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

WHITE
DRIVE PRODUCTS

TABLE OF CONTENTS

TECHNICAL INFORMATION

OPTIONAL MOTOR FEATURES

LIGHT DUTY HYDRAULIC MOTORS

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.

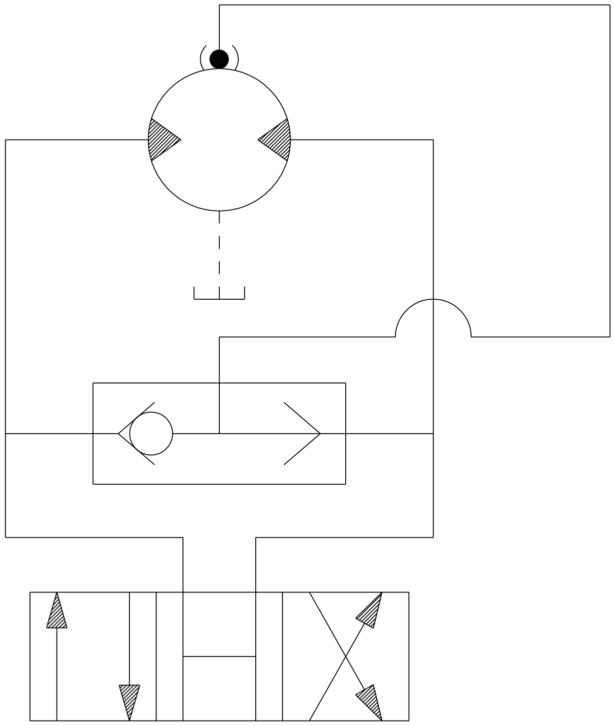
Caution! - Because it is possible for some large displacement motors to overpower the brake, it is critical that the maximum system pressure be limited for these applications. Failure to do so could cause serious injury or death. When choosing a motor/brake for an application, consult the performance 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.

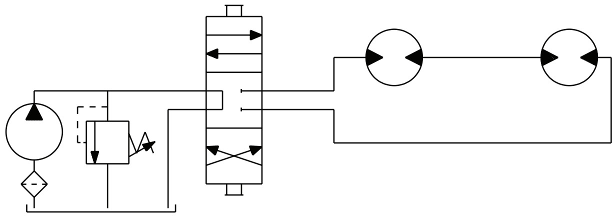
► NOTE: It is vital that all operating recommendations be followed. Failure to do so could result in injury or death.

MOTOR CIRCUITS

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

SERIES CONNECTION

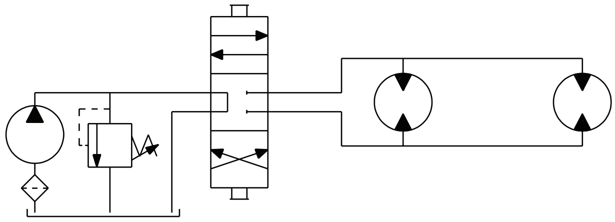
When motors are connected in series, the outlet of one motor is connected to the inlet of the next motor. This allows the full pump flow to go through each motor and provide maximum speed. Pressure and torque are distributed between the motors based on the load each motor is subjected to. The maximum 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.

080

76 cc [4.6 in^3/rev.]

Pressure - bars [psi] (Max. Cont. = 207 [3000], Max. Inter. = 242 [3500])

Torque - Nm [lb-in], **Speed rpm** (6) — **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	69 [1000]	104 [150 (2)	38 [2000]	173 [2500]	207 [3000] Max. Cont.	242 [3500] Max. Inter.	Theoretical rpm
2 [0.5]	(6) 14 [127] **25**	30 [262] **24**	61 [543] **21**	91 [806] **18**	120 [1062] **17**	145 [1285] **11**	169 [1496] **11**	191 [1693] **9**	26
4 [1]	16 [140] **50**	32 [286] **50**	63 [559] **43**	95 [839] **43**	124 [1099] **34**	151 [1340] **32**	178 [1579] **32**	203 [1796] **31**	51
8 [2]	16 [139] **100**	32 [280] **100**	64 [563] **99**	97 [857] **92**	129 [1139] **87**	157 [1390] **79**	187 [1652] **78**	211 [1865] **77**	101
15 [4]	14 [127] **200**	31 [275] **200**	65 [572] **199**	99 [872] **191**	131 [1155] **181**	160 [1420] **174**	186 [1643] **160**	216 [1911] **154**	201
23 [6]	13 [113] **301**	30 [262] **300**	63 [557] **297** (7)	96 [853] **295**	130 [1149] **284**	160 [1420] **271**	186 [164 (3) **253**	18 [1930] **245**	302
(1)	10 [91] **401**	27 [243] **400**	61 [536] **398**	93 [826] **390**	127 [1125] **384**	159 [1409] **372**	187 [1654] **346**	220 [1945] **339**	(4)
38 [10]		24 [212] **502**	58 [511] **500**	89 [790] **499**	123 [1087] **498**	156 [1379] **485**	185 [1638] **443**	213 [1883] **433**	503
45 [12]		20 [177] **602**	54 [482] **601**	87 [767] **600**	120 [1060] **597**	164 [1451] **540**	193 [1711] **526**	228 [2021] **510**	603
Max. Cont. 53 [14]		14 [127] **690**	50 [445] **689**	84 [741] (5)	124 [1098] **658**	155 [1369] **644**	185 [1640] **631**	217 [1918] **613**	704
61 [16]									804
Max. Inter. 64 [17]									904

Overall Efficiency - 70 - 100% ☐ 40 - 69% ☐ 0 - 39% ☐

Theoretical Torque - Nm [lb-in]

21 [183]	41 [366]	83 [732]	124 [109 (8)	66 [1465]	207 [1831]	248 [2197]	290 [2564]

Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]

1. Flow represents the amount of fluid passing through the motor during each minute of the test.

2. Pressure refers to the measured pressure differential between the inlet and return ports of the motor during the test.

3. The maximum continuous pressure rating and maximum intermittent pressure rating of the motor are separated by the dark lines on the chart.

4. 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.

5. The maximum continuous flow rating and maximum intermittent flow rating of the motor are separated by the dark line on the chart.

6. 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.

7. Areas within the white shading represent maximum motor efficiencies.

8. 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.

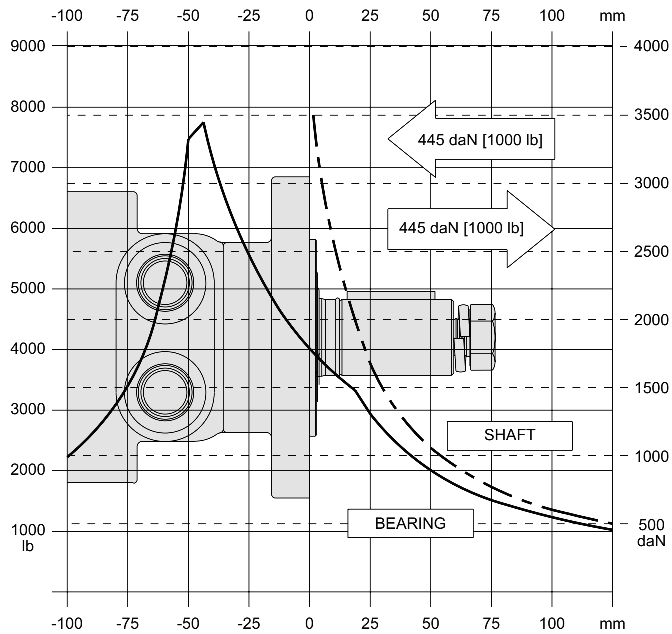
The bearing curves for each model are based on labratory analysis and testing results constructed at White Drive Products. The shaft loading is based on a 3:1 safety factor and 330 Kpsi tensile strength. The allowable load is the lower of the curves at a given point. For instance, one inch in front of 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

$$RPM = \frac{2.65 \times KPH \times G}{rm} \qquad RPM = \frac{168 \times MPH \times G}{ri}$$

Where:
MPH = max. vehicle speed (miles/hr)
KPH = max. vehicle speed (kilometers/hr)
ri = rolling radius of tire (inches)
G = gear reduction ratio (if none, G = 1)
rm = rolling radius of tire (meters)

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

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:

TE = RR + GR + FA + DP (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.

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

Where:
GVW = gross (loaded) vehicle weight (lb or kg)
R = surface friction (value from Table 1)

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

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:
% Grade = [tan of angle (degrees)] x 100

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

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

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.

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

Where:

t = time to maximum speed (seconds)

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

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.

$TE = RR + GR + FA + DP$ (lb or N)

Example $TE = 33 + 300 + 34 + 0\ (lbs) = 367\ lbs$

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.

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

Where:

M = number of driving motors

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

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

(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 $TS = \frac{425 \times .06 \times 16}{1}$ lb-in/motor = 4080 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.

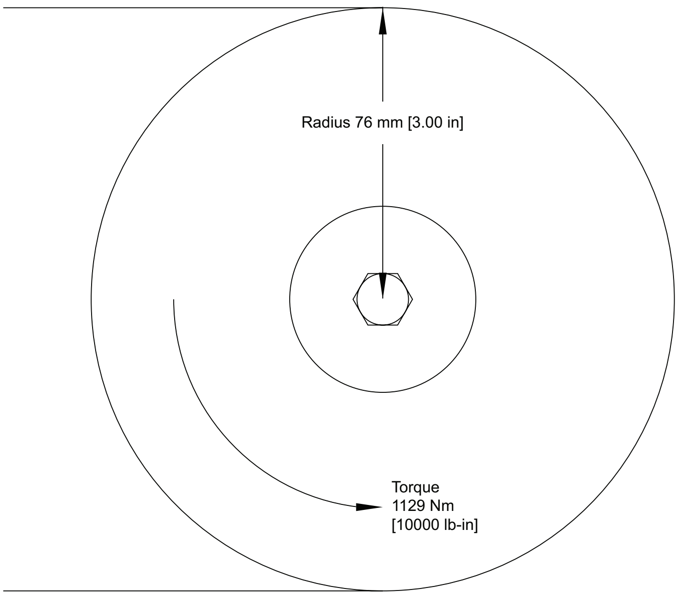
$$RL = \sqrt{W^2 + \left(\frac{T}{ri}\right)^2}\ lb \qquad RL = \sqrt{W^2 + \left(\frac{T}{rm}\right)^2}\ kg$$

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

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

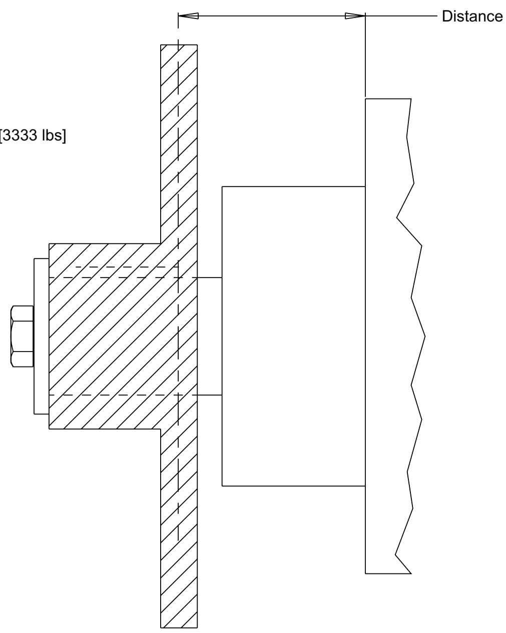
In many cases, pulleys or sprockets may be used to transmit the torque produced by the motor. Use of these components will create a torque induced side load on the motor shaft and bearings. It is important that this load be taken into consideration when choosing a motor with sufficient bearing and shaft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

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

Side Load = 14855 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) =

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

Power In (HP) =

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

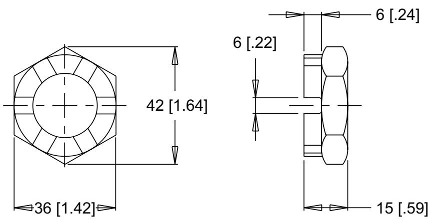
Power Out (HP) =

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

SHAFT NUT INFORMATION

35MM TAPERED SHAFTS
M24 x 1.5 Thread

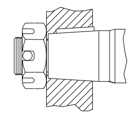
A Slotted Nut

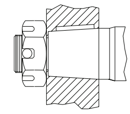


Torque Specifications: 32.5 daNm [240 ft.lb.]

