ENGINEERING
TOMORROW

Technical Information

# WD, WP and WR Series
## Orbital Motors

www.danfoss.com

## Revision history

*Table of revisions*

| Date | Changed | Rev |
|---|---|---|
| December 2019 | Conversion to CMS/ET Danfoss layout. | 0201 |
| June 2017 | First edition | 0101 |

## Contents

## Technical Information

### Operating Recommendations

#### Oil Type

Hydraulic oils with anti-wear, anti-foam and demulsifiers are recommended for systems incorporating Danfoss 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 and 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.

Danfoss recommends maintaining an oil cleanliness level of ISO 17-14 or better.

#### Installation and Start-up

When installing a Danfoss 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.

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### Motor/Brake Precaution

**Caution**

Danfoss' 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.

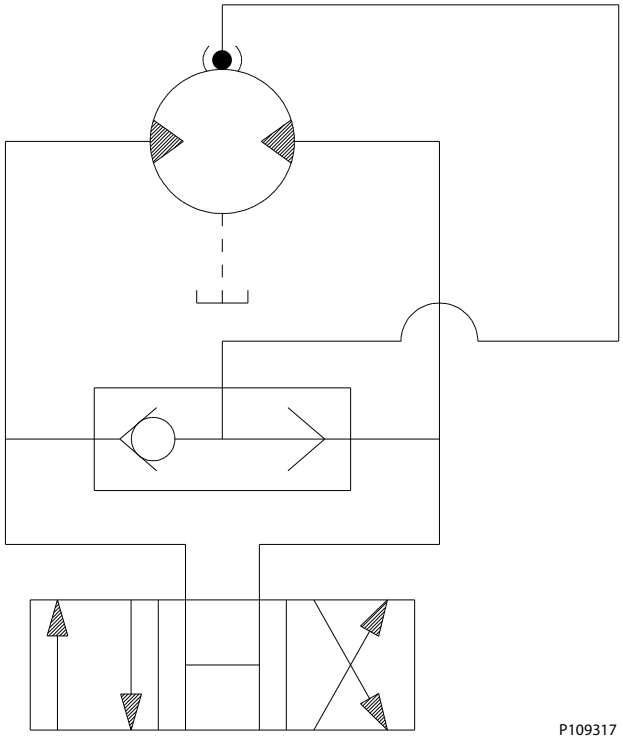
**Caution**

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 in *Typical Motor/Brake Schematic* on page 5. 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 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*



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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.

**Warning**

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

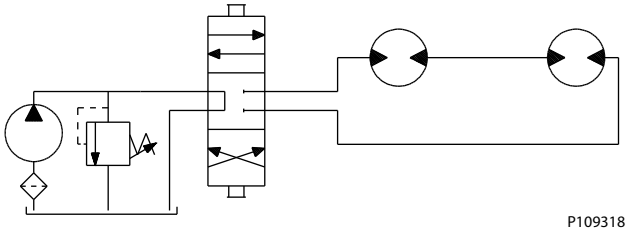
## Motor Connections

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*



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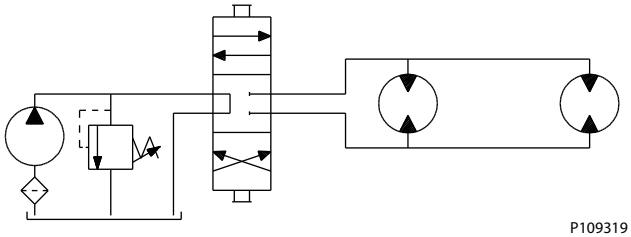
### Parallel Connection

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.

*Parallel Circuit*



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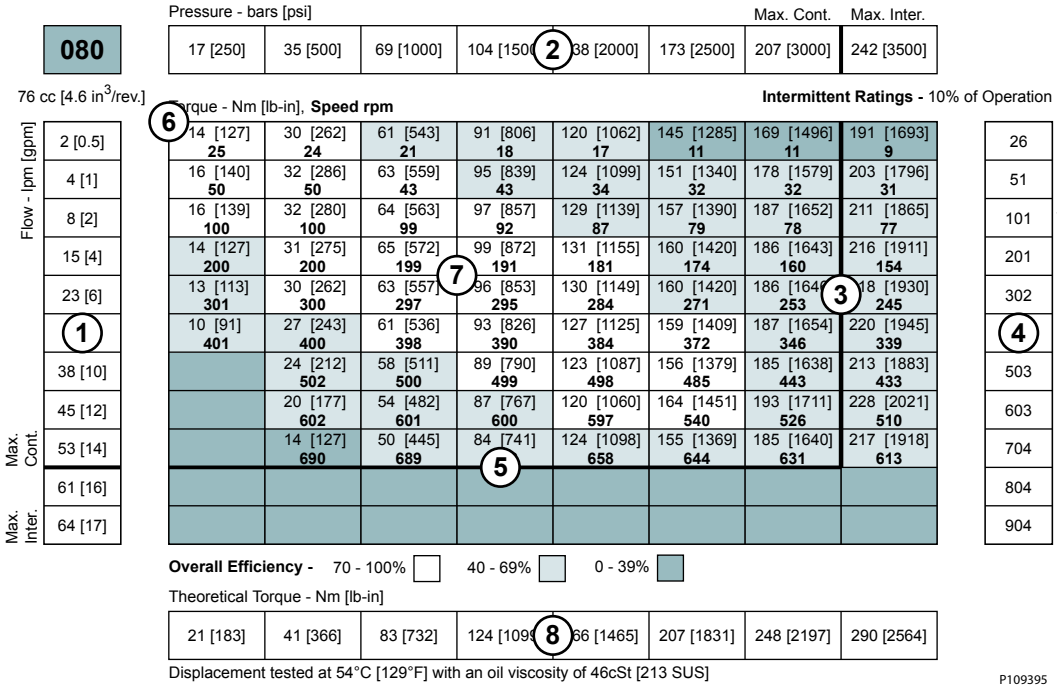
The motor circuits shown above are for illustration purposes only. Components and circuitry for actual applications may vary greatly and should be chosen based on the application.

