 [3098] 216	426 [3770] 206	468 [4142] 198	514 [4549] 190	574 [5080] 185	588 [5204] 180	261
Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>													
Theoretical Torque - Nm [lb-in]													
<div> <div>57.2 [2.252]</div> <div>mm [in]</div> </div>													
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

► Performance data is typical. Performance of production units varies slightly from one motor to another. Operating at maximum continuous pressure and maximum continuous flow simultaneously is not recommended. For additional information on product testing please refer to page 6.

## DISPLACEMENT PERFORMANCE

		Pressure - bar [psi]						Max. Cont.		Max. Inter.		
320		17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	
322 cm³ [19.6 in³] / rev		Intermittent Ratings - 10% of Operation										
		Torque - Nm [lb-in], Speed rpm										
Flow - lpm [gpm]	2 [0.5]	60 [531] 6	134 [1186] 5	189 [1673] 5	238 [2106] 4						6	
	4 [1]	70 [619] 12	140 [1239] 11	239 [2115] 10	276 [2442] 9	324 [2867] 6	393 [3478] 4	403 [3566] 2			12	
	8 [2]	73 [646] 24	154 [1363] 22	233 [2062] 20	291 [2575] 19	333 [2947] 17	425 [3761] 16	487 [4310] 13	545 [4823] 11	621 [5496] 6	659 [5832] 2	25
	15 [4]	79 [699] 46	152 [1345] 45	235 [2080] 44	311 [2752] 43	385 [3407] 41	452 [4000] 38	518 [4584] 35	555 [4912] 32	641 [5673] 28	690 [6106] 24	47
	23 [6]	68 [602] 70	150 [1328] 69	227 [2009] 68	295 [2611] 66	378 [3345] 63	443 [3920] 58	512 [4531] 53	578 [5115] 49	621 [5496] 47	686 [6071] 43	71
	30 [8]	56 [496] 93	145 [1283] 92	218 [1929] 89	286 [2531] 86	356 [3150] 82	436 [3858] 77	506 [4478] 73	560 [4956] 67	614 [5434] 63	665 [5885] 59	93
	38 [10]	54 [478] 118	140 [1239] 117	202 [1788] 115	273 [2416] 113	348 [3080] 110	427 [3779] 104	501 [4434] 98	557 [4929] 91	604 [5345] 85	664 [5876] 77	118
	45 [12]	38 [336] 140	134 [1186] 138	192 [1681] 136	260 [2301] 134	336 [2973] 130	409 [3619] 124	476 [4212] 117	542 [4796] 110	601 [5319] 103	642 [5681] 97	140
	53 [14]	22 [195] 165	122 [1080] 163	173 [1531] 161	255 [2257] 158	323 [2858] 154	391 [3460] 147	451 [3991] 141	521 [4611] 134	582 [5150] 126	630 [5575] 118	165
	61 [16]	11 [97] 188	105 [930] 186	157 [1389] 184	229 [2027] 182	298 [2637] 177	376 [3327] 170	440 [3894] 162	503 [4451] 155	557 [4929] 147	618 [5469] 138	189
Max. Inter.	68 [18]		88 [779] 210	144 [1274] 208	220 [1947] 204	285 [2522] 197	356 [3150] 190	424 [3752] 181	487 [4310] 173	549 [4858] 165	602 [5327] 156	211
	76 [20]		70 [620] 235	126 [1062] 233	190 [1681] 230	262 [2319] 226	335 [2965] 218	410 [3628] 209	463 [4097] 202	528 [4673] 193	586 [5186] 185	236
Rotor Width		Overall Efficiency - 70 - 100% <div></div> 40 - 69% <div></div> 0 - 39% <div></div>										
Theoretical Torque - Nm [lb-in]		87 [770]	177 [1566]	267 [2362]	354 [3132]	441 [3903]	533 [4717]	620 [5487]	708 [6265]	795 [7035]	887 [7850]	
63.5 [2.502] mm [in]		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]										

		Pressure - bar [psi]					Max. Cont.		Max. Inter.		
400		17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]		
400 cm <sup>3</sup> [24.4 in <sup>3</sup> ] / rev											
		Torque - Nm [lb-in], Speed rpm					Intermittent Ratings - 10% of Operation				
Flow - lpm [gpm]	2 [0.5]	82 [723] 5	165 [1459] 4	250 [2213] 3	329 [2912] 2	418 [3699] 2					5
	4 [1]	86 [761] 10	175 [1549] 9	262 [2317] 8	345 [3053] 7	427 [3779] 6	497 [4398] 4	577 [5106] 3	660 [5841] 2	10	
	8 [2]	89 [791] 20	191 [1690] 19	284 [2513] 18	364 [3219] 17	448 [3962] 15	502 [4443] 13	606 [5363] 11	682 [6036] 8	20	
	15 [4]	87 [771] 38	189 [1673] 37	277 [2451] 36	378 [3346] 34	467 [4135] 33	529 [4679] 32	629 [5569] 28	698 [6177] 25	38	
	23 [6]	79 [703] 58	185 [1637] 56	271 [2398] 55	373 [3305] 53	464 [4110] 50	551 [4873] 49	631 [5584] 46	696 [6159] 44	58	
	30 [8]	70 [620] 75	176 [1558] 73	260 [2301] 71	364 [3217] 69	455 [4025] 66	550 [4868] 63	623 [5515] 60	676 [5982] 58	75	
	38 [10]	59 [523] 95	159 [1407] 93	239 [2115] 92	351 [3106] 87	442 [3913] 84	541 [4787] 81	611 [5410] 78	663 [5864] 75	95	
	45 [12]	52 [460] 113	145 [1283] 111	233 [2062] 108	335 [2968] 105	430 [3806] 103	529 [4684] 96	595 [5269] 91	645 [5705] 88	113	
	53 [14]	46 [404] 133	138 [1221] 131	215 [1903] 127	318 [2813] 126	409 [3622] 121	513 [4543] 114	578 [5115] 109	624 [5522] 104	133	
	61 [16]		113 [1000] 152	191 [1690] 147	298 [2641] 145	390 [3448] 139	496 [4393] 130	560 [4959] 127	606 [5364] 121	153	
Max. Cont.	68 [18]		96 [850] 170	178 [1575] 164	263 [2328] 163	365 [3230] 156	478 [4228] 146	517 [4572] 142	580 [5133] 137	170	
	76 [20]		74 [655] 190	150 [1327] 185	240 [2122] 180	342 [3027] 174	436 [3855] 165	493 [4365] 160	560 [4956] 156	190	
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>									
		Theoretical Torque - Nm [lb-in]									
78.9 [3.106]		112 [992]	224 [1984]	336 [2976]	448 [3968]	560 [4960]	673 [5952]	785 [6944]	897 [7935]		
mm [in]		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]									

► Performance data is typical. Performance of production units varies slightly from one motor to another. Operating at maximum continuous pressure and maximum continuous flow simultaneously is not recommended. For additional information on product testing please refer to page 6.