PRECAUTION

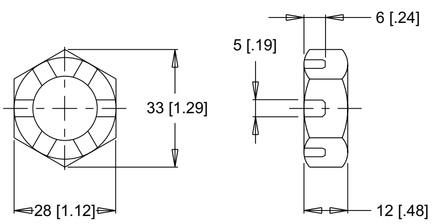
The tightening torques listed with each nut should only be used as a guideline. Hubs may require higher or lower tightening torque depending on the material. Consult the hub manufacturer to obtain recommended tightening torque. To maximize torque transfer from the shaft to the hub, and to minimize the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


incorrect


correct

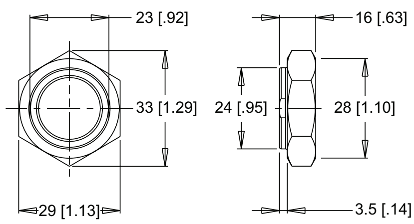
1” TAPERED SHAFTS
3/4-28 Thread

A Slotted Nut



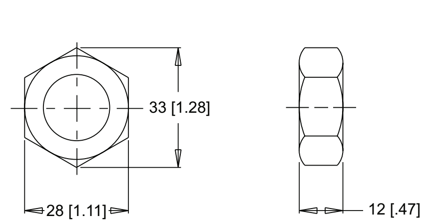
Torque Specifications: 20 - 23 daNm [150 - 170 ft.lb.]

B Lock Nut



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

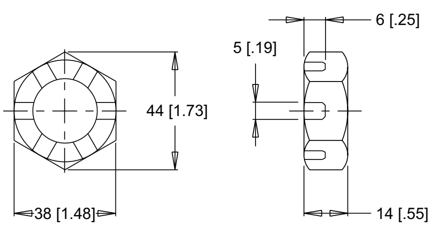
C Solid Nut



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

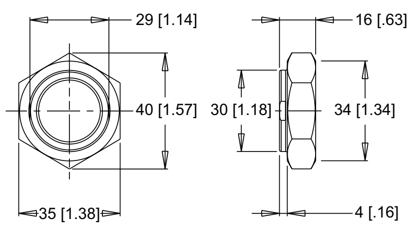
1-1/4” TAPERED SHAFTS
1-20 Thread

A Slotted Nut



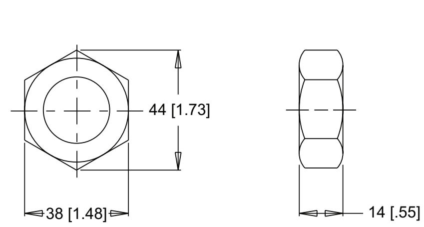
Torque Specifications: 38 daNm [280 ft.lb.] Max.

B Lock Nut



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

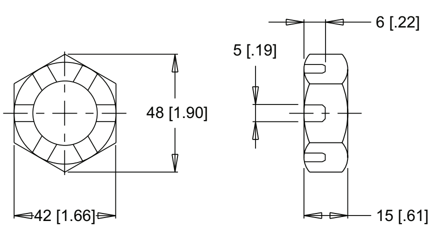
C Solid Nut



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

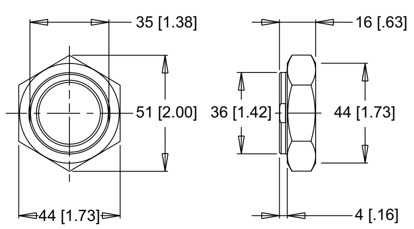
1-3/8” & 1-1/2” TAPERED SHAFTS
1 1/8-18 Thread

A Slotted Nut



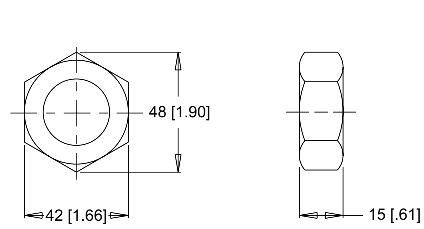
Torque Specifications: 41 - 54 daNm [300 - 400 ft.lb.]

B Lock Nut



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

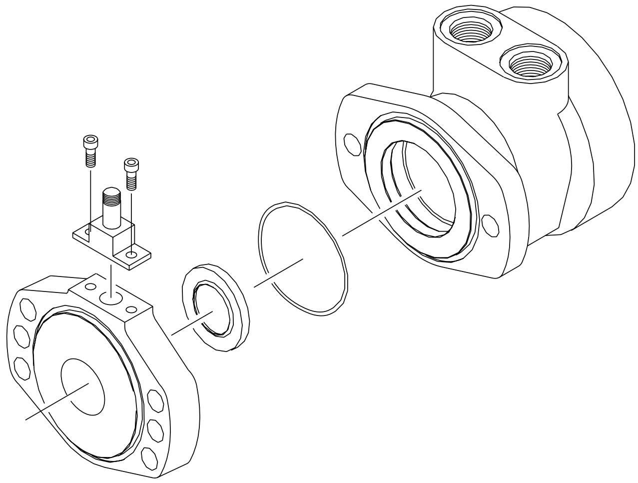
C Solid Nut



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

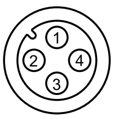
Supply voltages .... 7.5-24 Vdc
Maximum output off voltage .... 24 V
Maximum continuous output current .... < 25 ma
Signal levels (low, high) .... 0.8 to supply voltage
Operating Temp ....-30°C to 83°C [-22°F to 181°F]

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

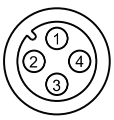
Z Option



PIN

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

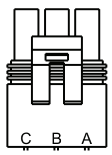
X Option



PIN

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

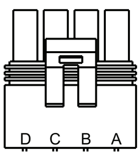
Y Option



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.

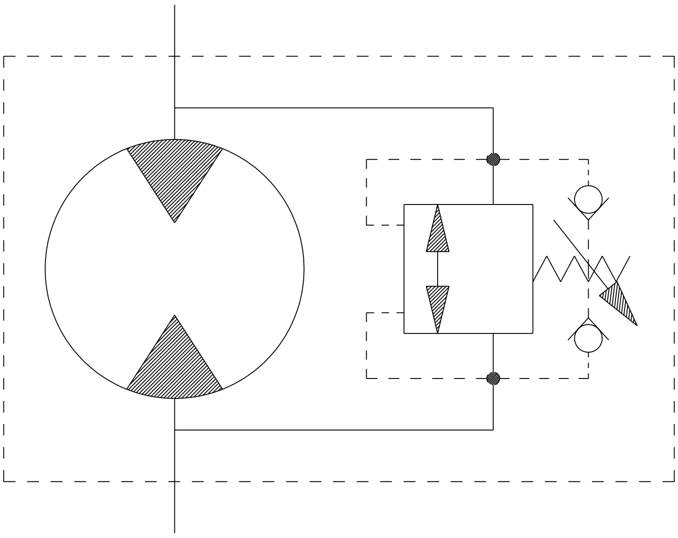
FREE TURNING ROTOR

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

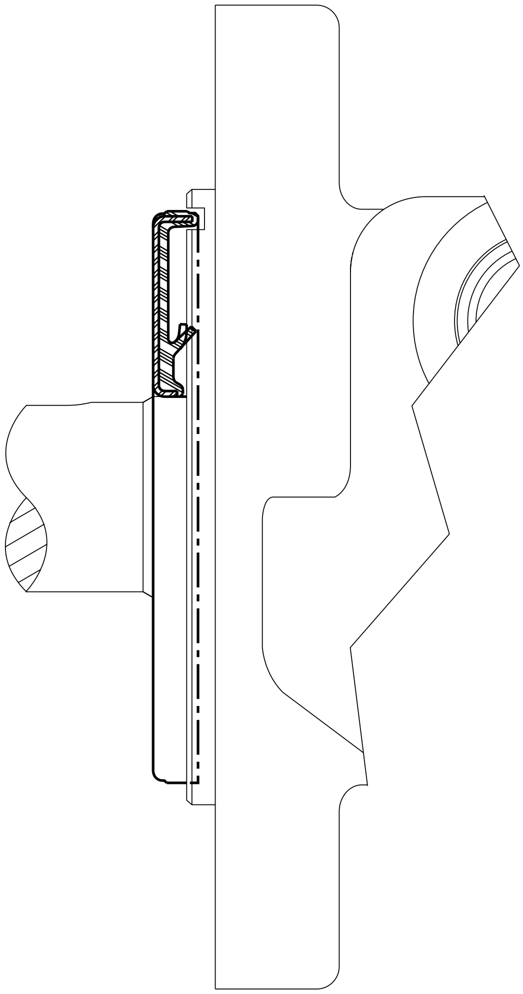
The valve cavity option provides a cost effective way to incorporate a variety of cartridge valves integral to the motor. The valve cavity is a standard 10 series (12 series on the 800 series motor) 2-way cavity that accepts numerous cartridge valves, including overrunning check valves, relief cartridges, flow control valves, pilot operated check fuses, 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 extendes shaft/shaft seal protection by prevented 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 WP motor series is an economical alternative to more complex roller gerotor designs and still provides high efficiency across a wide performance range. These motors are intended for light-duty applications requiring high torque in a compact package and are suitable for industrial and mobile applications including car wash brushes, food processing equipment, conveyors, machine tools, agricultural equipment, sweepers, skid steer attachments, and more.

FEATURES / BENEFITS

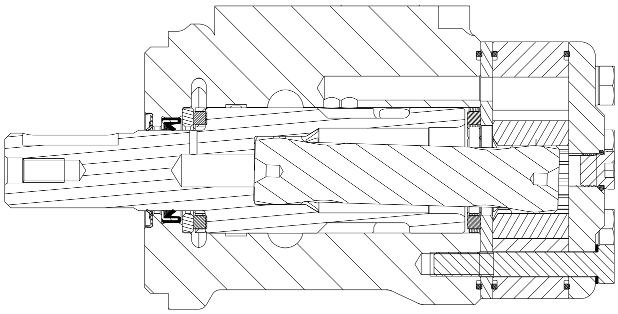
- Built-in check valves offer versatility and increased seal life.
- A variety of mounts and shafts provide flexibility in application design.
- Spool valve design gives superior performance and smooth operation over a wide speed and torque range.
- Standard high pressure shaft seals offer superior seal life and performance.

TYPICAL APPLICATIONS

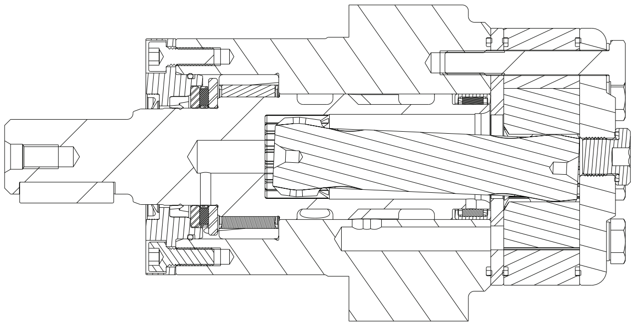
agriculture equipment, conveyors, carwashes, sweepers, food processing, grain augers, spreaders, feed rollers, augers, brush drives and more

SERIES DESCRIPTIONS

155/156 - Hydraulic Motor
Standard



157/158 - Hydraulic Motor
With Needle Bearings



SPECIFICATIONS

CODE	Displacement cm^3 [in^3/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
025	25 [1.5]	1570	1687	40 [11]	45 [12]	35 [310]	48 [425]	100 [1450]	140 [2030]	225 [3260]
032	32 [2.0]	1550	1674	50 [13]	55 [15]	45 [398]	57 [504]	100 [1450]	140 [2030]	225 [3260]
040	40 [2.5]	1471	1670	60 [16]	70 [19]	65 [575]	74 [655]	100 [1450]	140 [2030]	225 [3260]
050	50 [3.0]	1208	1500	60 [16]	75 [20]	91 [805]	108 [956]	140 [2030]	175 [2540]	240 [3480]
060	59 [3.6]	1185	1271	60 [16]	75 [20]	125 [1106]	136 [1204]	160 [2320]	175 [2540]	240 [3480]
080	78 [4.8]	896	960	60 [16]	75 [20]	164 [1451]	183 [1620]	160 [2320]	175 [2540]	240 [3480]
100	96 [5.9]	728	780	60 [16]	75 [20]	195 [1726]	213 [1885]	160 [2320]	175 [2540]	240 [3480]
125	125 [7.6]	559	599	60 [16]	75 [20]	258 [2285]	278 [2460]	160 [2320]	175 [2540]	240 [3480]
160	159 [9.7]	452	483	60 [16]	75 [20]	321 [2840]	362 [3205]	160 [2320]	175 [2540]	240 [3480]
200	190 [11.6]	367	385	60 [16]	75 [20]	380 [3365]	420 [3720]	150 [2180]	175 [2540]	240 [3480]
250	240 [14.6]	291	312	60 [16]	75 [20]	445 [3940]	557 [4930]	140 [2030]	175 [2540]	240 [3480]
315	303 [18.5]	228	245	60 [16]	75 [20]	460 [4071]	602 [5330]	120 [1740]	160 [2320]	200 [2900]
400	388 [23.7]	155	189	60 [16]	75 [20]	488 [4320]	625 [5532]	95 [1380]	125 [1810]	180 [2610]

► 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.