## Technical Information

### 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 Danfoss' 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.




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 and 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.

## Technical Information

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.

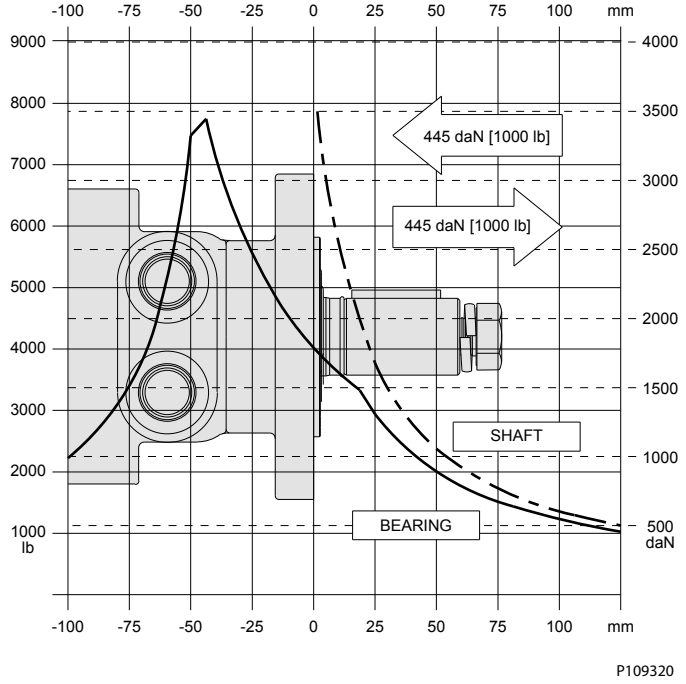
The bearing curves for each model are based on laboratory analysis and testing conducted at Danfoss. The shaft loading is based on a 3:1 safety factor and 330 Kpsi tensile strength. The allowable load is the lower of the curves at a given point. For instance, one inch in front of the mounting flange 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. Manufacturer's 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 [106 revolutions] |
| **$L_{10}$** | nominal rating life |
| **C** | dynamic load rating |

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| | |
|---|---|
| **P** | equivalent dynamic load |
| **Life Exponent p** | 10/3 for needle bearings |

*Bearing Load Multiplication Factor Table*

| RPM | Factor |
|---|---|
| 50 | 1.23 |
| 100 | 1.00 |
| 200 | 0.81 |
| 300 | 0.72 |
| 400 | 0.66 |
| 500 | 0.62 |
| 600 | 0.58 |
| 700 | 0.56 |
| 800 | 0.50 |

## 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 = (2.65 x KPH x G) / rm or RPM = (168 x MPH x G) / ri

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

RPM = (168 x 5 x 1) / 16 = 52.5

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### 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)

| | |
|---|---|
| **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 = (GVW / 1000) x R (lb or N)

| | |
|---|---|
| **GVW** | gross (loaded) vehicle weight (lb or kg) |
| **R** | surface friction (value from *Rolling Resistance* on page 10) |

*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.

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To convert incline degrees to % Grade:

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

GR = (% Grade / 100) x GVW (lb or N)

Example: GR = (20 / 100) x 1500 lbs = 300 lbs

### 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 = (KPH x GVW (N)) / (35.32 x t) or FA = (MPH x GVW (lb)) / (22 x t)

**t** time to maximum speed (seconds)

Example: FA = (5 x 1500 lbs) / (22 x 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 = (TE x rm) / (M x G) Nm per motor or T = (TE x ri) / (M x G) lb-in per motor

**M** number of driving motors

Example: T = (367 x 16) / (2 x 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 = (W x f x rm) / G (Nm per motor) or TS = (W x f x ri) / G (lb-in per motor)

**f** coefficient of friction (see *Coefficient of friction (f)* on page 11)

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

Example: TS = (425 x .06 x 16) / 1 = lb-in/motor = 4080 lbs

*Coefficient of friction (f)*

| | |
|---|---|
| Steel on steel | 0.3 |
| Rubber tire on dirt | 0.5 |

## Technical Information

*Coefficient of friction (f) (continued)*

| | |
|---|---|
| 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.

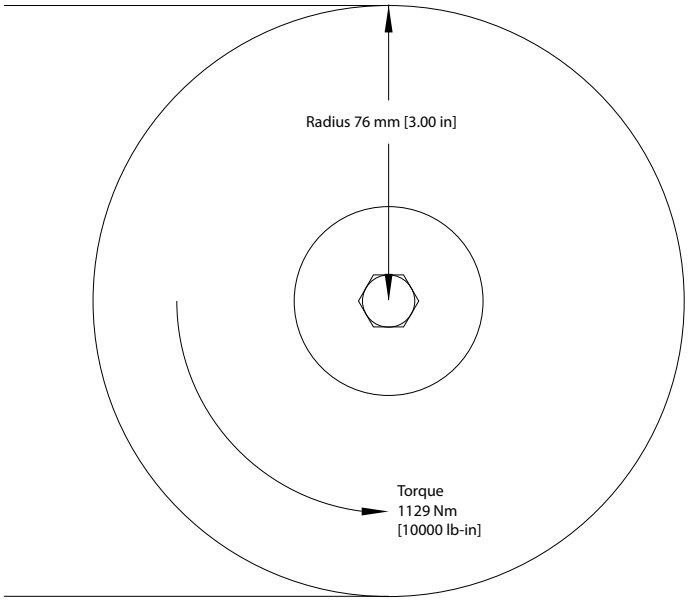
$RL = \text{sqrt}(W^2 + (T / ri)^2)$ lb or $RL = \text{sqrt}(W^2 + (T / rm)^2)$ kg

Example: $RL = \text{sqrt}(425^2 + (2936 / 16)^2) = 463$ 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.