# WR (255/256 Series) Light Duty Hydraulic Motor

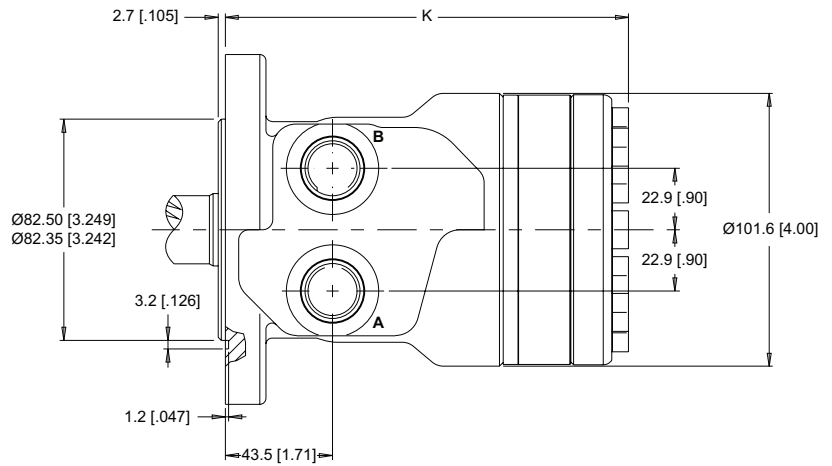
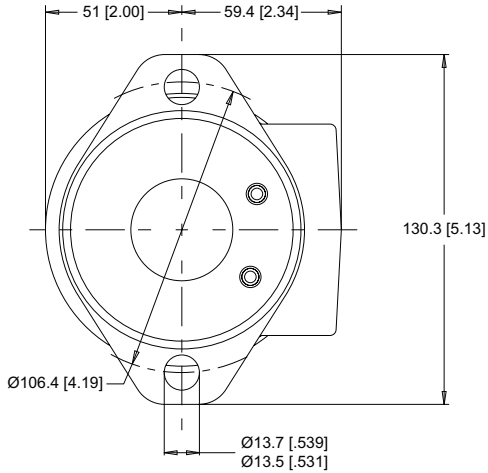


## HOUSINGS

► Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

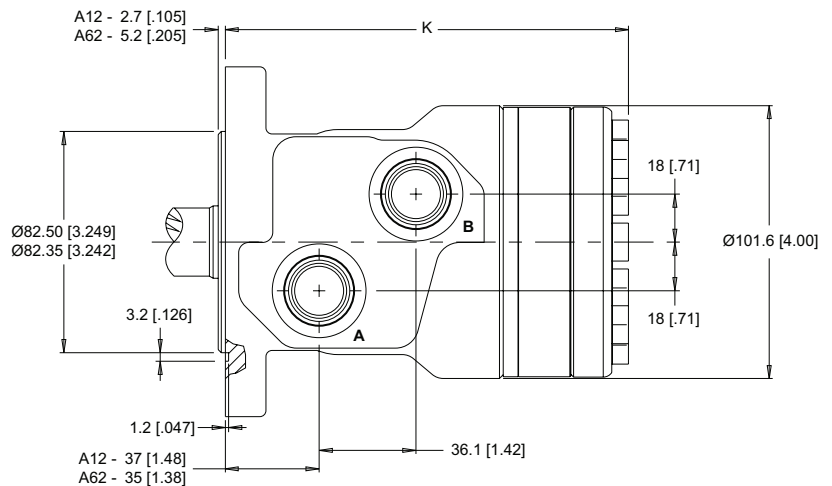
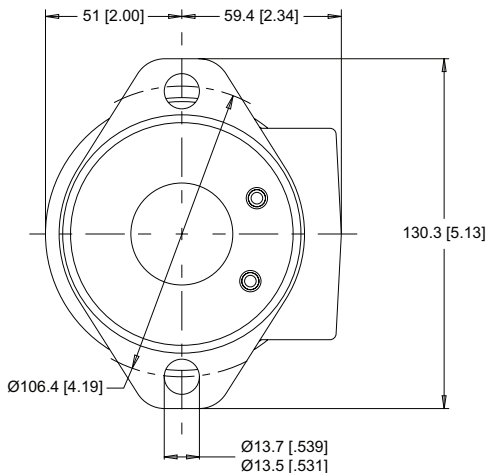
### 2-HOLE, SAE A MOUNT, ALIGNED PORTS

**A10** 1/2-14 NPT **A11** 7/8-14 UNF



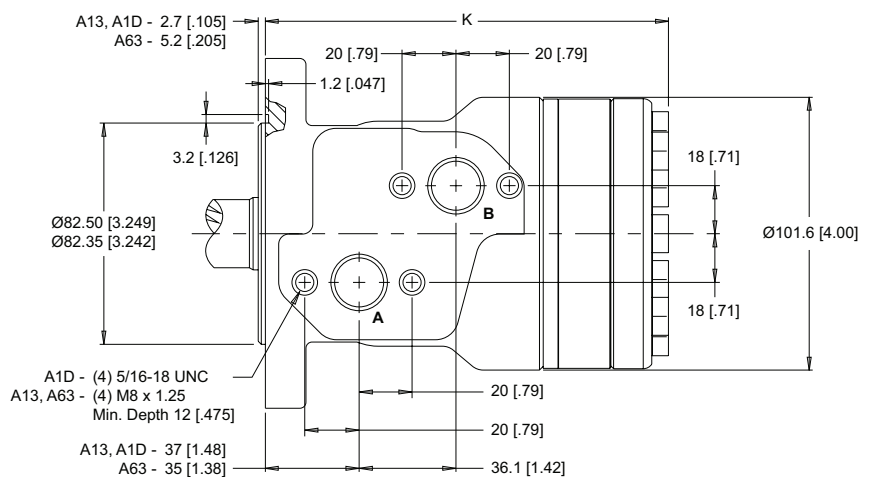
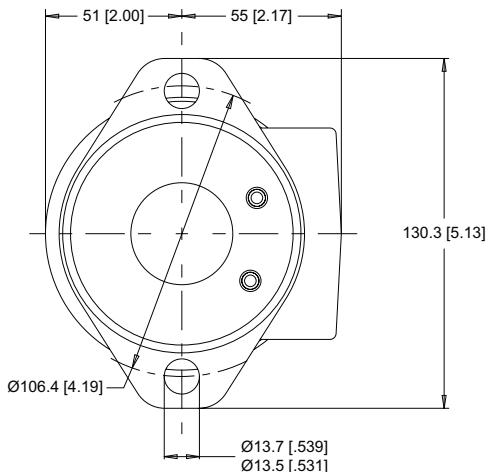
### 2-HOLE, SAE A MOUNT, OFFSET PORTS