WHITE DRIVE PRODUCTS

DISPLACEMENT PERFORMANCE

025

25 cm³ [1.5 in³] / rev

Pressure - bar [psi] (Max. Cont.: 100 [1450]; Max. Inter.: 140 [2030])

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	Theoretical rpm
5 [1.3]	9 [80] **186**	18 [159] **160**	25 [221] **134**	32 [283] **101**	35 [310] **106**		200
10 [2.6]	10 [88] **386**	18 [159] **352**	26 [230] **323**	34 [301] **280**	37 [327] **255**	48 [425] **210**	400
15 [4.0]	9 [80] **568**	19 [168] **537**	26 [230] **505**	35 [310] **467**	38 [336] **431**	44 [389] **390**	600
20 [5.3]	8 [71] **777**	19 [168] **736**	25 [221] **692**	33 [292] **660**	39 [345] **608**	45 [398] **566**	800
25 [6.6]	7 [62] **972**	18 [159] **920**	26 [230] **870**	32 [283] **840**	39 [345] **803**	45 [398] **756**	1000
30 [7.9]	6 [53] **1167**	17 [150] **1122**	25 [221] **1088**	32 [283] **1055**	39 [345] **998**	44 [389] **976**	1200
35 [9.2]	5 [44] **1360**	16 [142] **1318**	24 [212] **1282**	31 [274] **1258**	37 [327] **1216**	43 [381] **1160**	1400
40 [10.6] (Max. Cont.)	5 [44] **1570**	15 [133] **1503**	22 [195] **1476**	31 [274] **1432**	36 [319] **1394**	41 [363] **1359**	1600
45 [11.9] (Max. Inter.)		13 [115] **1687**	20 [177] **1636**	28 [248] **1600**	34 [301] **1558**	39 [345] **1516**	1800

Overall Efficiency - 70 - 100% (white) 40 - 69% (light grey) 0 - 39% (dark grey)

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]
4.1 [.160]	12 [106]	24 [211]	32 [282]	40 [352]	48 [423]	56 [493]

Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

032

32 cm³ [2.0 in³] / rev

Pressure - bar [psi] (Max. Cont.: 100 [1450]; Max. Inter.: 140 [2030])

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	Theoretical rpm
5 [1.3]	11 [97] **149**	24 [212] **135**	35 [310] **114**	37 [327] **94**			156
10 [2.6]	12 [106] **308**	27 [239] **284**	37 [327] **270**	43 [381] **250**	46 [407] **240**	56 [496] **211**	313
15 [4.0]	11 [97] **465**	26 [230] **444**	36 [319] **429**	45 [398] **398**	48 [425] **378**	57 [504] **355**	469
20 [5.3]	10 [88] **624**	25 [221] **589**	35 [310] **575**	44 [389] **557**	46 [407] **544**	56 [496] **524**	625
25 [6.6]	9 [80] **780**	24 [212] **771**	34 [301] **751**	42 [372] **735**	45 [398] **719**	54 [478] **695**	781
30 [7.9]	8 [71] **931**	23 [204] **908**	32 [283] **895**	40 [354] **876**	45 [398] **857**	52 [460] **822**	938
35 [9.2]	7 [62] **1086**	20 [177] **1066**	29 [257] **1051**	39 [345] **1030**	43 [381] **1012**	51 [451] **981**	1094
40 [10.6]	7 [62] **1240**	19 [168] **1212**	27 [239] **1190**	38 [336] **1178**	43 [381] **1145**	50 [442] **1121**	1250
45 [11.9]	6 [53] **1400**	18 [159] **1382**	26 [230] **1366**	35 [310] **1340**	42 [372] **1314**	48 [425] **1280**	1406
50 [13.2] (Max. Cont.)	5 [44] **1550**	16 [142] **1526**	24 [212] **1500**	31 [274] **1478**	40 [354] **1452**	46 [407] **1418**	1563
55 [14.5] (Max. Inter.)		12 [106] **1674**	20 [177] **1641**	28 [248] **1617**	34 [301] **1584**	39 [345] **1555**	1719

Overall Efficiency - 70 - 100% (white) 40 - 69% (light grey) 0 - 39% (dark grey)

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]
5.1 [.200]	15 [135]	31 [271]	41 [361]	51 [451]	61 [541]	71 [631]

Displacement tested at 45°C [113°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 tesing please refer to page 6.

DISPLACEMENT PERFORMANCE

040

40 cm³ [2.5 in³] / rev

Pressure - bar [psi] (Max. Cont. 120 [1740]; Max. Inter. 140 [2030])

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740] (Max. Cont.)	140 [2030] (Max. Inter.)	Theoretical rpm
5 [1.3]	15 [133] **113**	31 [274] **98**	38 [336] **83**	48 [425] **60**	56 [496] **48**		125
10 [2.6]	14 [124] **238**	31 [274] **222**	41 [363] **204**	54 [478] **182**	62 [549] **161**	70 [619] **114**	250
20 [5.3]	13 [115] **482**	32 [283] **458**	41 [363] **442**	53 [469] **423**	65 [575] **402**	74 [655] **381**	500
30 [7.9]	12 [106] **730**	30 [265] **704**	39 [345] **687**	51 [451] **668**	63 [558] **646**	74 [655] **624**	750
40 [10.6]	10 [88] **968**	27 [239] **949**	39 [345] **928**	51 [451] **908**	61 [540] **892**	72 [637] **870**	1000
50 [13.2]	7 [62] **1219**	25 [221] **1191**	37 [327] **1173**	49 [434] **1150**	59 [522] **1127**	71 [628] **1107**	1250
Max. Cont. 60 [15.8]	4 [35] **1471**	23 [204] **1428**	34 [301] **1411**	46 [407] **1387**	56 [496] **1369**	68 [602] **1341**	1500
Max. Inter. 70 [18.5]		16 [142] **1670**	30 [265] **1653**	41 [363] **1627**	52 [460] **1612**	64 [566] **1598**	2000

Overall Efficiency - 70 - 100% | 40 - 69% | 0 - 39%

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]
6.6 [.260]	19 [168]	38 [336]	50 [442]	64 [566]	76 [673]	89 [788]

Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

050

50 cm³ [3.0 in³] / rev

Pressure - bar [psi] (Max. Cont. 140 [2030]; Max. Inter. 175 [2540])

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030] (Max. Cont.)	160 [2320]	175 [2540] (Max. Inter.)	Theoretical rpm
5 [1.3]	19 [168] **100**	39 [345] **85**	48 [425] **75**	62 [549] **64**	75 [664] **48**				101
10 [2.6]	20 [177] **197**	38 [336] **196**	50 [442] **174**	63 [558] **159**	78 [690] **146**	92 [814] **127**	102 [903] **101**	107 [947] **97**	202
20 [5.3]	18 [159] **400**	38 [336] **386**	52 [460] **371**	64 [566] **355**	78 [690] **341**	90 [796] **314**	104 [920] **292**	108 [956] **290**	404
30 [7.9]	15 [133] **600**	37 [327] **585**	50 [442] **571**	64 [566] **560**	77 [681] **540**	89 [788] **516**	103 [912] **499**	107 [947] **495**	606
40 [10.6]	12 [106] **808**	31 [274] **800**	45 [398] **790**	59 [522] **770**	73 [646] **766**	87 [770] **733**	99 [876] **703**	106 [938] **697**	808
50 [13.2]	9 [80] **1009**	27 [239] **1006**	41 [363] **986**	55 [487] **982**	68 [602] **964**	84 [743] **956**	98 [867] **930**	105 [929] **872**	1010
Max. Cont. 60 [15.8]	6 [53] **1208**	24 [212] **1200**	37 [327] **1196**	53 [469] **1188**	64 [566] **1176**	82 [726] **1160**	95 [841] **1140**	102 [903] **963**	1212
70 [18.5]	3 [27] **1410**	17 [150] **1396**	32 [283] **1382**	44 [389] **1370**	58 [513] **1358**	80 [708] **1347**	93 [823] **1334**	98 [867] **1315**	1414
Max. Inter. 75 [19.8]		15 [133] **1500**	30 [265] **1488**	40 [354] **1473**	56 [496] **1457**	77 [681] **1439**	88 [779] **1412**	93 [823] **1388**	1515

Overall Efficiency - 70 - 100% | 40 - 69% | 0 - 39%

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]
6.6 [.260]	24 [212]	47 [416]	63 [558]	79 [699]	95 [841]	110 [973]	126 [1115]	138 [1221]

Displacement tested at 45°C [113°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 tesing please refer to page 6.

DISPLACEMENT PERFORMANCE

060 — 59 cm³ [3.6 in³] / rev

Pressure - bar [psi]; Torque - Nm [lb-in], **Speed rpm**; **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320] (Max. Cont.)	175 [2540] (Max. Inter.)	Theoretical rpm
5 [1.3]	20 [177] **83**	46 [407] **79**	65 [575] **72**	80 [708] **64**	95 [841] **51**	112 [991] **38**			85
10 [2.6]	22 [195] **169**	47 [416] **164**	66 [584] **155**	81 [717] **142**	96 [850] **135**	113 [1000] **124**	125 [1106] **108**	136 [1204] **88**	170
20 [5.3]	20 [177] **338**	45 [398] **332**	64 [566] **320**	80 [708] **309**	93 [823] **290**	111 [982] **276**	123 [1088] **245**	134 [1186] **222**	339
30 [7.9]	17 [150] **507**	43 [381] **502**	62 [549] **493**	76 [673] **482**	89 [788] **468**	109 [965] **454**	121 [1071] **424**	131 [1159] **400**	509
40 [10.6]	14 [124] **678**	41 [363] **669**	58 [513] **660**	73 [646] **645**	87 [770] **630**	105 [929] **616**	117 [1035] **594**	127 [1124] **582**	678
50 [13.2]	10 [88] **845**	37 [327] **841**	55 [487] **833**	70 [619] **818**	84 [743] **805**	102 [903] **792**	113 [1000] **770**	122 [1080] **754**	848
Max. Cont. 60 [15.8]	7 [62] **1014**	34 [301] **1005**	52 [460] **999**	66 [584] **992**	82 [726] **982**	99 [876] **968**	109 [965] **956**	118 [1044] **933**	1017
70 [18.5]	4 [35] **1185**	27 [239] **1182**	47 [416] **1180**	62 [549] **1175**	76 [673] **1158**	93 [823] **1144**	104 [920] **1128**	114 [1009] **1112**	1186
Max. Inter. 75 [19.8]		22 [195] **1271**	43 [381] **1265**	58 [513] **1256**	73 [646] **1241**	86 [761] **1228**	100 [885] **1212**	110 [973] **1196**	1271

Overall Efficiency - 70 - 100% ☐ 40 - 69% ☐ 0 - 39% ☐

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]
8.0 [.314]	28 [249]	56 [499]	75 [665]	94 [831]	113 [998]	132 [1164]	150 [1330]	164 [1455]

Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

080 — 78 cm³ [4.8 in³] / rev

Pressure - bar [psi]; Torque - Nm [lb-in], **Speed rpm**; **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320] (Max. Cont.)	175 [2540] (Max. Inter.)	Theoretical rpm
5 [1.3]	32 [283] **60**	62 [549] **56**	80 [708] **50**	106 [938] **42**	125 [1106] **30**				64
10 [2.6]	31 [274] **125**	64 [566] **118**	84 [743] **112**	104 [920] **104**	120 [1062] **98**	142 [1257] **82**	162 [1434] **67**	175 [1549] **50**	128
20 [5.3]	26 [230] **254**	60 [531] **245**	84 [743] **236**	102 [903] **228**	125 [1106] **215**	144 [1274] **204**	164 [1451] **190**	183 [1619] **175**	256
30 [7.9]	24 [212] **384**	56 [496] **374**	81 [717] **366**	100 [885] **358**	122 [1080] **346**	142 [1257] **335**	160 [1416] **318**	175 [1549] **305**	385
40 [10.6]	19 [168] **512**	53 [469] **505**	75 [664] **494**	96 [850] **483**	118 [1044] **473**	140 [1239] **462**	158 [1398] **450**	170 [1504] **438**	513
50 [13.2]	14 [124] **638**	46 [407] **630**	70 [619] **625**	92 [814] **615**	110 [973] **606**	135 [1195] **593**	156 [1381] **580**	168 [1487] **568**	641
Max. Cont. 60 [15.8]	10 [88] **768**	42 [372] **762**	66 [584] **756**	86 [761] **748**	106 [938] **738**	128 [1133] **728**	150 [1327] **717**	164 [1451] **694**	769
70 [18.5]	6 [53] **896**	36 [319] **890**	56 [496] **882**	78 [690] **872**	98 [867] **860**	118 [1044] **846**	140 [1239] **830**	160 [1416] **816**	897
Max. Inter. 75 [19.8]	3 [27] **960**	27 [239] **955**	50 [442] **948**	74 [655] **938**	92 [814] **926**	113 [1000] **916**	133 [1177] **896**	148 [1310] **802**	962

Overall Efficiency - 70 - 100% ☐ 40 - 69% ☐ 0 - 39% ☐

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]
10.4 [.410]	37 [327]	75 [664]	100 [885]	125 [1106]	149 [1319]	174 [1540]	199 [1761]	218 [1929]

Displacement tested at 45°C [113°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 tesing please refer to page 6.