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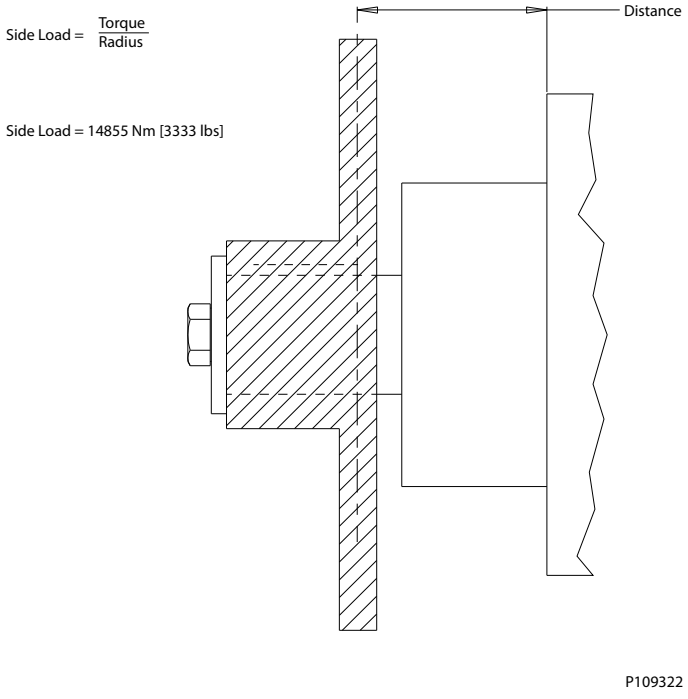
To determine the side load, the motor torque and pulley or sprocket radius must be known. Side load may be calculated using the formula below. The distance from the pulley/sprocket centerline to the mounting flange of the motor must also be determined. These two figures may then be compared to the bearing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

## Technical Information




## Hydraulic Equations

| Multiplication Factor | Abbreviation | 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 |

| | |
|---|---|
| **Theo. Speed (RPM)** | (1000 x LPM) / Displacement ($cm^3$/rev) |
| | (231 x GPM) / Displacement ($in^3$/rev) |
| **Theo. Torque (lb-in)** | (Bar x Disp. ($cm^3$/rev)) / 20 pi |
| | (PSI x Disp. ($in^3$/rev) / 6.28 |
| **Power In (HP)** | (Bar x LPM) / 600 |
| | (PSI x GPM) / 1714 |
| **Power Out (HP)** | (Torque (Nm) x RPM) / 9543 |
| | (Torque (lb-in) x RPM) / 63024 |

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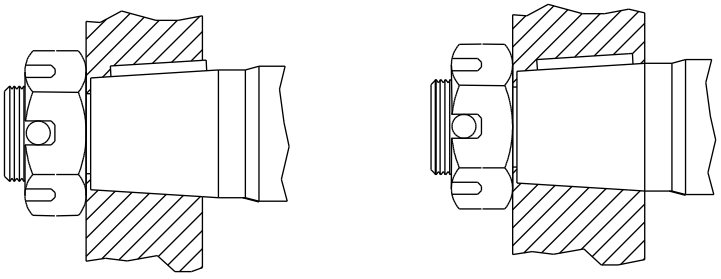
### Shaft Nut Information

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.

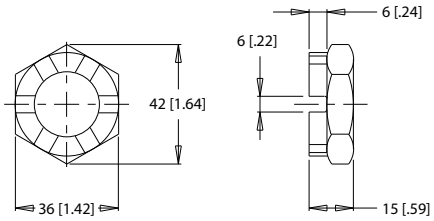
*Hub engagement*



## Technical Information

35MM TAPERED SHAFTS
M24 x 1.5 Thread

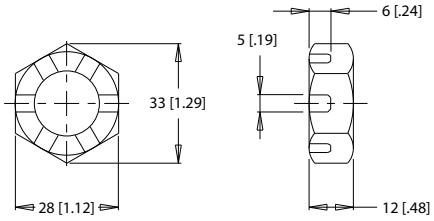
A Slotted Nut




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

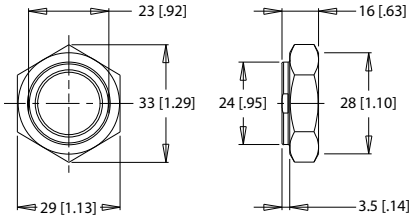
1" TAPERED SHAFTS
3/4-28 Thread

A Slotted Nut



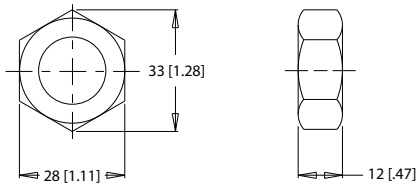

Torque Specifications: 20 - 23 daNm [150 - 170 ft.lb.]