**A12** G 1/2 **A62** G 1/2 (TP)



### 2-HOLE, SAE A MOUNT, OFFSET MANIFOLD PORTS

**A13** G 1/2 **A1D** 7/8-14 UNF **A63** G 1/2 (TP)



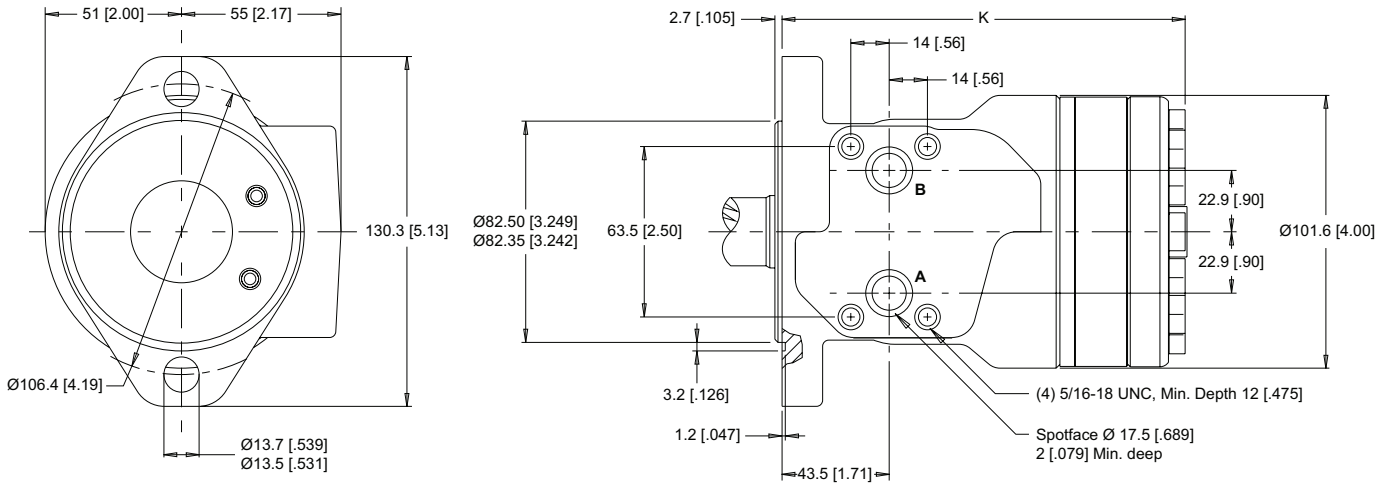
► Dimension K is charted on page 84. ► (TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

## HOUSINGS

► Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

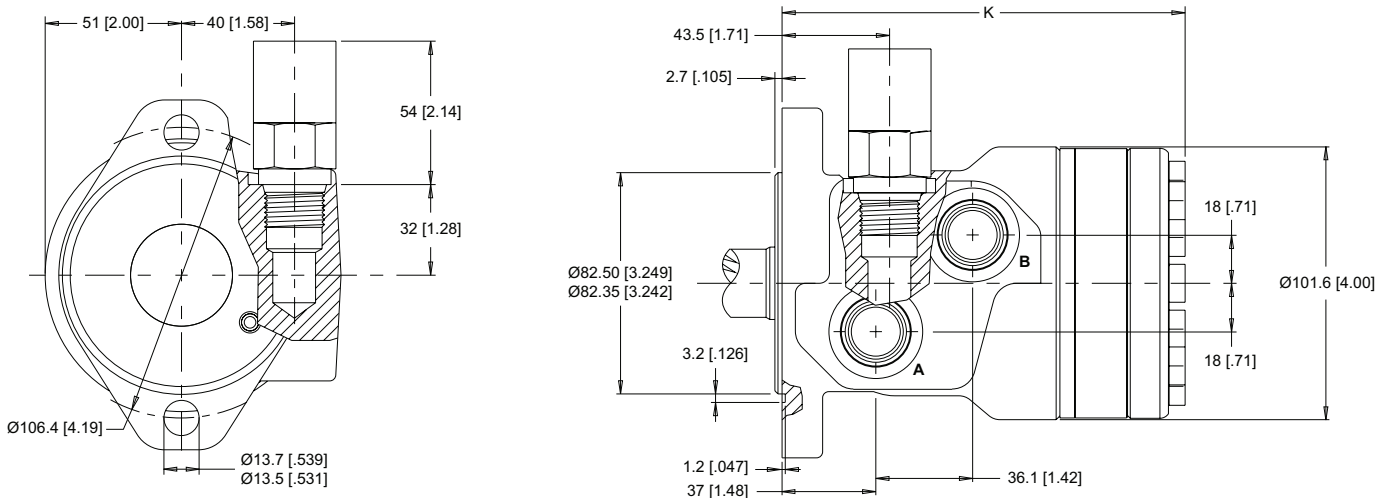
### 2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS

**A17** 1/2" Drilled



### 2-HOLE, SAE A MOUNT, OFFSET PORTS, VALVE CAVITY

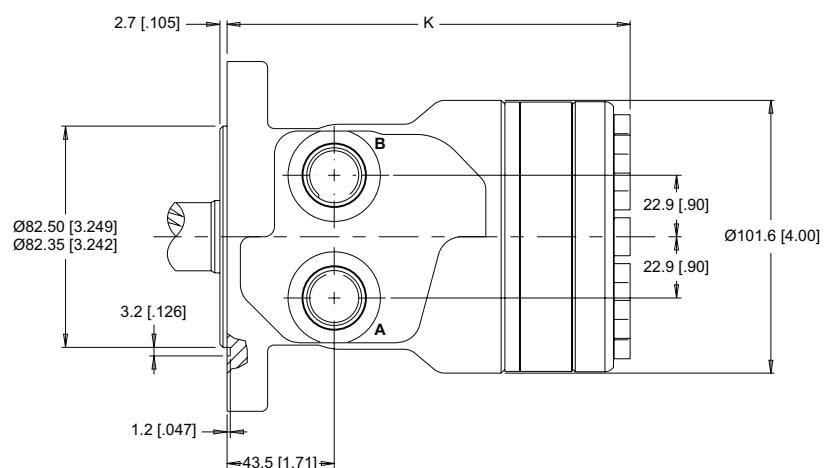
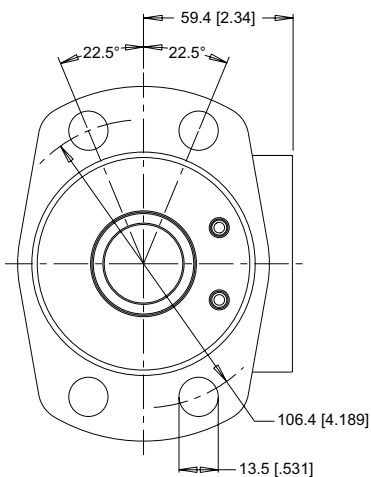
**A19** 7/8-14 UNF



### 4-HOLE, MAGNETO MOUNT, ALIGNED PORTS

**A30** 1/2-14 NPT

**A31** 7/8-14 UNF



► Dimension K is charted on page 84.