DISPLACEMENT PERFORMANCE

100 — 96 cm³ [5.9 in³] / rev

Pressure - bar [psi]; Max. Cont. = 160 [2320]; Max. Inter. = 175 [2540]

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]	Theoretical rpm
5 [1.3]	43 [381] **51**	82 [726] **42**	109 [965] **35**	131 [1159] **25**					52
10 [2.6]	43 [381] **99**	84 [743] **93**	108 [956] **84**	133 [1177] **72**	152 [1345] **62**	180 [1593] **48**	197 [1743] **24**		104
20 [5.3]	41 [363] **205**	79 [699] **202**	107 [947] **197**	127 [1124] **192**	154 [1363] **182**	178 [1575] **172**	200 [1770] **140**	212 [1876] **118**	208
30 [7.9]	39 [345] **311**	74 [655] **307**	101 [894] **301**	126 [1115] **294**	152 [1345] **283**	176 [1558] **271**	198 [1752] **258**	213 [1885] **240**	313
40 [10.6]	29 [257] **413**	63 [558] **410**	93 [823] **406**	121 [1071] **399**	150 [1327] **388**	172 [1522] **379**	195 [1726] **368**	208 [1841] **347**	417
50 [13.2]	20 [177] **519**	52 [460] **515**	85 [752] **510**	115 [1018] **503**	148 [1310] **492**	169 [1496] **480**	193 [1708] **464**	203 [1796] **446**	521
Max. Cont. 60 [15.8]	17 [150] **624**	53 [469] **620**	83 [735] **615**	111 [982] **608**	138 [1221] **600**	165 [1460] **582**	183 [1619] **565**	193 [1708] **548**	625
70 [18.5]	11 [97] **728**	42 [372] **726**	73 [646] **723**	93 [823] **714**	126 [1115] **706**	159 [1407] **684**	172 [1522] **668**	183 [1619] **646**	729
Max. Inter. 75 [19.8]	6 [53] **780**	35 [310] **771**	61 [540] **764**	89 [788] **755**	118 [1044] **736**	145 [1283] **724**	156 [1381] **712**	176 [1558] **699**	781

Overall Efficiency - 70 - 100% ☐ 40 - 69% ☐ 0 - 39% ☐

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]
13.0 [.510]	46 [407]	92 [814]	122 [1080]	153 [1354]	183 [1623]	214 [1894]	245 [2168]	268 [2372]

Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

125 — 125 cm³ [7.6 in³] / rev

Pressure - bar [psi]; Max. Cont. = 160 [2320]; Max. Inter. = 175 [2540]

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]	Theoretical rpm
5 [1.3]	52 [460] **38**	95 [841] **35**	135 [1195] **32**	168 [1487] **27**					40
10 [2.6]	50 [442] **78**	98 [867] **74**	138 [1221] **69**	172 [1522] **62**	190 [1681] **54**	234 [2071] **45**	258 [2283] **35**		80
20 [5.3]	50 [442] **158**	96 [850] **152**	132 [1168] **144**	168 [1487] **135**	202 [1788] **124**	236 [2088] **110**	256 [2265] **94**	278 [2460] **78**	160
30 [7.9]	44 [389] **238**	92 [814] **232**	126 [1115] **225**	164 [1451] **215**	198 [1752] **210**	232 [2053] **198**	262 [2319] **168**	268 [2372] **155**	240
40 [10.6]	35 [310] **319**	82 [726] **316**	118 [1044] **312**	160 [1416] **308**	193 [1708] **300**	226 [2000] **288**	252 [2230] **262**	266 [2354] **238**	320
50 [13.2]	31 [274] **399**	77 [681] **396**	108 [956] **392**	155 [1372] **383**	182 [1611] **368**	220 [1947] **354**	238 [2106] **338**	262 [2319] **326**	400
Max. Cont. 60 [15.8]	15 [133] **479**	64 [566] **478**	97 [858] **475**	146 [1292] **470**	166 [1469] **463**	210 [1858] **454**	224 [1982] **443**	256 [2265] **434**	480
70 [18.5]	8 [71] **559**	50 [442] **555**	90 [796] **548**	140 [1239] **538**	162 [1434] **524**	204 [1805] **516**	209 [1850] **500**	236 [2088] **488**	560
Max. Inter. 75 [19.8]		40 [354] **599**	71 [628] **594**	128 [1133] **588**	158 [1398] **576**	192 [1699] **565**	199 [1761] **536**	224 [1982] **524**	600

Overall Efficiency - 70 - 100% ☐ 40 - 69% ☐ 0 - 39% ☐

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]
16.8 [.660]	60 [531]	119 [1053]	159 [1407]	199 [1761]	239 [2115]	279 [2469]	318 [2814]	348 [3080]

Displacement tested at 45°C [113°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 tesing please refer to page 6.

DISPLACEMENT PERFORMANCE

160

159 cm³ [9.7 in³] / rev

Pressure - bar [psi] (Max. Cont. = 160 [2320]; Max. Inter. = 175 [2540])

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320] (Max. Cont.)	175 [2540] (Max. Inter.)	Theoretical rpm
5 [1.3]	56 [496] **30**	112 [991] **25**	154 [1363] **18**	201 [1779] **10**					32
10 [2.6]	58 [513] **63**	115 [1018] **60**	156 [1381] **56**	205 [1814] **52**	245 [2168] **48**	285 [2522] **37**			65
20 [5.3]	60 [532] **128**	123 [1089] **125**	162 [1434] **121**	202 [1788] **116**	242 [2142] **110**	282 [2496] **100**	327 [2894] **86**	360 [3186] **78**	130
30 [7.9]	50 [443] **193**	117 [1035] **190**	157 [1389] **187**	197 [1743] **183**	238 [2106] **179**	278 [2460] **173**	322 [2850] **160**	358 [3168] **144**	194
40 [10.6]	48 [425] **257**	113 [1000] **255**	155 [1372] **252**	195 [1726] **248**	236 [2089] **244**	273 [2416] **239**	318 [2814] **224**	355 [3142] **211**	258
50 [13.2]	32 [283] **323**	106 [938] **320**	149 [1319] **316**	188 [1664] **312**	235 [2080] **306**	267 [2363] **299**	313 [2770] **288**	352 [3115] **275**	323
Max. Cont. 60 [15.8]	23 [204] **387**	88 [779] **384**	133 [1177] **380**	178 [1575] **375**	212 [1876] **371**	260 [2301] **366**	308 [2726] **358**	342 [3027] **346**	387
70 [18.5]	16 [142] **452**	82 [726] **451**	128 [1133] **448**	170 [1505] **444**	206 [1823] **436**	255 [2257] **430**	302 [2673] **423**	331 [2929] **412**	453
Max. Inter. 75 [19.8]	10 [89] **483**	79 [699] **481**	124 [1097] **477**	164 [1451] **472**	201 [1779] **466**	248 [2195] **460**	296 [2620] **450**	319 [2823] **436**	485

Overall Efficiency - 70 - 100% ☐ 40 - 69% ☐ 0 - 39% ☐

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]								
20.8 [.820]	74 [651]	147 [1302]	196 [1736]	245 [2170]	282 [2496]	343 [3038]	392 [3472]	429 [3798]

Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

200

190 cm³ [11.6 in³] / rev

Pressure - bar [psi] (Max. Cont. = 150 [2180]; Max. Inter. = 175 [2540])

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	80 [1160]	100 [1450]	115 [1670]	140 [2030]	150 [2180] (Max. Cont.)	175 [2540] (Max. Inter.)	Theoretical rpm
5 [1.3]	75 [664] **25**	158 [1398] **22**	200 [1770] **20**	241 [2133] **10**					26
10 [2.6]	78 [690] **51**	160 [1416] **49**	204 [1805] **45**	252 [2230] **39**	291 [2575] **35**	348 [3080] **29**	377 [3336] **22**		53
20 [5.3]	74 [655] **104**	156 [1381] **102**	200 [1770] **99**	246 [2177] **95**	293 [2593] **89**	354 [3133] **83**	380 [3363] **76**	416 [3681] **65**	105
30 [7.9]	70 [619] **157**	152 [1345] **155**	196 [1735] **152**	240 [2124] **148**	290 [2566] **143**	352 [3115] **137**	378 [3345] **130**	420 [3717] **118**	158
40 [10.6]	65 [575] **210**	147 [1301] **208**	190 [1681] **205**	228 [2018] **200**	286 [2531] **193**	340 [3009] **186**	376 [3327] **178**	418 [3699] **168**	211
50 [13.2]	54 [478] **262**	142 [1257] **260**	180 [1593] **258**	222 [1965] **254**	277 [2451] **249**	333 [2947] **243**	356 [3150] **235**	402 [3558] **223**	263
Max. Cont. 60 [15.8]	36 [319] **315**	128 [1133] **313**	166 [1469] **309**	210 [1858] **305**	266 [2354] **299**	322 [2850] **293**	350 [3097] **284**	400 [3540] **268**	316
70 [18.5]	15 [133] **367**	102 [903] **365**	158 [1398] **362**	202 [1788] **358**	254 [2248] **352**	302 [2673] **336**	327 [2894] **330**	376 [3327] **316**	368
Max. Inter. 75 [19.8]		94 [832] **394**	146 [1292] **390**	194 [1717] **385**	230 [2035] **380**	290 [2566] **374**	317 [2805] **365**	364 [3221] **352**	395

Overall Efficiency - 70 - 100% ☐ 40 - 69% ☐ 0 - 39% ☐

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]								
25.9 [1.020]	91 [803]	182 [1611]	242 [2142]	303 [2677]	348 [3079]	424 [3748]	454 [4016]	529 [4685]

Displacement tested at 45°C [113°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 tesing please refer to page 6.

DISPLACEMENT PERFORMANCE

250

240 cm³ [14.6 in³] / rev

Pressure - bar [psi]; Max. Cont.: 140 [2030]; Max. Inter.: 175 [2540]

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	60 [870]	85 [1230]	100 [1450]	125 [1810]	140 [2030]	160 [2320]	175 [2540]	Theoretical rpm
5 [1.3]	89 [788] **19**	194 [1717] **16**	264 [2336] **10**	326 [2885] **6**					21
10 [2.6]	92 [814] **40**	196 [1735] **36**	268 [2372] **32**	329 [2912] **21**	394 [3487] **10**				42
20 [5.3]	90 [796] **81**	192 [1699] **77**	264 [2336] **72**	321 [2841] **65**	397 [3513] **50**	445 [3938] **42**	510 [4513] **36**	554 [4903] **23**	83
30 [7.9]	86 [761] **124**	185 [1637] **121**	256 [2265] **115**	314 [2779] **106**	392 [3469] **94**	439 [3855] **84**	502 [4442] **76**	557 [4929] **61**	125
40 [10.6]	82 [726] **165**	179 [1584] **162**	248 [2195] **158**	305 [2699] **153**	384 [3398] **144**	431 [3814] **135**	486 [4301] **125**	545 [4823] **113**	167
50 [13.2]	69 [611] **207**	169 [1496] **203**	243 [2150] **195**	293 [2593] **189**	378 [3345] **183**	421 [3726] **170**	475 [4204] **157**	526 [4655] **138**	208
Max. Cont. 60 [15.8]	48 [425] **250**	152 [1345] **247**	230 [2035] **243**	282 [2496] **236**	364 [3221] **222**	407 [3602] **216**	456 [4035] **205**	508 [4496] **188**	250
70 [18.5]	37 [327] **291**	139 [1230] **285**	219 [1938] **278**	263 [2327] **271**	343 [3035] **256**	386 [3416] **249**	441 [3903] **234**	496 [4389] **221**	292
Max. Inter. 75 [19.8]	26 [230] **312**	128 [1133] **310**	205 [1814] **307**	245 [2168] **302**	328 [2903] **294**	374 [3310] **270**	428 [3788] **254**	481 [4257] **242**	313

Overall Efficiency - 70 - 100% | 40 - 69% | 0 - 39%

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	60 [870]	85 [1230]	100 [1450]	125 [1810]	140 [2030]	160 [2320]	175 [2540]
32.5 [1.280]	115 [1018]	229 [2027]	325 [2875]	382 [3381]	478 [4230]	535 [4735]	611 [5407]	669 [5920]

Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

315

303 cm³ [18.5 in³] / rev

Pressure - bar [psi]; Max. Cont.: 120 [1740]; Max. Inter.: 160 [2320]

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	50 [725]	70 [1015]	85 [1230]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	Theoretical rpm
5 [1.3]	123 [1089] **16**	200 [1770] **13**	282 [2496] **10**	344 [3044] **6**					17
10 [2.6]	117 [1035] **31**	194 [1717] **29**	277 [2451] **25**	342 [3027] **21**	399 [3531] **17**				33
20 [5.3]	112 [991] **64**	196 [1735] **62**	275 [2434] **58**	340 [3009] **54**	397 [3513] **49**	460 [4071] **43**	526 [4655] **32**	605 [5354] **23**	66
30 [7.9]	104 [920] **98**	183 [1620] **94**	267 [2363] **90**	322 [2850] **85**	390 [3452] **79**	448 [3965] **70**	520 [4602] **62**	602 [5328] **56**	99
40 [10.6]	86 [761] **129**	168 [1487] **126**	252 [2230] **122**	304 [2690] **118**	365 [3230] **113**	440 [3894] **106**	515 [4558] **99**	588 [5204] **76**	132
50 [13.2]	73 [646] **164**	156 [1381] **160**	238 [2106] **155**	288 [2549] **150**	350 [3098] **144**	424 [3752] **136**	500 [4425] **127**	571 [5053] **119**	165
Max. Cont. 60 [15.8]	60 [531] **195**	140 [1239] **192**	223 [1974] **188**	270 [2390] **183**	325 [2876] **176**	396 [3505] **170**	480 [4248] **164**	546 [4832] **157**	198
70 [18.5]	37 [327] **228**	122 [1080] **226**	186 [1646] **223**	254 [2248] **218**	309 [2735] **212**	368 [3257] **206**	455 [4027] **196**	527 [4664] **188**	231
Max. Inter. 75 [19.8]	23 [204] **245**	100 [885] **242**	174 [1540] **238**	237 [2097] **233**	293 [2593] **228**	359 [3177] **222**	444 [3929] **215**	516 [4567] **206**	248

Overall Efficiency - 60 - 100% | 40 - 59% | 0 - 39%

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	50 [725]	70 [1015]	85 [1230]	100 [1450]	120 [1740]	140 [2030]	160 [2320]
40.9 [1.610]	145 [1283]	241 [2133]	338 [2991]	410 [3628]	482 [4265]	579 [5124]	675 [5973]	772 [6832]

Displacement tested at 45°C [113°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 tesing please refer to page 6.