B Lock Nut




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

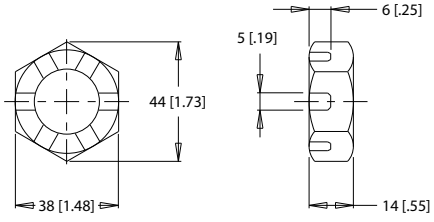
C Solid Nut




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

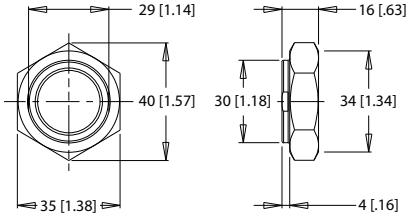
1-1/4" TAPERED SHAFTS
1-20 Thread

A Slotted Nut



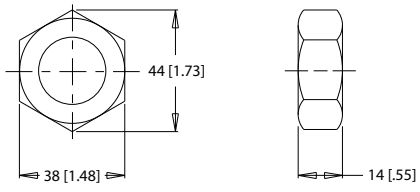

Torque Specifications: 38 daNm [280 ft.lb.] Max.

B Lock Nut




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

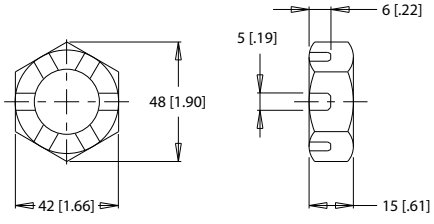
C Solid Nut




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

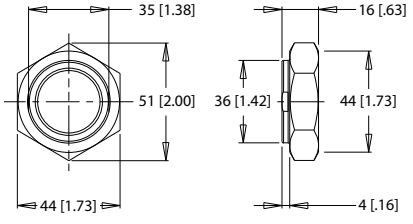
1-3/8" & 1-1/2" TAPERED SHAFTS
1 1/8-18 Thread

A Slotted Nut



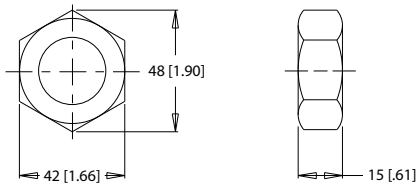

Torque Specifications: 41 - 54 daNm [300 - 400 ft.lb.]

B Lock Nut




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

C Solid Nut




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

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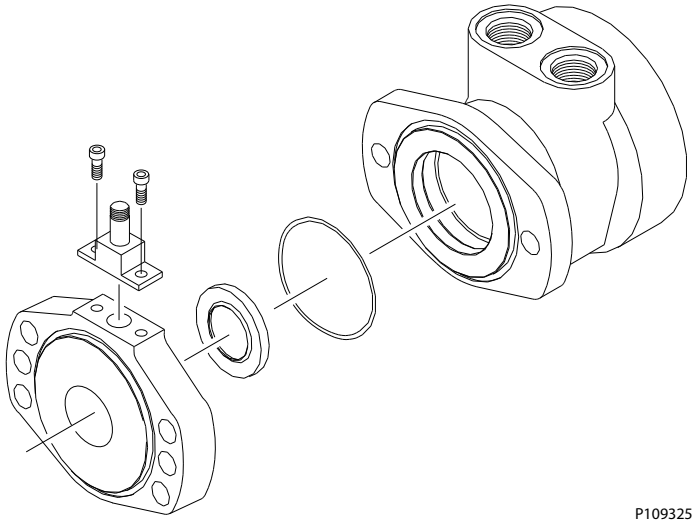
## Optional Motor Features

### Speed Sensor Options

Danfoss 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 Danfoss 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.



P109325

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 oring 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.

## Optional Motor Features

- Acetal resin flange is resistant to moisture, chemicals, oils, solvents and greases.
- Self-centering design eliminates need to set magnetto-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. Includes a 610 mm [2 ft] cable.
- 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. Includes a 610 mm [2 ft] cable.

### Single Element Sensor - Y & Z

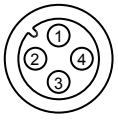
| | |
|---|---|
| Supply voltages | 7.5-24 Vdc |
| Maximum output off voltage | 24 V |
| Maximum continuous output current | < 25 ma |
| Signal levels (low, high) | 0.8 to supply voltage |
| Operating Temp | -30°C to 83°C [-22°F to 181°F] |

### 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*

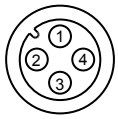



P109326

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

## Optional Motor Features

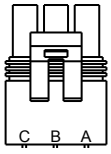
*X Option*



P109327

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

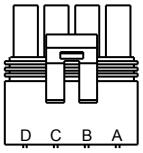
*Y Option*



P109328

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

*W Option*



P109329

| | | |
|---|---|---|
| Pin A | positive | brown or red |
| Pin B | negative | blue |
| Pin C | pulse out | black |
| Pin 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:

## Optional Motor Features

- 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 Danfoss 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.

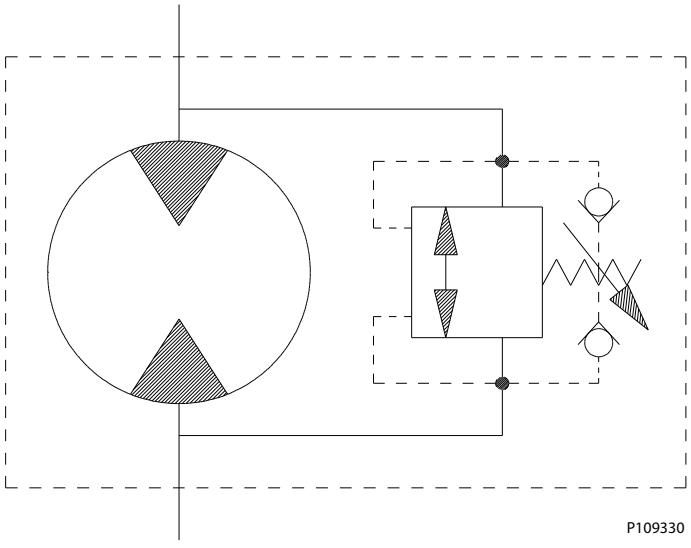
### Freeturning Rotor Option

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 Option

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.