## HOUSINGS

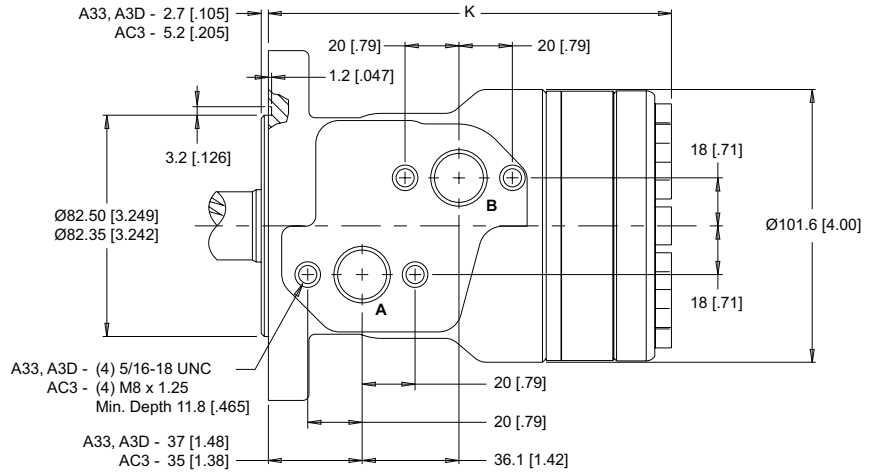
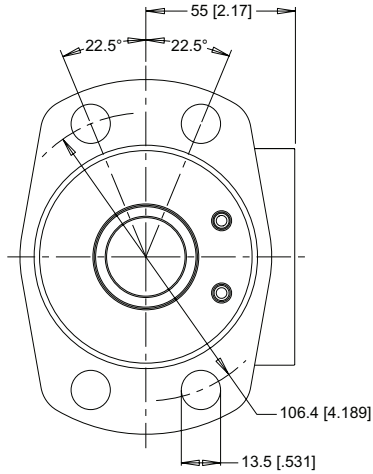
► Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

### 4-HOLE, MAGNETO MOUNT, OFFSET MANIFOLD PORTS

**A33** G 1/2

**A3D** 7/8-14 UNF

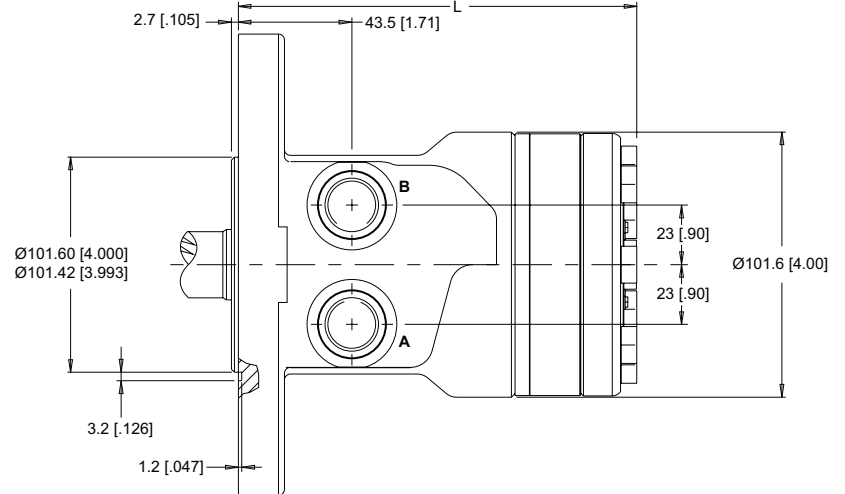
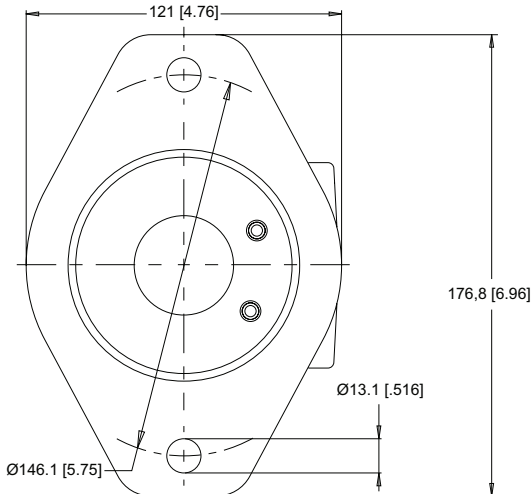
**AC3** G 1/2 (TP)



### 2-HOLE, SAE B MOUNT, ALIGNED PORTS

**B11** 7/8-14 UNF

**B18** G 1/2



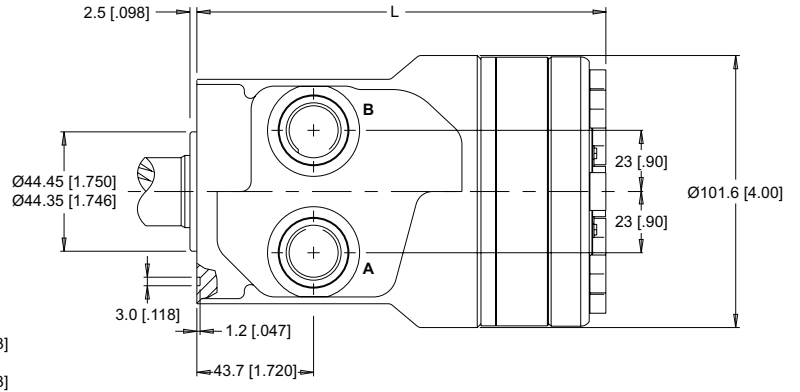
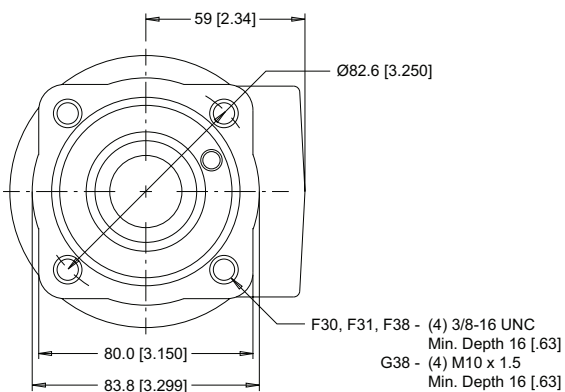
### 4-HOLE, SQUARE MOUNT, ALIGNED PORTS