DISPLACEMENT PERFORMANCE

400 — 388 cm³ [23.7 in³] / rev

Pressure - bar [psi] (Max. Cont.: 95 [1380]; Max. Inter.: 125 [1810])

Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	30 [435]	45 [650]	55 [800]	65 [940]	80 [1160]	95 [1380]	110 [1595]	125 [1810]	Theoretical rpm
5 [1.3]	144 [1274] **11**	220 [1947] **10**	270 [2389] **7**	338 [2991] **5**					13
10 [2.6]	146 [1292] **25**	223 [1973] **23**	272 [2407] **20**	340 [3009] **16**	412 [3646] **10**	488 [4319] **6**			26
20 [5.3]	145 [1283] **51**	219 [1938] **50**	269 [2381] **48**	333 [2347] **45**	408 [3611] **40**	484 [4283] **35**	548 [4850] **27**		52
30 [7.9]	138 [1221] **76**	215 [1903] **75**	262 [2319] **73**	322 [2850] **70**	402 [3558] **67**	472 [4177] **59**	546 [4832] **47**	625 [5531] **36**	77
40 [10.6]	120 [1062] **103**	204 [1805] **102**	250 [2212] **100**	310 [2743] **96**	393 [3478] **89**	458 [4053] **82**	535 [4735] **73**	618 [5469] **62**	103
50 [13.2]	100 [885] **129**	186 [1646] **128**	238 [2106] **125**	295 [2611] **123**	374 [3310] **119**	446 [3947] **112**	520 [4602] **102**	600 [5310] **91**	129
Max. Cont. 60 [15.8]	76 [673] **155**	166 [1469] **153**	222 [1965] **150**	282 [2496] **148**	358 [3168] **143**	427 [3779] **139**	496 [4389] **130**	576 [5097] **121**	155
70 [18.5]	50 [442] **179**	145 [1283] **177**	194 [1717] **174**	250 [2212] **170**	334 [2956] **165**	402 [3558] **158**	472 [4177] **152**	540 [4779] **144**	180
Max. Inter. 75 [19.8]	42 [372] **189**	135 [1195] **187**	176 [1558] **184**	226 [2000] **180**	306 [2708] **175**	373 [3301] **167**	445 [3938] **160**	520 [4602] **150**	190

Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	30 [435]	45 [650]	55 [800]	65 [940]	80 [1160]	95 [1380]	110 [1595]	125 [1810]
52.1 [2.050]	185 [1640]	278 [2460]	340 [3007]	402 [3554]	494 [4374]	587 [5194]	680 [6014]	772 [6834]

Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

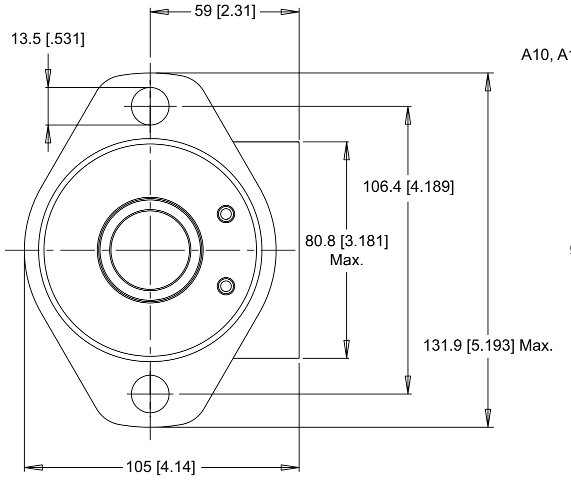
▶ Performance data is typical. Performance of production units varies slightly from one motor to another. Operating at maximum continuous pressure and maximum continuous flow simultaneously is not recommended. For additional information on product tesing please refer to page 6.

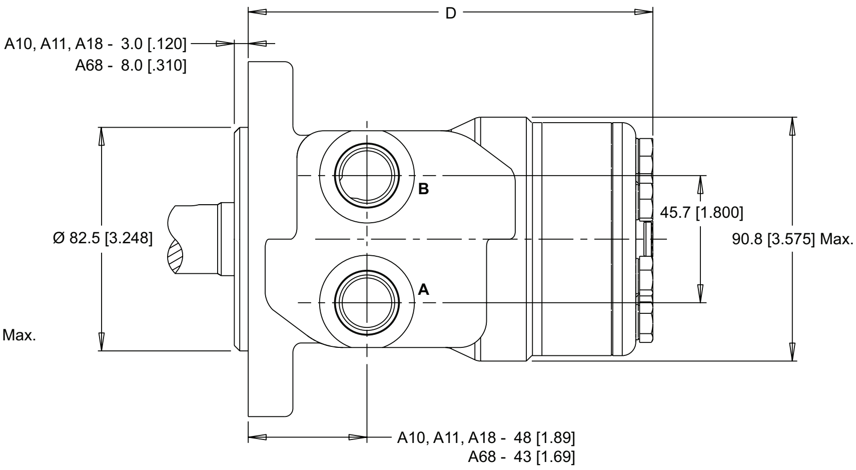
HOUSINGS

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

2-HOLE, SAE A MOUNT, ALIGNED PORTS

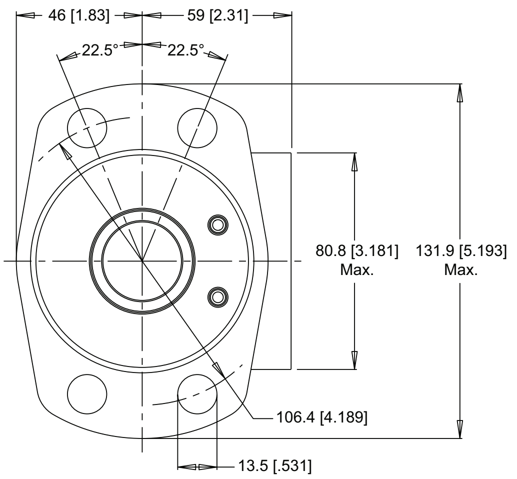
A10 1/2-14 NPT **A11** 7/8-14 UNF **A18** G 1/2 **A68** G 1/2 (TP)

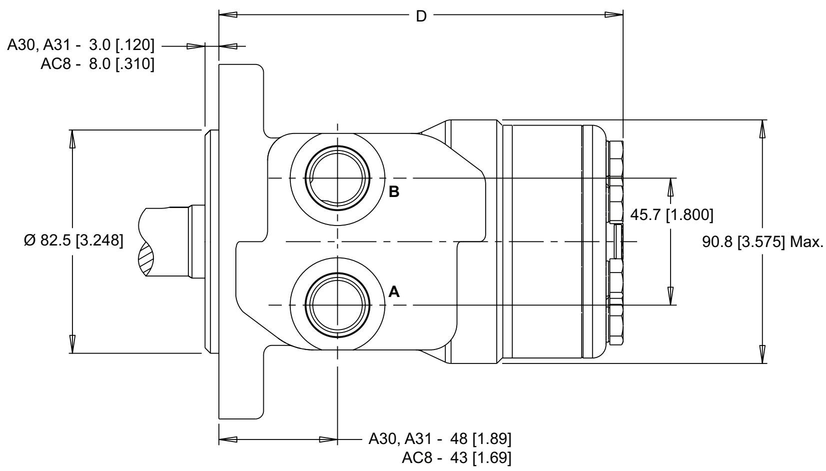




4-HOLE, MAGNETO MOUNT, ALIGNED PORTS

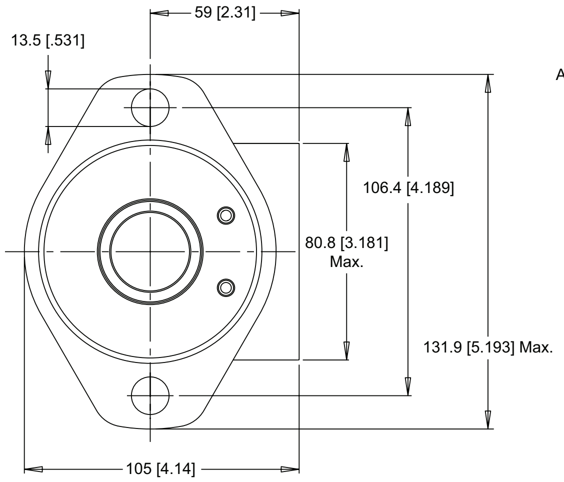
A30 1/2-14 NPT **A31** 7/8-14 UNF **AC8** G 1/2 (TP)

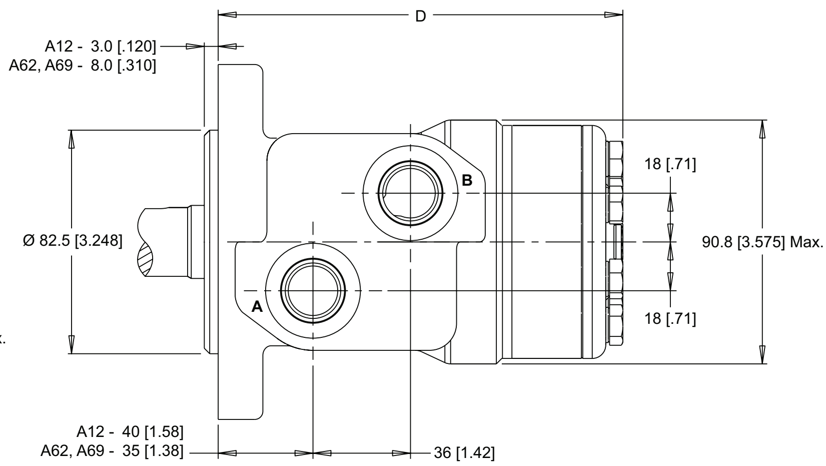




2-HOLE, SAE A MOUNT, OFFSET PORTS

A12 G 1/2 **A62** G 1/2 (TP) **A69** 7/8-14 UNF (TP)





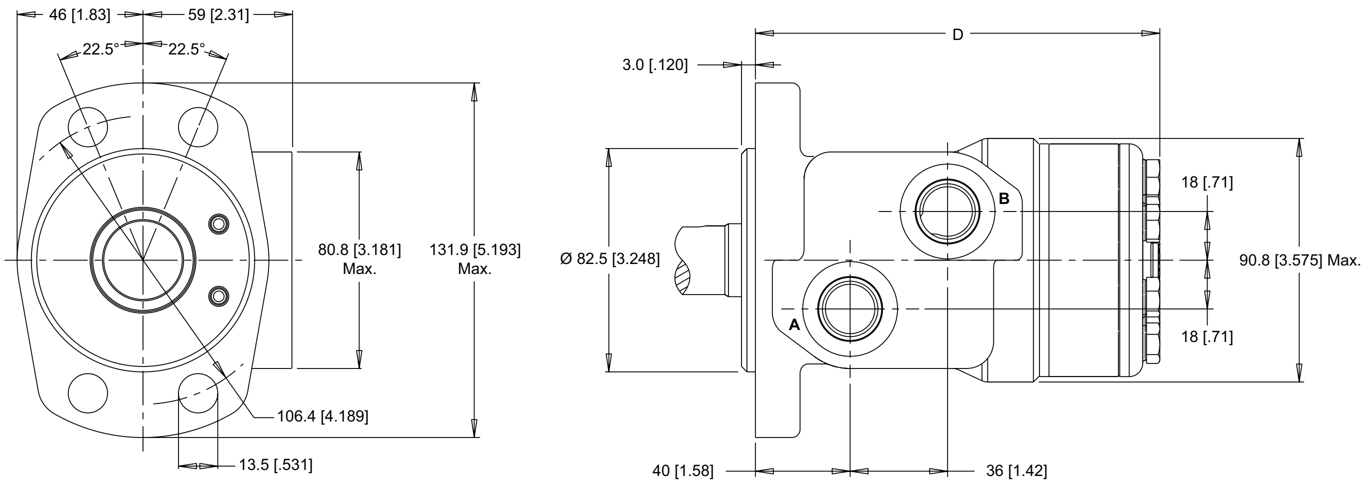
▶ Dimension D is charted on page 46. ▶ (TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