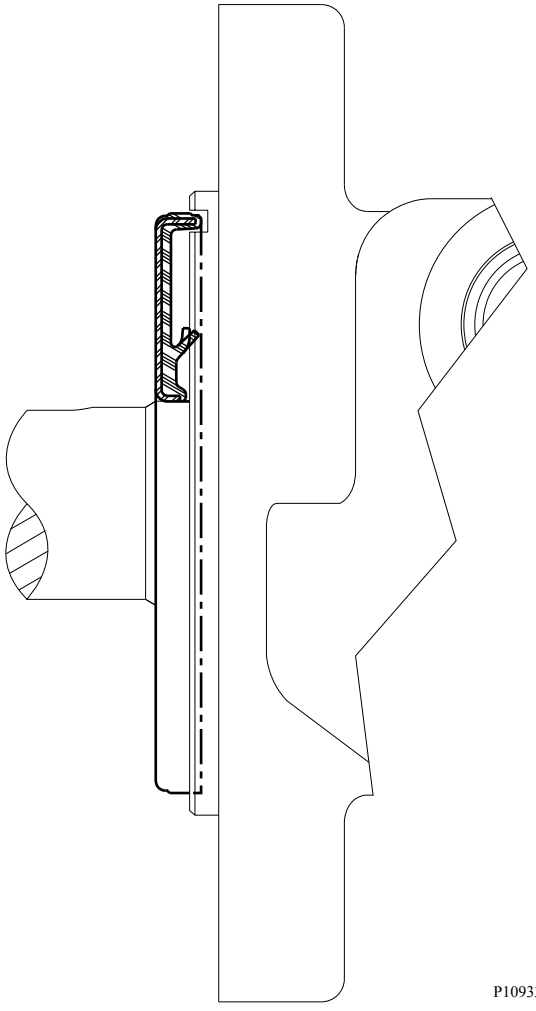


## Optional Motor Features

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 Danfoss distributor.

### Slinger Seal Option

Slinger seals are available on select series offered by Danfoss. 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 Danfoss 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 Danfoss Customer Service Representative for additional information.

## WD Product Line

### WD Introduction

#### Overview

The WD motor series is an economical solution for light duty applications requiring high torque. It has a smaller outline yet still provides high efficiency across a wide performance range. Its integral check valves and a provision for a case drain reduce pressure on internal seals to improve product life. The compact package is 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

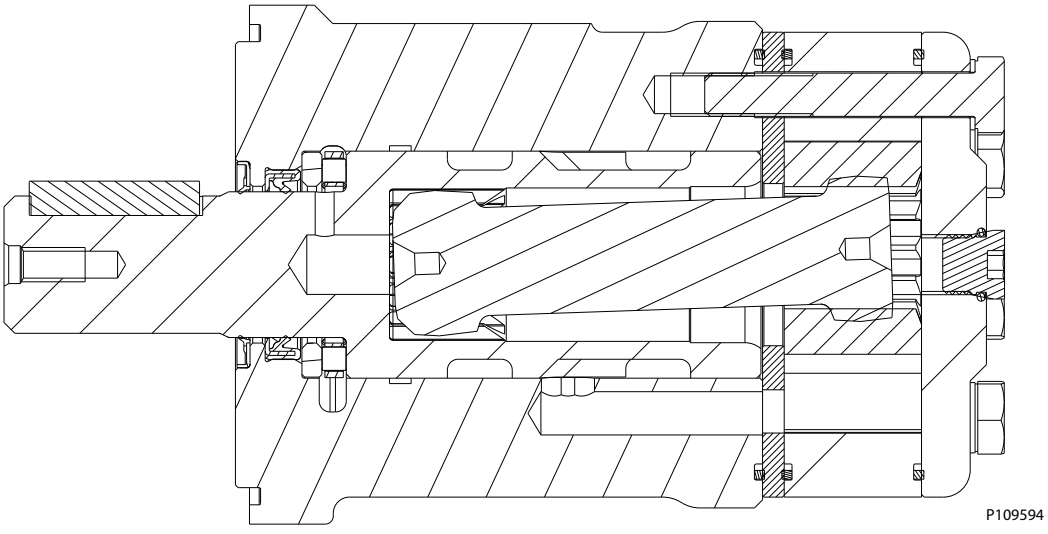
- Built-in check valves offer versatility and increased seal life.
- A variety of mounts and shafts provide flexibility in application design.
- Spool valve design gives superior performance and smooth operation over a wide speed and torque range.
- Integral rotor design provides smooth performance, compact volume and low weight.
- Low port profiling is suitable for applications with limited space.

#### Typical Applications

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

#### Series Descriptions

*145/146 - Hydraulic Motor (standard)*




#### Specifications

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.