**F30** 1/2-14 NPT

**F31** 7/8-14 UNF

**F38** G 1/2

**G38** G 1/2



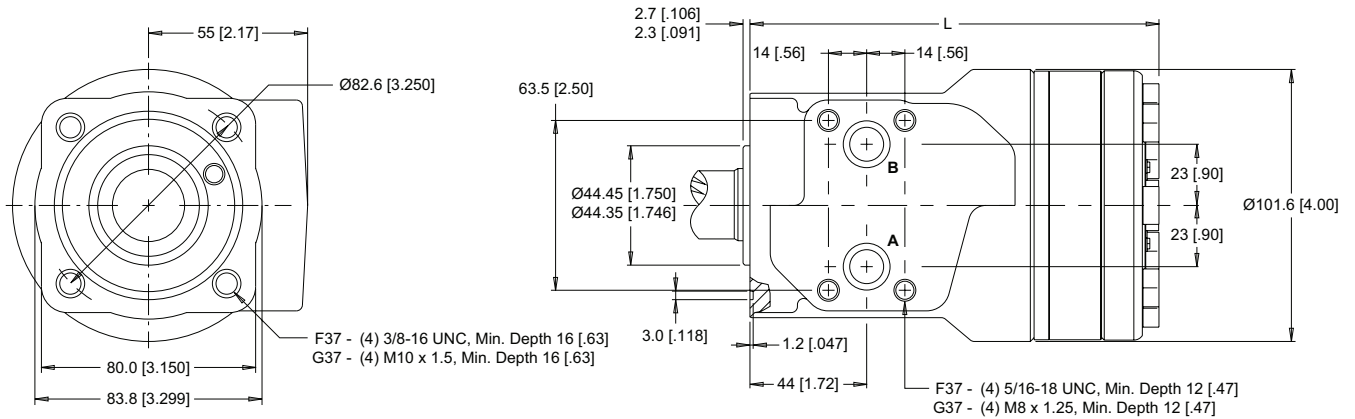
► Dimensions K & L are charted on page 84. ► (TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

## HOUSINGS

► Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

### 4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS

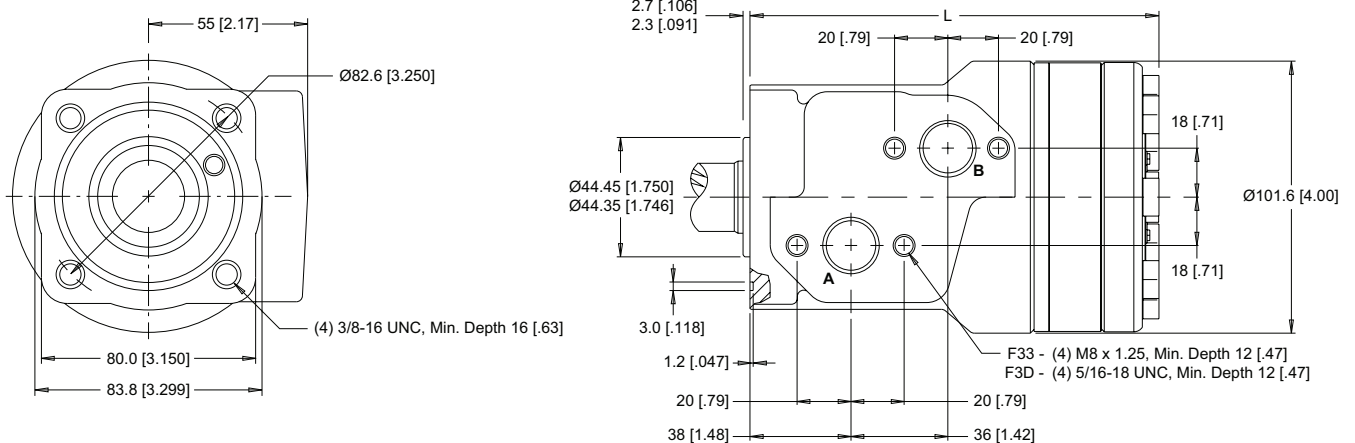
**F37** 1/2" Drilled      **G37** 1/2" Drilled



### 4-HOLE, SQUARE MOUNT, OFFSET MANIFOLD PORTS

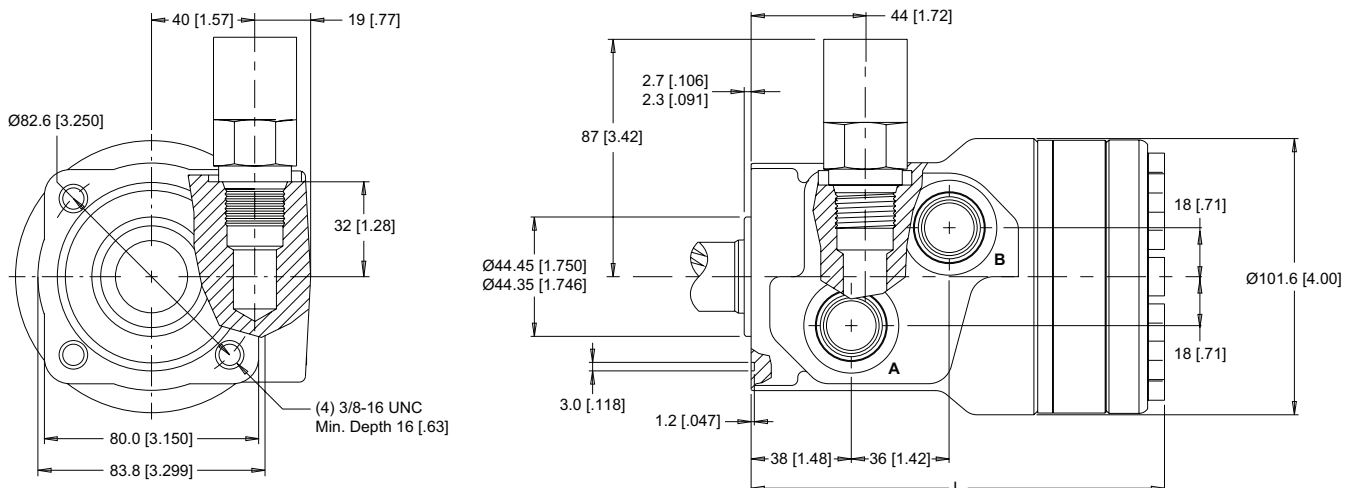
**F33** G 1/2

**F3D** 7/8-14 UNF



**4-HOLE, SQUARE MOUNT, OFFSET PORTS, VALVE CAVITY** **F39** 7/8-14 UNF

**F39** 7/8-14 UNF



► Dimension L is charted on page 84.