HOUSINGS

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

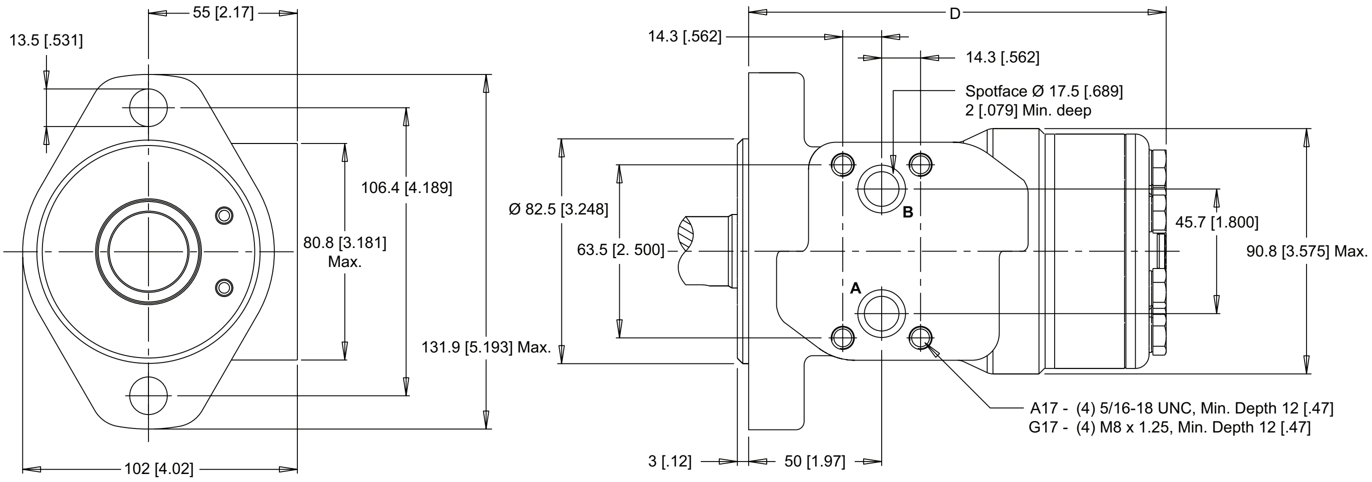
4-HOLE, MAGNETO MOUNT, OFFSET PORTS

A32 G 1/2



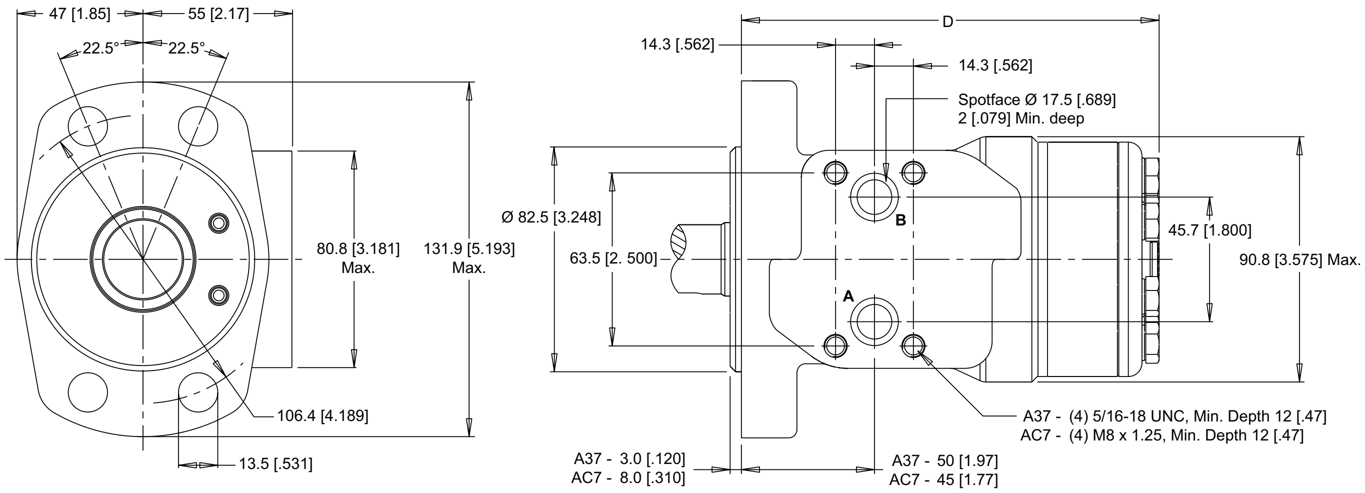
2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS

A17 1/2" Drilled **G17** 1/2" Drilled



4-HOLE, MAGNETO MOUNT, ALIGNED MANIFOLD PORTS

A37 1/2" Drilled **AC7** 1/2" Drilled (TP)



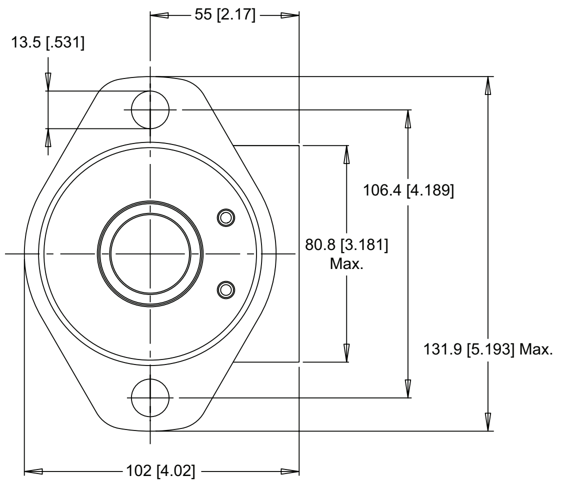
► Dimension D is charted on page 46. ► (TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

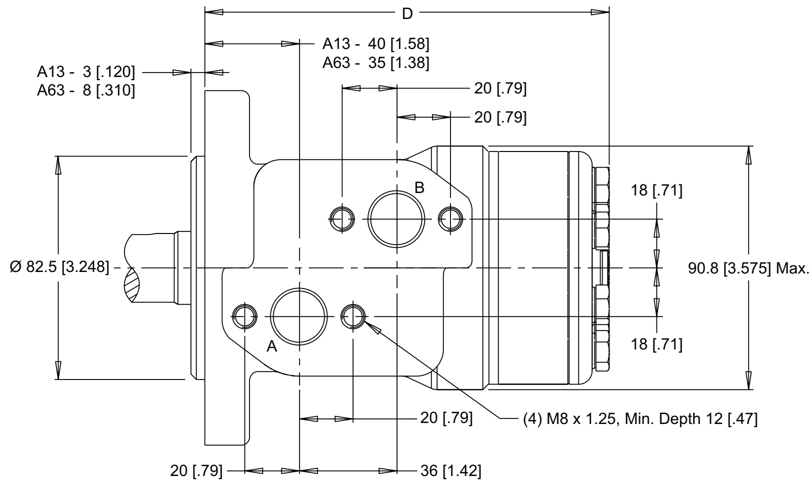
HOUSINGS

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

2-HOLE, SAE A MOUNT, OFFSET MANIFOLD PORTS

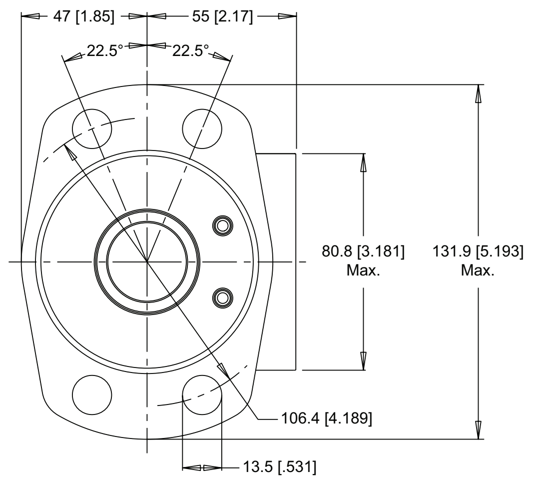
A13 G 1/2 **A63** G 1/2 (TP)

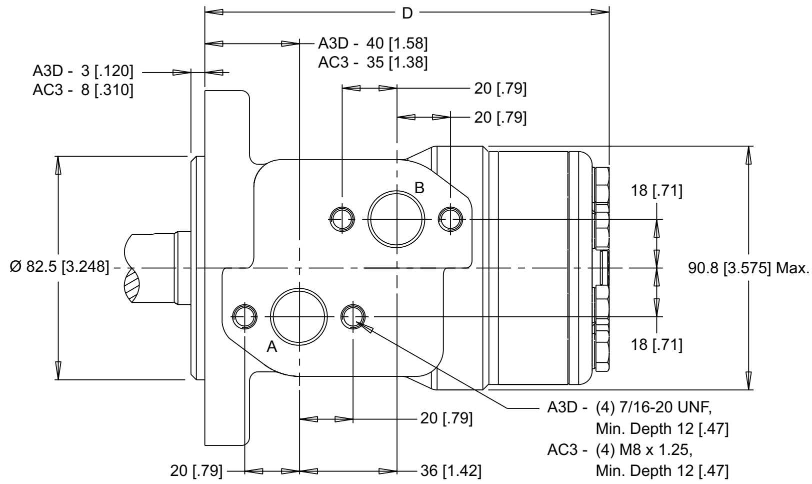




4-HOLE, MAGNETO MOUNT, OFFSET MANIFOLD PORTS

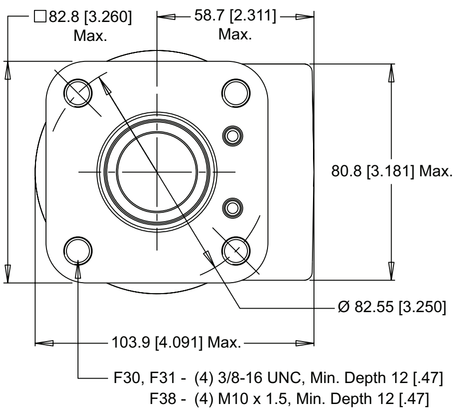
A3D 7/8-14 UNF **AC3** G 1/2 (TP)

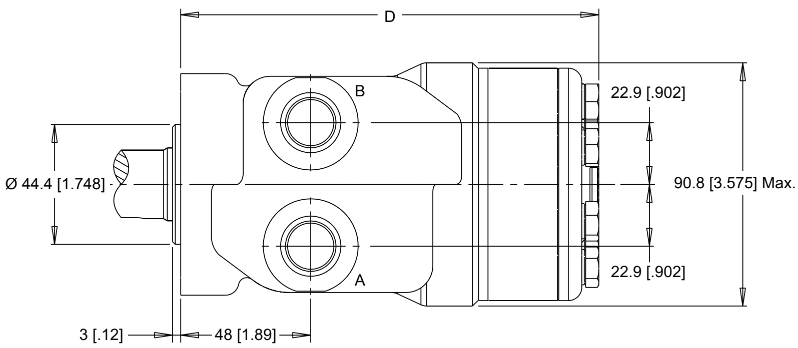




4-HOLE, SQUARE MOUNT, ALIGNED PORTS

F30 1/2-14 NPT **F31** 7/8-14 UNF **F38** G 1/2





► Dimension D is charted on page 46. ► (TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

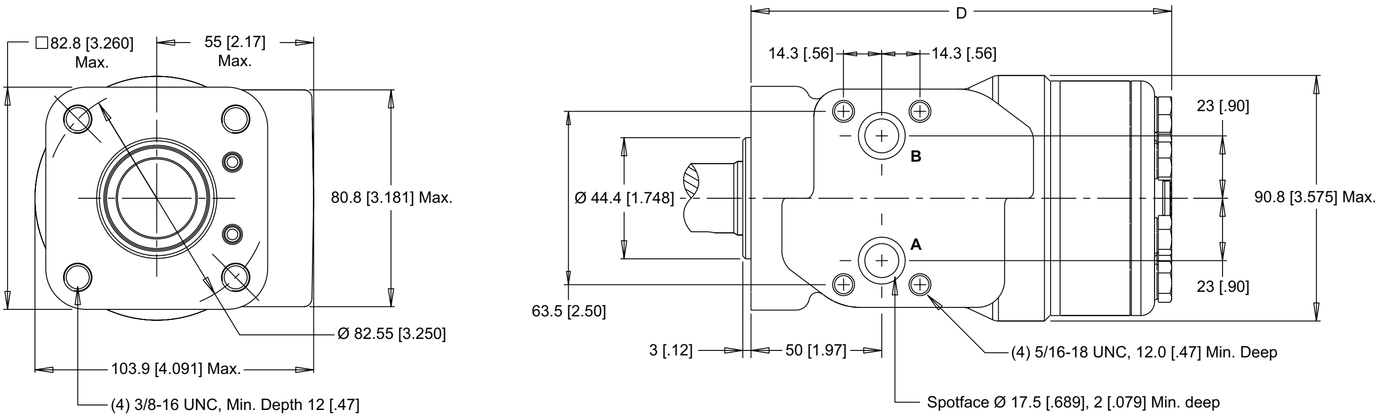
WP (155/156 Series)
Light Duty Hydraulic Motor