## WD Product Line

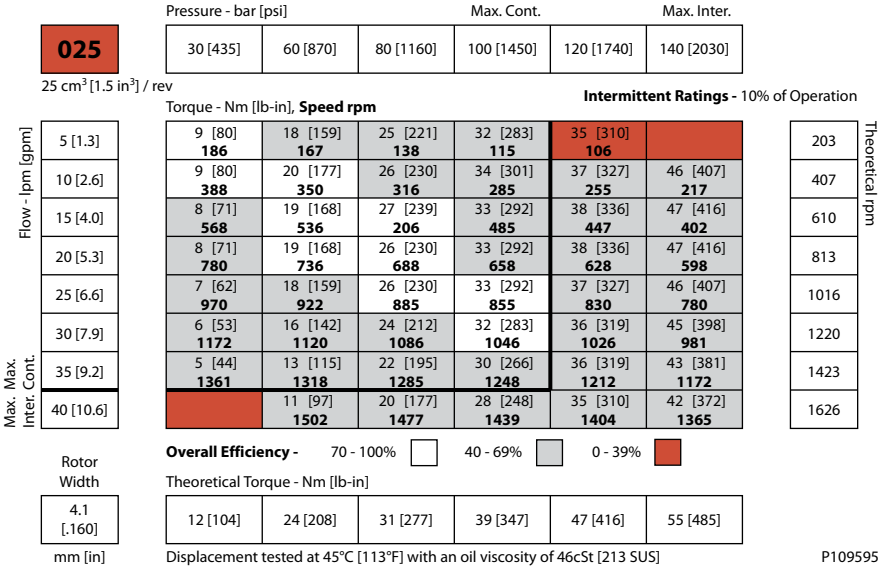
*Specifications*

| CODE | Displacement cm³ [in³] | 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 | 24.6 [1.5] | 1361 | 1502 | 35 [9] | 40 [11] | 34 [301] | 47 [416] | 100 [1450] | 140 [2030] | 225 [3260] |
| 032 | 30.8 [1.9] | 1244 | 1388 | 40 [11] | 45 [12] | 42 [372] | 57 [505] | 100 [1450] | 140 [2030] | 225 [3260] |
| 040 | 39.7 [2.4] | 1124 | 1312 | 45 [12] | 53 [14] | 66 [584] | 79 [699] | 124 [1800] | 155 [2250] | 225 [3260] |
| 050 | 48.2 [2.9] | 900 | 1012 | 45 [12] | 53 [14] | 91 [805] | 114 [1009] | 138 [2000] | 173 [2500] | 225 [3260] |
| 060 | 59.4 [3.6] | 880 | 970 | 53 [14] | 60 [16] | 110 [974] | 136 [1204] | 138 [2000] | 173 [2500] | 225 [3260] |
| 080 | 79.6 [4.9] | 752 | 934 | 60 [16] | 75 [20] | 141 [1248] | 175 [1549] | 138 [2000] | 173 [2500] | 225 [3260] |
| 100 | 96.0 [5.9] | 628 | 786 | 60 [16] | 75 [20] | 170 [1505] | 220 [1947] | 138 [2000] | 173 [2500] | 225 [3260] |
| 125 | 122.8 [7.5] | 483 | 604 | 60 [16] | 75 [20] | 225 [1991] | 274 [2425] | 138 [2000] | 173 [2500] | 225 [3260] |
| 160 | 158.0 [9.6] | 383 | 479 | 60 [16] | 75 [20] | 284 [2513] | 345 [3054] | 138 [2000] | 173 [2500] | 225 [3260] |
| 200 | 196.5 [12.0] | 308 | 384 | 60 [16] | 75 [20] | 312 [2761] | 411 [3638] | 124 [1800] | 166 [2400] | 225 [3260] |
| 250 | 240.5 [14.7] | 248 | 312 | 60 [16] | 75 [20] | 317 [2806] | 450 [3983] | 103 [1500] | 155 [2250] | 225 [3260] |
| 315 | 303.2 [18.5] | 199 | 250 | 60 [16] | 75 [20] | 396 [3505] | 576 [5098] | 103 [1500] | 155 [2250] | 200 [2900] |
| 400 | 385.8 [23.5] | 150 | 189 | 60 [16] | 75 [20] | 480 [4248] | 582 [5151] | 97 [1400] | 121 [1750] | 180 [2610] |

## WD Functional Charts

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 *Product Testing* on page 7.

*025 Displacement Performance*



## WD Product Line

### *032cc Displacement Performance*

**032**

31 cm³ [1.9 in³] / rev

| Flow - lpm [gpm] | Pressure - bar [psi] 30 [435] | 60 [870] | 80 [1160] | 100 [1450] Max. Cont. | 120 [1740] | 140 [2030] Max. Inter. | Theoretical rpm |
|---|---|---|---|---|---|---|---|
| | Torque - Nm [lb-in], **Speed rpm** | | | | | **Intermittent Ratings -** 10% of Operation | |
| 5 [1.3] | 12 [106] **150** | 24 [212] **133** | 32 [283] **100** | 40 [354] **68** | | | 162 |
| 10 [2.6] | 12 [106] **300** | 25 [221] **276** | 33 [292] **253** | 42 [372] **236** | 48 [425] **203** | 55 [487] **186** | 325 |
| 15 [4.0] | 11 [97] **460** | 24 [212] **433** | 33 [292] **415** | 42 [372] **398** | 49 [434] **375** | 57 [504] **346** | 487 |
| 20 [5.3] | 9 [80] **616** | 24 [212] **586** | 32 [283] **566** | 41 [363] **543** | 49 [434] **520** | 56 [496] **500** | 649 |
| 25 [6.6] | 8 [71] **780** | 23 [204] **754** | 32 [283] **736** | 40 [354] **712** | 48 [425] **688** | 56 [496] **658** | 812 |
| 30 [7.9] | 7 [62] **928** | 22 [195] **910** | 31 [274] **882** | 40 [354] **860** | 47 [416] **824** | 56 [496] **806** | 974 |
| 35 [9.2] | 7 [62] **1090** | 21 [186] **1077** | 31 [274] **1057** | 38 [336] **1035** | 46 [407] **1008** | 55 [487] **980** | 1136 |
| Max. Inter. 40 [10.6] | 6 [53] **1244** | 19 [168] **1214** | 29 [257] **1198** | 37 [327] **1177** | 46 [407] **1155** | 54 [478] **1130** | 1299 |
| Max. Cont. 45 [11.9] | | 17 [150] **1388** | 28 [248] **1362** | 37 [327] **1342** | 45 [398] **1326** | 54 [478] **1300** | 1461 |