# WR (255/256 Series)

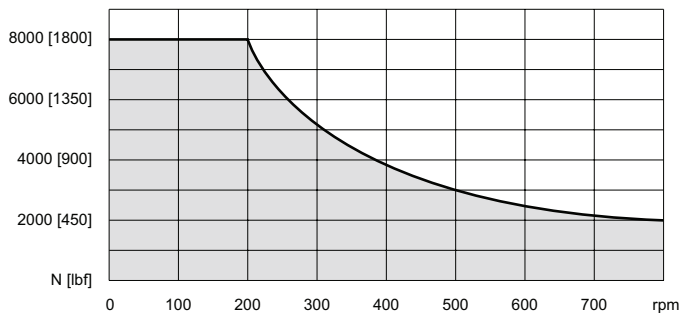
## Light Duty Hydraulic Motor



### TECHNICAL INFORMATION

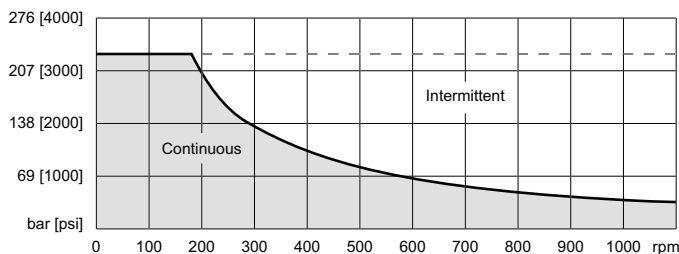
#### ALLOWABLE SHAFT LOAD / BEARING CURVE

The bearing curve below represents the side load capacity of the motor at the centerline of the key for various motor speeds. Operating conditions within the shaded area will maintain acceptable oil film lubrication with recommended fluids. Operating conditions outside the shaded area are susceptible to motor failure due to oil starvation and/or excessive heat generation. Fluids with low lubricity or low viscosity may require the maximum load and speed ratings to be derated to provide acceptable motor life and performance.

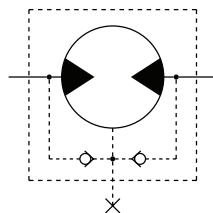


#### PERMISSIBLE SHAFT SEAL PRESSURE

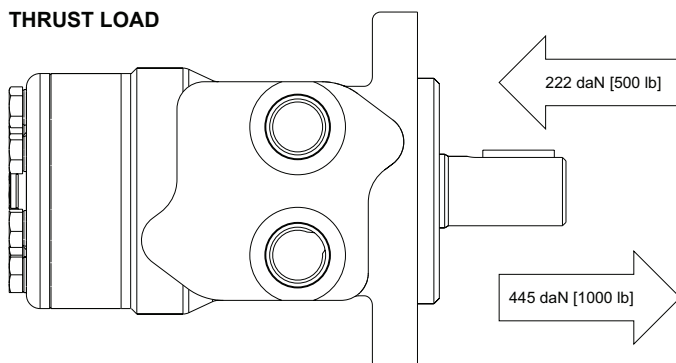
The curve below represents allowable seal pressure at various speeds. Operation in the gray area results in maintaining the rated life of the shaft seal. Actual shaft seal pressure depends on motor configuration.



- ▶ With check valves and drain connection, the shaft seal pressure equals pressure in the drain line. With check valves and no drain connection, shaft seal pressure is identical to output pressure. No check valves and no drain connection, the shaft seal pressure is identical to the average value of input and output pressure.



#### THRUST LOAD



#### LENGTH & WEIGHT CHARTS

Dimension K is the overall motor length from the rear of the motor to the mounting flange surface and is referenced on detailed housing drawings listed on pages 80-82.

K	3mm Pilot	8mm Pilot	Weight
#	mm [in]	mm [in]	kg [lb]
040	142 [5.60]	140 [5.50]	6.6 [14.5]
050	144 [5.67]	142 [5.57]	6.6 [14.5]
060	146 [5.74]	144 [5.64]	6.7 [14.7]
070	147 [5.80]	145 [5.70]	6.7 [14.7]
080	150 [5.91]	148 [5.81]	6.8 [15.0]
090	151 [5.96]	149 [5.86]	6.8 [15.0]
100	154 [6.06]	152 [5.96]	6.9 [15.2]
115	156 [6.15]	154 [6.05]	7.1 [15.6]
130	160 [6.28]	158 [6.18]	7.3 [16.0]
160	166 [6.53]	164 [6.43]	7.5 [16.5]
200	173 [6.83]	171 [6.73]	8.0 [17.6]
240	182 [7.15]	180 [7.05]	8.5 [18.7]
250	183 [7.20]	181 [7.10]	8.5 [18.7]
290	192 [7.56]	190 [7.46]	8.8 [19.4]
320	198 [7.78]	196 [7.68]	9.0 [19.8]
400	213 [8.39]	211 [8.29]	9.8 [21.6]

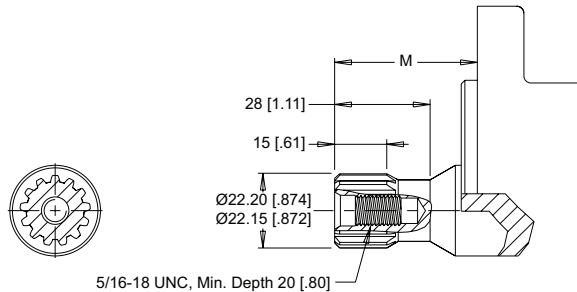
Dimension L is the overall motor length from the rear of the motor to the mounting flange surface and is referenced on detailed housing drawings listed on pages 82-83.