HOUSINGS

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

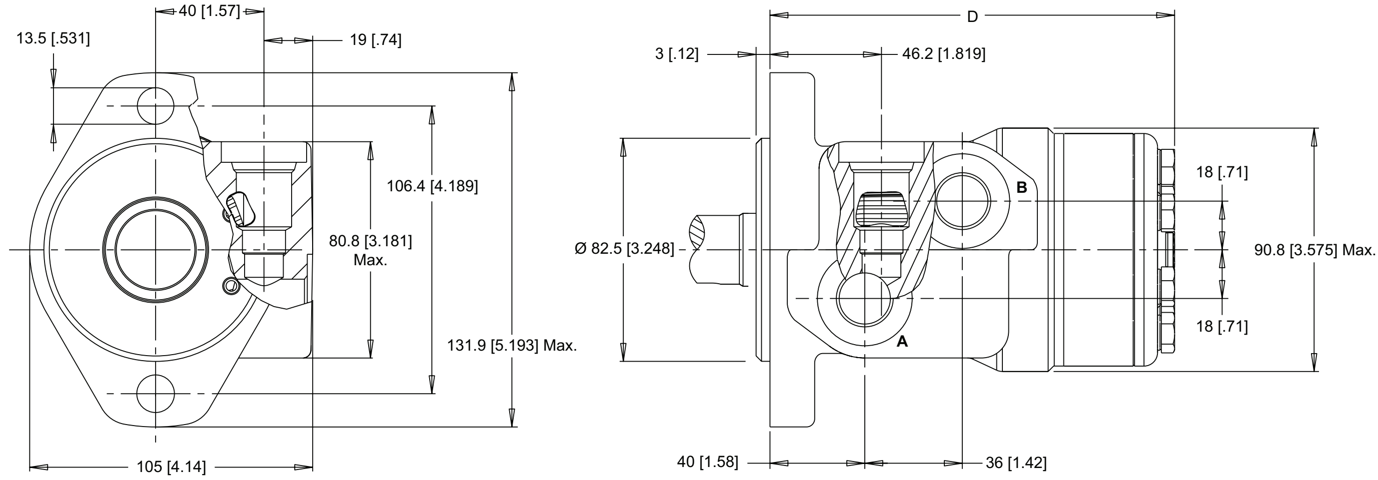
4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS

F37 1/2” Drilled



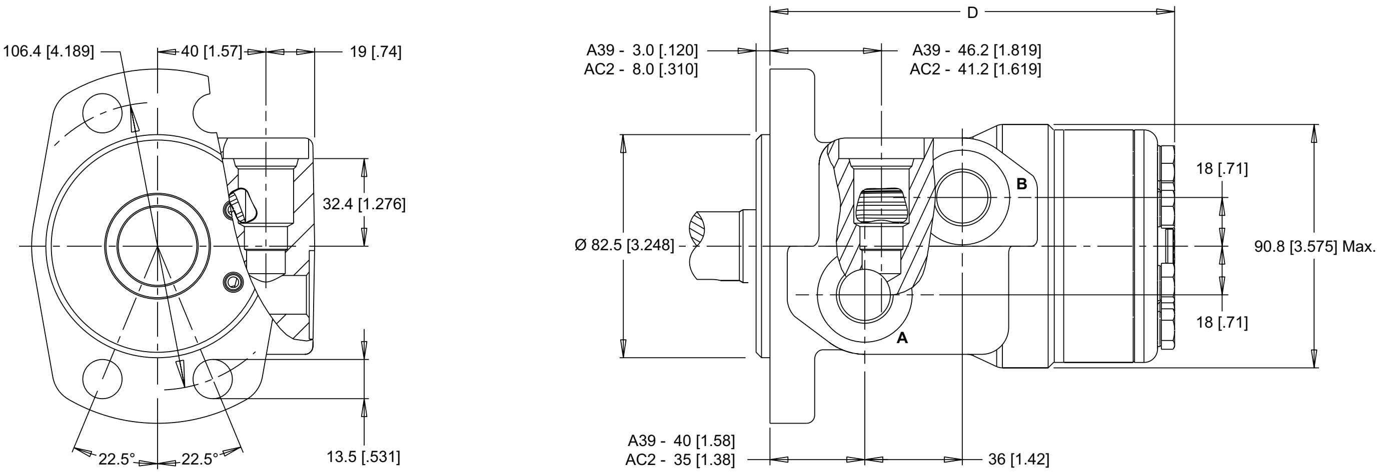
2-HOLE, SAE A MOUNT, OFFSET PORTS, VALVE CAVITY

A19 7/8-14 UNF



4-HOLE, MAGNETO MOUNT, OFFSET PORTS, VALVE CAVITY

A39 7/8-14 UNF **AC2** G 1/2 (TP)



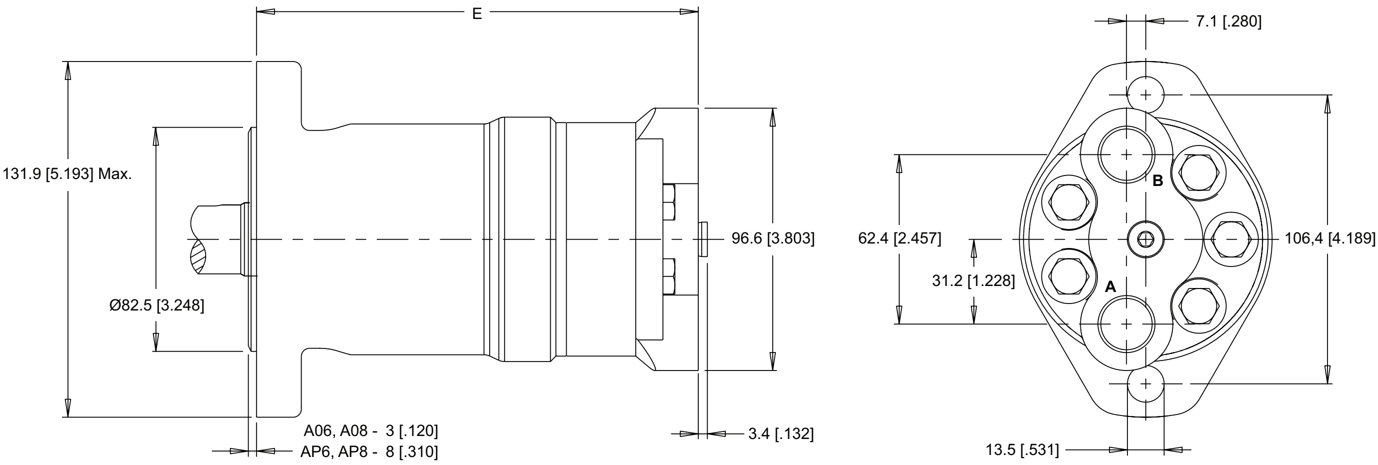
▶ Dimension D is charted on page 46. ▶ (TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

HOUSINGS

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

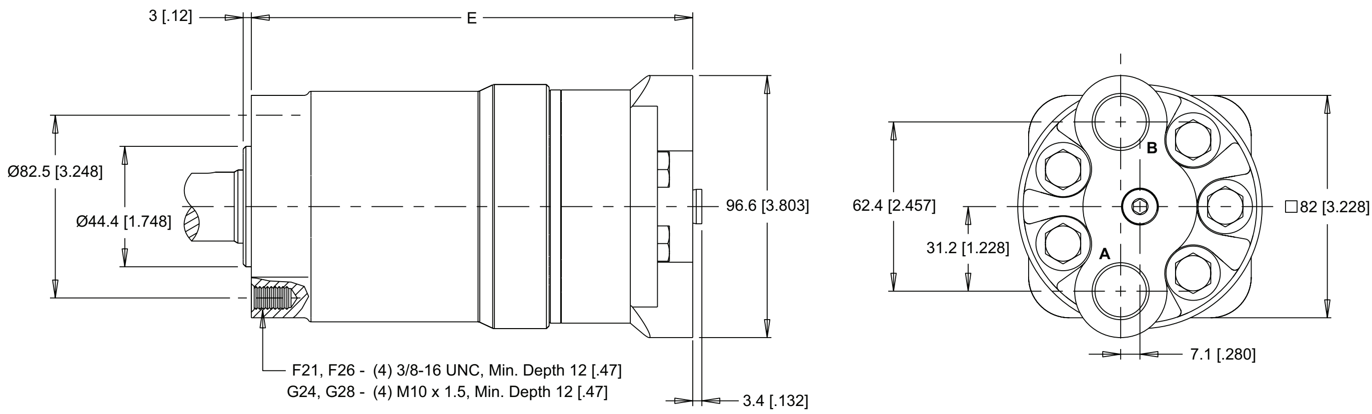
2-HOLE, SAE A MOUNT, ALIGNED END PORTS

A06 3/4-16 UNF **A08** G 1/2 **AP6** 3/4-16 UNF (TP) **AP8** G 1/2 (TP)



4-HOLE, SQUARE MOUNT, ALIGNED END PORTS

F21 7/8-14 UNF **F26** 3/4-16 UNF **G24** M22 x 1.5 **G28** G 1/2

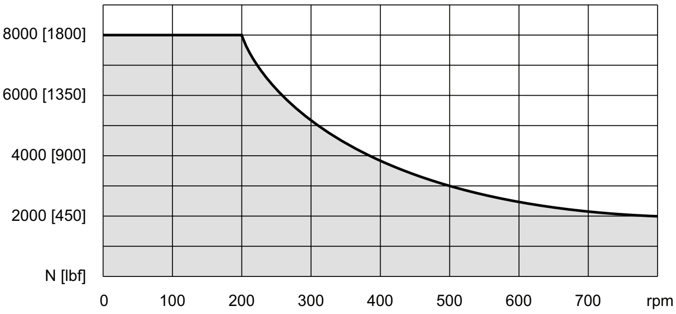


► Dimension E is charted on page 46. ► (TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

TECHNICAL INFORMATION

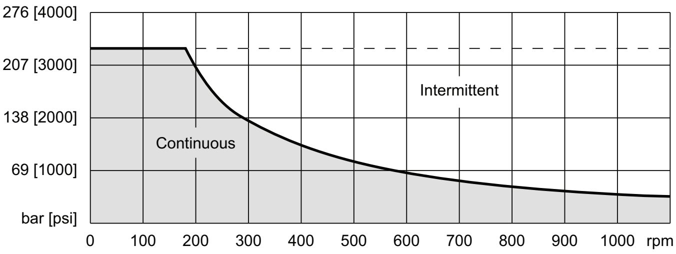
ALLOWABLE SHAFT LOAD / BEARING CURVE

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.

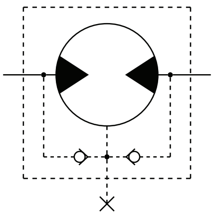


PERMISSIBLE SHAFT SEAL PRESSURE

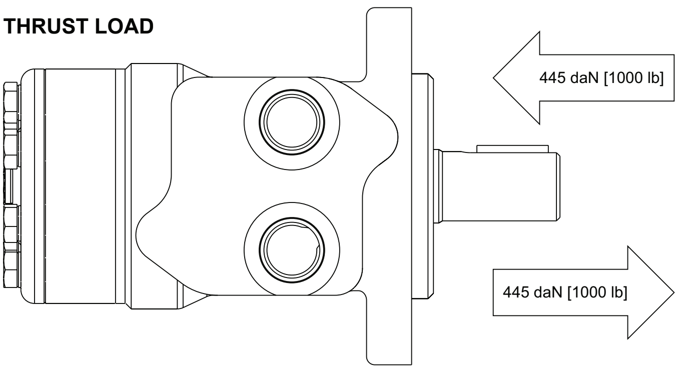
The curve below represents allowable seal pressure at various speeds. Operation in the gray area results in maintaining the rated life of the shaft seal. Actual shaft seal pressure depends on motor configuration.



▶ 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 D 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 41-44.