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | |
|---|---|---|---|---|---|---|
| 5.1 [.200] | 15 [130] | 29 [260] | 39 [347] | 49 [434] | 59 [521] | 69 [608] |

mm [in]

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

P109596

### *040cc Displacement Performance*

**040**

40 cm³ [2.4 in³] / rev

| Flow - lpm [gpm] | Pressure - bar [psi] 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] Max. Cont. | 155 [2250] Max. Inter. | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|
| | Torque - Nm [lb-in], **Speed rpm** | | | | | | **Intermittent Ratings -** 10% of Operation | |
| 8 [2] | 10 [89] **182** | 20 [177] **169** | 29 [257] **128** | 40 [354] **90** | | | | 191 |
| 15 [4] | 11 [97] **362** | 21 [186] **344** | 31 [274] **334** | 43 [381] **320** | 54 [478] **304** | 65 [575] **284** | 78 [690] **254** | 380 |
| 23 [6] | 10 [89] **548** | 20 [177] **535** | 32 [283] **519** | 42 [372] **502** | 53 [469] **488** | 66 [584] **468** | 79 [699] **428** | 572 |
| 30 [8] | 7 [62] **738** | 19 [168] **729** | 31 [274] **706** | 41 [363] **688** | 52 [460] **670** | 64 [566] **648** | 78 [690] **614** | 763 |
| 38 [10] | 6 [53] **932** | 16 [142] **914** | 30 [266] **896** | 40 [354] **878** | 51 [451] **856** | 62 [549] **834** | 77 [681] **798** | 955 |
| Max. Inter. 45 [12] | 3 [27] **1124** | 14 [124] **1102** | 28 [248] **1084** | 38 [336] **1062** | 49 [434] **1043** | 60 [531] **1014** | 76 [673] **976** | 1144 |
| Max. Cont. 53 [14] | | 14 [124] **1312** | 25 [221] **1290** | 38 [336] **1266** | 48 [425] **1242** | 60 [531] **1218** | 76 [673] **1168** | 1335 |

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | |
|---|---|---|---|---|---|---|---|
| 6.6 [.260] | 13 [117] | 26 [229] | 39 [347] | 52 [464] | 65 [576] | 78 [694] | 98 [867] |

mm [in]

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

P109597

## WD Product Line

### *050cc Displacement Performance*

**050**

48 cm³ [2.9 in³] / rev

Pressure - bar [psi]

| 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] Max. Cont. | 138 [2000] | 173 [2500] Max. Inter. |
|---|---|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|
| 8 [2] | 14 [124] **148** | 26 [230] **143** | 40 [354] **130** | 55 [354] **116** | 65 [575] **102** | 82 [726] **86** | 88 [779] **75** | | 158 |
| 15 [4] | 14 [124] **298** | 27 [239] **289** | 42 [372] **276** | 56 [381] **260** | 67 [593] **245** | 83 [735] **229** | 89 [788] **214** | 114 [1009] **166** | 313 |
| 23 [6] | 12 [106] **450** | 24 [212] **438** | 41 [363] **423** | 54 [372] **406** | 68 [602] **388** | 84 [743] **374** | 91 [805] **352** | 112 [991] **314** | 471 |
| 30 [8] | 9 [80] **602** | 21 [186] **590** | 38 [336] **580** | 52 [363] **555** | 65 [575] **540** | 81 [717] **523** | 88 [779] **508** | 110 [974] **475** | 629 |
| 38 [10] | 2 [18] **750** | 19 [168] **732** | 37 [327] **722** | 51 [354] **713** | 63 [558] **693** | 77 [681] **681** | 85 [752] **669** | 107 [947] **635** | 786 |
| 45 [12] | | 17 [150] **900** | 33 [292] **885** | 46 [336] **875** | 60 [531] **860** | 73 [646] **848** | 83 [735] **830** | 105 [929] **794** | 942 |
| Max. Inter. Cont. 53 [14] | | | 28 [248] **1012** | 42 [336] **1000** | 58 [513] **986** | 70 [620] **972** | 80 [708] **960** | 100 [885] **924** | 1100 |

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6.6 [.260] | 16 [143] | 31 [278] | 48 [422] | 64 [564] | 79 [700] | 95 [842] | 106 [937] | 133 [1175] |

mm [in]

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

P109598

### *060cc Displacement Performance*

**060**

59 cm³ [3.6 in³] / rev

Pressure - bar [psi]