L	Square & B Mounts	B Mount Weight	Sq. Mount Weight
#	mm [in]	kg [lb]	kg [lb]
040	142 [5.60]	7.8 [17.2]	5.3 [11.8]
050	144 [5.67]	7.8 [17.2]	5.3 [11.9]
060	146 [5.74]	7.9 [17.4]	5.4 [11.9]
070	147 [5.80]	7.9 [17.4]	5.4 [11.9]
080	150 [5.91]	8.0 [17.6]	5.5 [12.1]
090	151 [5.96]	8.0 [17.6]	5.5 [12.1]
100	154 [6.06]	8.1 [17.8]	5.6 [12.3]
115	156 [6.15]	8.3 [18.3]	5.8 [12.8]
130	160 [6.28]	8.5 [18.7]	6.0 [13.2]
160	166 [6.53]	8.7 [19.1]	6.2 [13.7]
200	173 [6.83]	9.2 [20.2]	6.7 [14.8]
240	182 [7.15]	9.7 [21.3]	7.2 [15.9]
250	183 [7.20]	9.7 [21.3]	7.2 [15.9]
290	192 [7.56]	10.0 [22.0]	7.5 [16.5]
320	198 [7.78]	10.2 [22.4]	7.7 [17.0]
400	213 [8.39]	11.0 [24.2]	8.5 [18.7]

- ▶ 255 & 256 series motor weights can vary  $\pm 0.5$  kg [1 lb] depending on model configurations such as housing, shaft, endcover, options etc.

## SHAFTS

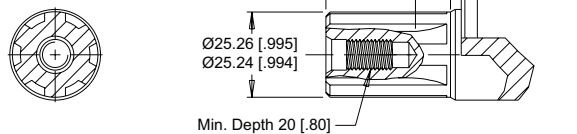
### 01 7/8" 13 Tooth Spline



Max. Torque: 170 Nm [1500 lb-in]

### 02 1" 6B Spline, 5/16-18 Tap

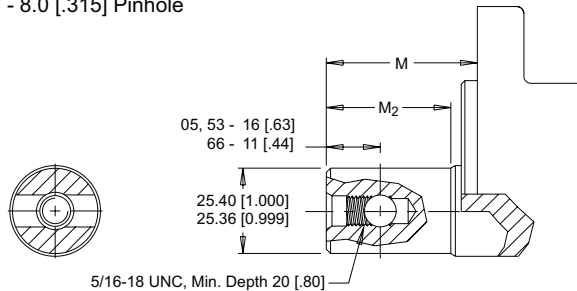
6B Spline  
SAE J499 Standard



Max. Torque: 678 Nm [6000 lb-in]

### 05 1" - 9.5 [.375] Pinhole

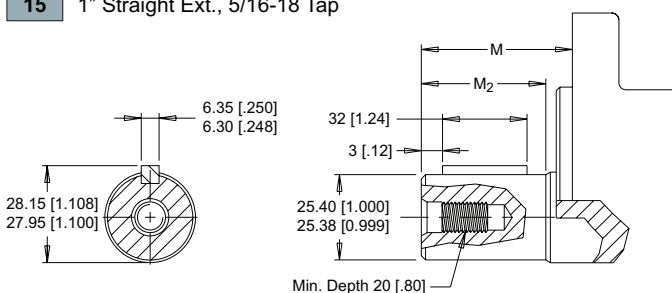
### 66 1" - 8.0 [.315] Pinhole



Max. Torque: 678 Nm [6000 lb-in]

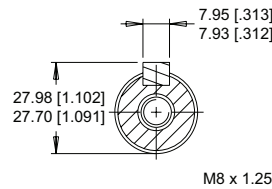
### 10 1" Straight, 5/16-18 Tap

### 15 1" Straight Ext., 5/16-18 Tap



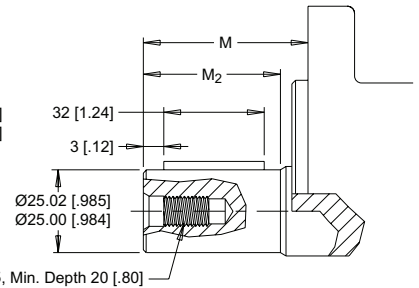
Max. Torque: 655 Nm [5800 lb-in]

### 12 25mm Straight

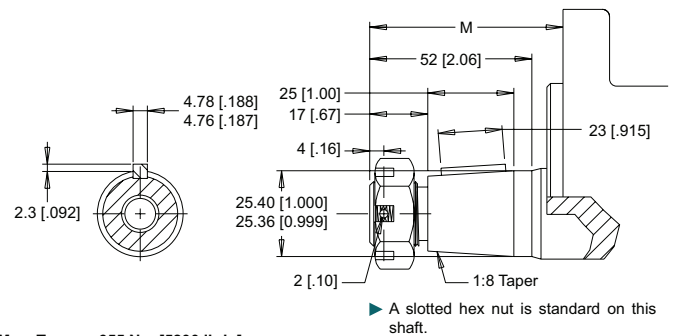


Max. Torque: 678 Nm [6000 lb-in]

### 16 25mm Straight Extended



### 13 1" Tapered



Max. Torque: 655 Nm [5800 lb-in]

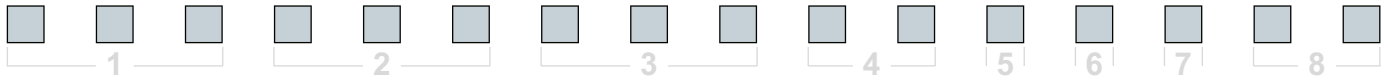
## MOUNTING / SHAFT LENGTH CHART

Dimension M is the overall distance from the motor mounting surface to the end of the shaft.

Additional shaft length information, if necessary, is noted as M<sub>2</sub> and does not increase or decrease the listed M dimensions in this chart. The overall shaft lengths are already factored into the overall distance from the mounting surface to the end of the shaft.

M	3mm Pilot	5mm Pilot	M <sub>2</sub>
#	mm [in]	mm [in]	mm [in]
01	40 [1.59]	43 [1.69]	N/A
02	48 [1.88]	51 [1.98]	N/A
04	48 [1.88]	51 [1.98]	N/A
05	48 [1.88]	51 [1.98]	42 [1.64]
10	48 [1.88]	51 [1.98]	42 [1.64]
12	53 [2.08]	56 [2.18]	43 [1.69]
13	58 [2.29]	61 [2.39]	N/A
15	64 [2.52]	67 [2.62]	58 [2.28]
16	64 [2.52]	67 [2.62]	59 [2.34]
53	48 [1.88]	51 [1.98]	42 [1.64]
66	54 [2.13]	57 [2.23]	48 [1.89]

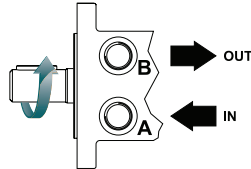
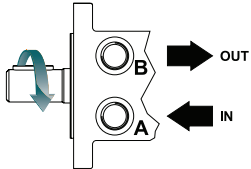
## ORDERING INFORMATION



### 1. CHOOSE SERIES DESIGNATION

**255** Standard Rotation

**256** Reverse Rotation



► The 255 & 256 series are bi-directional.