D	3mm Pilot	8mm Pilot	Weight
#	mm [in]	mm [in]	kg [lb]
025	133 [5.24]	128 [5.04]	6.3 [13.9]
032	134 [5.28]	129 [5.08]	6.4 [14.1]
040	136 [5.34]	131 [5.16]	6.5 [14.2]
050	136 [5.34]	131 [5.16]	6.5 [14.2]
060	137 [5.40]	132 [5.20]	6.5 [14.3]
080	139 [5.49]	134 [5.28]	6.6 [14.5]
100	142 [5.59]	137 [5.39]	6.7 [14.7]
125	146 [5.74]	141 [5.55]	6.8 [14.9]
160	150 [5.90]	145 [5.71]	6.9 [15.2]
200	155 [6.10]	150 [5.91]	7.1 [15.6]
250	162 [6.36]	157 [6.18]	7.3 [16.1]
315	170 [6.69]	165 [6.50]	7.6 [16.7]
400	181 [7.13]	176 [6.93]	7.9 [17.5]

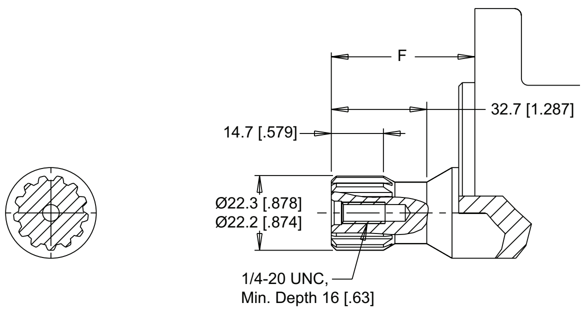
Dimension E is the overall motor length from the rear of the motor to the mounting flange surface and is referenced on detailed housing drawings listed on pages 45.

E	3mm Pilot	8mm Pilot	Weight
#	mm [in]	mm [in]	kg [lb]
025	144 [5.67]	139 [5.47]	5.9 [13.0]
032	145 [5.71]	140 [5.51]	6.0 [13.2]
040	146 [5.75]	141 [5.55]	6.1 [13.4]
050	146 [5.75]	141 [5.55]	6.1 [13.4]
060	148 [5.83]	143 [5.63]	6.1 [13.4]
080	150 [5.91]	145 [5.71]	6.2 [13.6]
100	153 [6.02]	148 [5.83]	6.3 [13.9]
125	157 [6.18]	152 [5.98]	6.4 [14.1]
160	161 [6.33]	156 [6.14]	6.5 [14.3]
200	166 [6.54]	161 [6.34]	6.7 [14.7]
250	173 [6.81]	168 [6.61]	6.9 [15.2]
315	181 [7.13]	176 [6.93]	7.2 [15.8]
400	192 [7.56]	187 [7.36]	7.5 [16.5]

▶ The overall motor weights listed in each chart above were calculated using the heaviest of the housing options associated with that mounting flange to end of motor dimension. 155 & 156 series motor weights can vary ± 0.5 kg [1 lb] depending on model configurations such as housing, shaft, endcover, options etc.

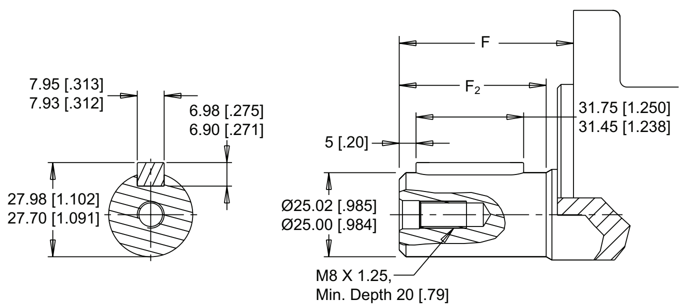
SHAFTS

01 7/8” 13 Tooth Spline



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

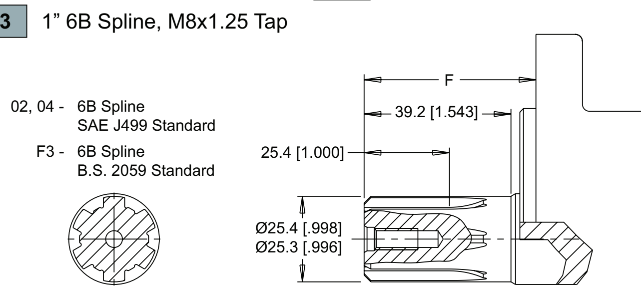
12 25mm Straight **16** 25mm Straight Extended



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

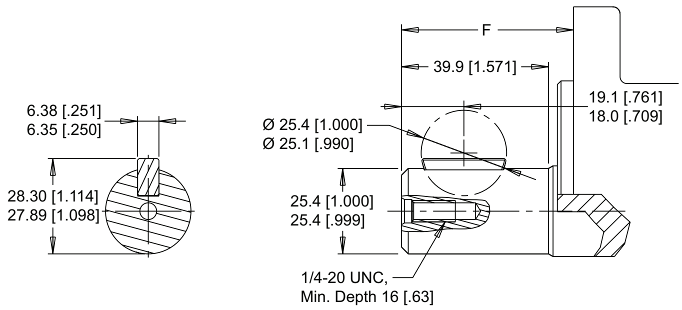
02 1” 6B Spline, 1/4-20 Tap **04** 1” 6B Spline, M8x1.25 Tap

F3 1” 6B Spline, M8x1.25 Tap



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

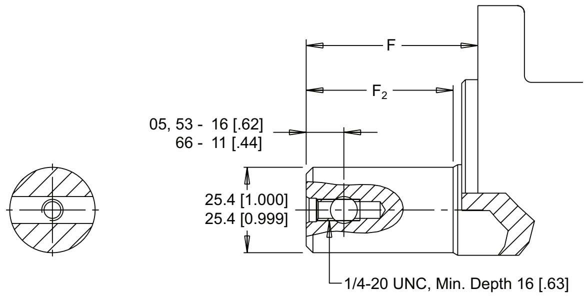
B1 1” Straight, Woodruff Key



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

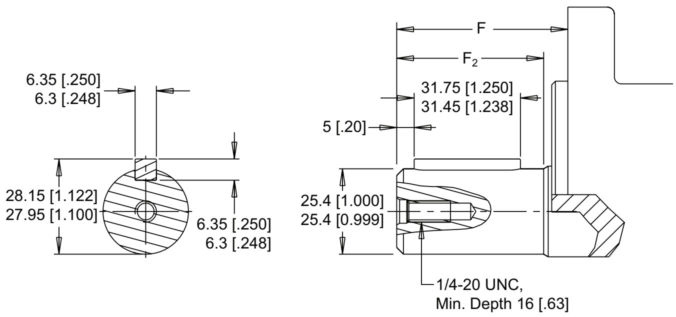
05 1” - 9.5 [.375] Pinhole **53** 1” - 10.3 [.406] Pinhole

66 1” - 8.0 [.315] Pinhole



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

10 1” Straight **15** 1” Straight Extended



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

MOUNTING / SHAFT LENGTH CHART

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

Additional shaft length information, if necessary, is noted as F_2 and does not increase or decrease the listed F 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.

F	3mm Pilot	8mm Pilot	F_2
#	mm [in]	mm [in]	mm [in]
01	43.3 [1.705]	48.3 [1.902]	N/A
02	45.3 [1.783]	50.3 [1.980]	N/A
04	45.3 [1.783]	50.3 [1.980]	N/A
05	45.3 [1.783]	50.3 [1.980]	39.2 [1.543]
10	45.3 [1.783]	50.3 [1.980]	39.2 [1.543]
12	50.3 [1.980]	55.3 [2.177]	44.2 [1.740]
15	62.1 [2.445]	67.1 [2.642]	56.0 [2.205]
16	62.6 [2.464]	67.6 [2.661]	56.5 [2.225]
53	45.3 [1.783]	50.3 [1.980]	39.2 [1.543]
66	50.3 [1.980]	55.3 [2.177]	44.2 [1.740]
B1	45.3 [1.783]	50.3 [1.980]	N/A

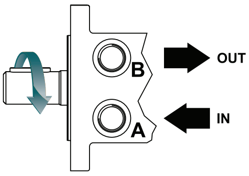
WHITE DRIVE PRODUCTS

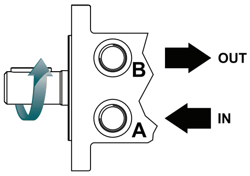
ORDERING INFORMATION

1			2			3			4		5	6	7	8	

1. CHOOSE SERIES DESIGNATION

155	Standard Rotation
156	Reverse Rotation





▶ The 155 & 156 series are bi-directional.

2. SELECT A DISPLACEMENT OPTION

025	25 cm^3/rev	[1.5 in^3/rev]
032	32 cm^3/rev	[2.0 in^3/rev]
040	40 cm^3/rev	[2.5 in^3/rev]
050	50 cm^3/rev	[3.0 in^3/rev]
060	59 cm^3/rev	[3.6 in^3/rev]
080	78 cm^3/rev	[4.8 in^3/rev]
100	96 cm^3/rev	[5.9 in^3/rev]
125	125 cm^3/rev	[7.6 in^3/rev]
160	154 cm^3/rev	[9.4 in^3/rev]
200	190 cm^3/rev	[11.6 in^3/rev]
250	240 cm^3/rev	[14.6 in^3/rev]
315	303 cm^3/rev	[18.5 in^3/rev]
400	388 cm^3/rev	[23.7 in^3/rev]

3. SELECT A MOUNT & PORT OPTION

A06	2-Hole, SAE A Mount, Aligned End Ports, 3/4-16 UNF
A08	2-Hole, SAE A Mount, Aligned End Ports, G 1/2
AP6	2-Hole, SAE A Mount, Aligned End Ports, 3/4-16 UNF (TP)
AP8	2-Hole, SAE A Mount, Aligned End Ports, G 1/2 (TP)
A10	2-Hole, SAE A Mount, Aligned Ports, 1/2-14 NPT
A11	2-Hole, SAE A Mount, Aligned Ports, 7/8-14 UNF
A12	2-Hole, SAE A Mount, Offset Ports, G 1/2
A13	2-Hole, SAE A Mount, Offset Manifold Ports, G 1/2
A17	2-Hole, SAE A Mount, Aligned Manifold Ports, 1/2” Drilled
A18	2-Hole, SAE A Mount, Aligned Ports, G 1/2
A19	2-Hole, SAE A Mount, Offset Ports, Valve Cavity 7/8-14 UNF
A30	4-Hole, Magneto Mount, Aligned Ports, 1/2-14 NPT
A31	4-Hole, Magneto Mount, Aligned Ports, 7/8-14 UNF
A32	4-Hole, Magneto Mount, Offset Ports, G 1/2
A37	4-Hole, Magneto Mount, Aligned Manifold Ports, 1/2” Drilled
A39	4-Hole, Magneto Mount, Offset Ports, Valve Cavity 7/8-14 UNF
A3D	4-Hole, Magneto Mount, Offset Manifold Ports, 7/8-14 UNF
A62	2-Hole, SAE A Mount, Offset Ports, G 1/2 (TP)
A63	2-Hole, SAE A Mount, Offset Manifold Ports, G 1/2 (TP)
A68	2-Hole, SAE A Mount, Aligned Ports, G 1/2 (TP)
A69	2-Hole, SAE A Mount, Offset Ports, 7/8-14 UNF (TP)
AC2	4-Hole, Magneto Mount, Offset Ports, G 1/2 (TP)
AC3	4-Hole, Magneto Mount, Offset Manifold Ports, G 1/2 (TP)
AC7	4-Hole, Magneto Mount, Aligned Manifold Ports, 1/2” Drilled (TP)

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

3. SELECT A MOUNT & PORT OPTION

AC8	4-Hole, Magneto Mount, Aligned Ports, G 1/2 (TP)
F21	4-Hole, Square Mount, Aligned End Ports, 7/8-14 UNF
F26	4-Hole, Square Mount, Aligned End Ports, 3/4-16 UNF
F30	4-Hole, Square Mount, Aligned Ports, 1/2-14 NPT
F31	4-Hole, Square Mount, Aligned Ports, 7/8-14 UNF
F37	4-Hole, Square Mount, Aligned Manifold Ports, 1/2” Drilled
F38	4-Hole, Square Mount, Aligned Ports, G 1/2
G17	2-Hole, SAE A Mount, Aligned Manifold Ports, 1/2” Drilled
G24	4-Hole, Square Mount, Aligned End Ports, M22 x 1.5
G28	4-Hole, Square Mount, Aligned End Ports, G 1/2

4. SELECT A SHAFT OPTION

01	7/8” 13 Tooth Spline
02	1” 6B Spline, 1/4-20 Tap
04	1” 6B Spline, M8x1.25 Tap
05	1” - 9.5 [.375] Pinhole
10	1” Straight
12	25mm Straight
15	1” Straight Extended
16	25mm Straight Extended
53	1” - 10.3 [.406] Pinhole
66	1” - 8.0 [.315] Pinhole
B1	1” Straight, Woodruff Key
F3	1” 6B Spline, M8x1.25 Tap

▶ 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

A	Black
B	Black, Unpainted Mounting Surface

6. SELECT A VALVE CAVITY / CARTRIDGE OPTION

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

▶ Valve cavity is only available on the A19, A39 & AC2 housings.

7. SELECT AN ADD-ON OPTION

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

8. SELECT A MISCELLANEOUS OPTION

AA	None
AC	Freeturning Rotor
BE	Slinger Seal
DS	Groove In Mounting Flange
FB	No Check Valves Installed