### 2. SELECT A DISPLACEMENT OPTION

<b>040</b>	40 cm <sup>3</sup> /rev [2.5 in <sup>3</sup> /rev]	<b>130</b>	129 cm <sup>3</sup> /rev [7.9 in <sup>3</sup> /rev]
<b>050</b>	50 cm <sup>3</sup> /rev [3.1 in <sup>3</sup> /rev]	<b>160</b>	160 cm <sup>3</sup> /rev [9.8 in <sup>3</sup> /rev]
<b>060</b>	59 cm <sup>3</sup> /rev [3.6 in <sup>3</sup> /rev]	<b>200</b>	198 cm <sup>3</sup> /rev [12.1 in <sup>3</sup> /rev]
<b>070</b>	71 cm <sup>3</sup> /rev [4.3 in <sup>3</sup> /rev]	<b>240</b>	236 cm <sup>3</sup> /rev [14.4 in <sup>3</sup> /rev]
<b>080</b>	79 cm <sup>3</sup> /rev [4.9 in <sup>3</sup> /rev]	<b>250</b>	250 cm <sup>3</sup> /rev [15.3 in <sup>3</sup> /rev]
<b>090</b>	88 cm <sup>3</sup> /rev [5.4 in <sup>3</sup> /rev]	<b>290</b>	291 cm <sup>3</sup> /rev [17.8 in <sup>3</sup> /rev]
<b>100</b>	100 cm <sup>3</sup> /rev [6.1 in <sup>3</sup> /rev]	<b>320</b>	322 cm <sup>3</sup> /rev [19.6 in <sup>3</sup> /rev]
<b>115</b>	113 cm <sup>3</sup> /rev [6.9 in <sup>3</sup> /rev]	<b>400</b>	400 cm <sup>3</sup> /rev [24.4 in <sup>3</sup> /rev]

### 3. SELECT A MOUNT & PORT OPTION

<b>A10</b>	2-Hole, SAE A Mount, Aligned Ports, 1/2-14 NPT
<b>A11</b>	2-Hole, SAE A Mount, Aligned Ports, 7/8-14 UNF
<b>A12</b>	2-Hole, SAE A Mount, Offset Ports, G 1/2
<b>A13</b>	2-Hole, SAE A Mount, Offset Manifold Ports, G 1/2
<b>A1D</b>	2-Hole, SAE A Mount, Offset Manifold Ports, 7/8-14 UNF
<b>A19</b>	2-Hole, SAE A Mount, Offset Ports, Valve Cavity 7/8-14 UNF
<b>A30</b>	4-Hole, Magneto Mount, Aligned Ports, 1/2-14 NPT
<b>A31</b>	4-Hole, Magneto Mount, Aligned Ports, 7/8-14 UNF
<b>A33</b>	4-Hole, Magneto Mount, Offset Manifold Ports, G 1/2
<b>A3D</b>	4-Hole, Magneto Mount, Offset Manifold Ports, 7/8-14 UNF
<b>A62</b>	2-Hole, SAE A Mount, Offset Ports, G 1/2 (TP)
<b>A63</b>	2-Hole, SAE A Mount, Offset Manifold Ports, G 1/2 (TP)
<b>AC3</b>	4-Hole, Magneto Mount, Offset Manifold Ports, G 1/2 (TP)
<b>B11</b>	2-Hole, SAE B Mount, Aligned Ports, 7/8-14 UNF
<b>B18</b>	2-Hole, SAE B Mount, Aligned Ports, G 1/2
<b>F30</b>	4-Hole, Square Mount, Aligned Ports, 1/2-14 NPT
<b>F31</b>	4-Hole, Square Mount, Aligned Ports, 7/8-14 UNF
<b>F33</b>	4-Hole, Square Mount, Offset Manifold Ports, G 1/2
<b>F37</b>	4-Hole, Square Mount, Aligned Manifold Ports, 1/2" Drilled

► (TP) - Tall pilot. Speed sensor option is not available on tall pilot housings.

### 3. SELECT A MOUNT & PORT OPTION

<b>F38</b>	4-Hole, Square Mount, Aligned Ports, G 1/2
<b>F39</b>	4-Hole, Square Mount, Offset Ports, Valve Cavity 7/8-14 UNF
<b>F3D</b>	4-Hole, Square Mount, Offset Manifold Ports, 7/8-14 UNF
<b>G37</b>	4-Hole, Square Mount, Aligned Manifold Ports, 1/2" Drilled
<b>G38</b>	4-Hole, Square Mount, Aligned Ports, G 1/2

### 4. SELECT A SHAFT OPTION

<b>01</b>	7/8" 13 Tooth Spline	<b>12</b>	25mm Straight
<b>02</b>	1" 6B Spline, 5/16-18 Tap	<b>13</b>	1" Tapered
<b>04</b>	1" 6B Spline, M8x1.25 Tap	<b>15</b>	1" Straight Extended
<b>05</b>	1" - 9.5 [.375] Pinhole	<b>16</b>	25mm Straight Extended
<b>10</b>	1" Straight 5/16-18 Tap	<b>53</b>	1" - 10.3 [.406] Pinhole
<b>11</b>	1" Straight M8x1.25 Tap	<b>66</b>	1" - 8.0 [.315] Pinhole

► The 15 & 16 extended shafts are designed for use with one of the speed sensor options listed in STEP 7.

### 5. SELECT A PAINT OPTION

<b>A</b>	Black
<b>B</b>	Black, Unpainted Mounting Surface

### 6. SELECT A VALVE CAVITY / CARTRIDGE OPTION

<b>A</b>	None	<b>F</b>	121 bar [1750 psi] Relief
<b>B</b>	Valve Cavity Only	<b>G</b>	138 bar [2000 psi] Relief
<b>C</b>	69 bar [1000 psi] Relief	<b>J</b>	173 bar [2500 psi] Relief
<b>D</b>	86 bar [1250 psi] Relief	<b>L</b>	207 bar [3000 psi] Relief
<b>E</b>	104 bar [1500 psi] Relief		

► Valve cavity is only available on the A19 & F39 housings.

### 7. SELECT AN ADD-ON OPTION

<b>A</b>	Standard
<b>B</b>	Lock Nut
<b>C</b>	Solid Hex Nut
<b>W</b>	Speed Sensor, Dual, 4-Pin Male Weatherpack Connector
<b>X</b>	Speed Sensor, Dual, 4-Pin M12 Male Connector
<b>Y</b>	Speed Sensor, Single, 3-Pin Male Weatherpack Connector
<b>Z</b>	Speed Sensor, Single, 4-Pin M12 Male Connector

### 8. SELECT A MISCELLANEOUS OPTION

<b>AA</b>	None
<b>EG</b>	Viton Shaft Seal