| 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] Max. Cont. | 138 [2000] | 173 [2500] Max. Inter. |
|---|---|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|
| 8 [2] | 17 [150] **122** | 30 [266] **119** | 46 [407] **113** | 63 [558] **107** | 82 [726] **94** | 99 [876] **77** | 109 [965] **65** | | 128 |
| 15 [4] | 16 [142] **247** | 32 [283] **243** | 48 [425] **236** | 65 [575] **223** | 82 [726] **209** | 102 [903] **192** | 110 [974] **180** | 136 [1204] **142** | 254 |
| 23 [6] | 15 [133] **371** | 29 [257] **367** | 47 [416] **360** | 66 [584] **347** | 81 [717] **330** | 99 [876] **315** | 107 [947] **304** | 135 [1195] **266** | 382 |
| 30 [8] | 12 [106] **496** | 26 [230] **492** | 44 [389] **484** | 62 [549] **470** | 79 [699] **457** | 96 [850] **436** | 105 [929] **425** | 130 [1151] **386** | 510 |
| 38 [10] | 8 [71] **626** | 23 [204] **618** | 40 [354] **608** | 60 [531] **596** | 77 [681] **582** | 94 [832] **567** | 104 [920] **558** | 128 [1133] **500** | 638 |
| 45 [12] | 2 [18] **752** | 20 [177] **744** | 37 [327] **735** | 58 [513] **727** | 75 [664] **716** | 91 [805] **696** | 100 [885] **680** | 127 [1124] **628** | 764 |
| Max. Inter. Cont. 53 [14] | | 15 [133] **880** | 31 [274] **870** | 48 [425] **862** | 71 [628] **847** | 87 [770] **830** | 97 [858] **800** | 121 [1071] **740** | 892 |
| 61 [16] | | 8 [71] **970** | 27 [239] **958** | 45 [398] **944** | 64 [566] **932** | 82 [726] **924** | 93 [823] **902** | 117 [1035] **842** | 1020 |

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 8.0 [.314] | 20 [176] | 39 [343] | 59 [520] | 79 [695] | 97 [862] | 117 [1038] | 131 [1155] | 164 [1448] |

mm [in]

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

P109599

## WD Product Line

### *080cc Displacement Performance*

| 080 | Pressure - bar [psi] | | | | | Max. Cont. | | Max. Inter. | |
|---|---|---|---|---|---|---|---|---|---|
| | 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] | |
| 80 cm³ [4.9 in³] / rev | Torque - Nm [lb-in], **Speed rpm** | | | | | | **Intermittent Ratings -** 10% of Operation | | |
| Flow - lpm [gpm] 8 [2] | 22 [195] **90** | 42 [372] **85** | 61 [540] **78** | 82 [726] **70** | 102 [903] **62** | 124 [1097] **52** | 138 [1221] **42** | | 95 |
| 15 [4] | 20 [177] **187** | 43 [381] **182** | 62 [549] **176** | 84 [743] **167** | 107 [947] **154** | 128 [1133] **143** | 141 [1248] **136** | 171 [1513] **112** | 190 |
| 23 [6] | 19 [168] **286** | 41 [363] **276** | 63 [558] **268** | 83 [735] **257** | 104 [920] **248** | 125 [1106] **237** | 139 [1230] **227** | 175 [1549] **202** | 285 |
| 30 [8] | 13 [115] **378** | 38 [336] **372** | 61 [540] **364** | 82 [726] **354** | 102 [903] **342** | 124 [1097] **334** | 137 [1212] **324** | 174 [1540] **297** | 381 |
| 38 [10] | 8 [71] **474** | 35 [310] **469** | 58 [513] **460** | 80 [708] **448** | 101 [894] **440** | 123 [1089] **430** | 135 [1195] **416** | 165 [1460] **370** | 476 |
| 45 [12] | 2 [18] **564** | 29 [257] **558** | 55 [487] **550** | 75 [664] **540** | 100 [885] **530** | 121 [1071] **519** | 133 [1177] **504** | 163 [1443] **472** | 570 |
| 53 [14] | | 26 [230] **662** | 48 [425] **658** | 70 [620] **648** | 96 [850] **637** | 115 [1018] **633** | 130 [1151] **609** | 161 [1425] **576** | 666 |
| Max. Max. Inter. Cont. 61 [16] | | 20 [177] **752** | 44 [389] **734** | 68 [602] **724** | 85 [752] **716** | 105 [929] **700** | 123 [1089] **690** | 154 [1363] **663** | 761 |
| 76 [20] | | 11 [97] **934** | 32 [283] **929** | 54 [478] **914** | 74 [655] **904** | 94 [832] **890** | 108 [956] **876** | 148 [1310] **814** | 951 |

Theoretical rpm

**Overall Efficiency -** 70 - 100% □ 40 - 69% ▒ 0 - 39% ■

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10.4 [.410] | 27 [236] | 52 [460] | 79 [697] | 105 [931] | 131 [1155] | 157 [1391] | 175 [1548] | 219 [1941] |

mm [in] Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS] P109600

### *100cc Displacement Performance*

| 100 | Pressure - bar [psi] | | | | | Max. Cont. | | Max. Inter. | |
|---|---|---|---|---|---|---|---|---|---|
| | 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] | |
| 96 cm³ [5.9 in³] / rev | Torque - Nm [lb-in], **Speed rpm** | | | | | | **Intermittent Ratings -** 10% of Operation | | |
| Flow - lpm [gpm] 8 [2] | 28 [248] **76** | 57 [504] **71** | 82 [726] **65** | 108 [956] **54** | 132 [1168] **45** | 158 [1398] **33** | | | 79 |
| 15 [4] | 25 [221] **154** | 56 [496] **147** | 80 [708] **140** | 106 [938] **132** | 130 [1151] **122** | 155 [1372] **113** | 165 [1460] **104** | 205 [1814] **84** | 157 |
| 23 [6] | 23 [204] **235** | 50 [443] **226** | 76 [673] **219** | 104 [920] **212** | 128 [1133] **203** | 153 [1354] **193** | 170 [1505] **185** | 212 [1876] **162** | 236 |
| 30 [8] | 19 [168] **313** | 47 [416] **307** | 74 [655] **299** | 104 [894] **291** | 125 [1106] **281** | 152 [1345] **270** | 167 [1478] **264** | 220 [1947] **240** | 316 |
| 38 [10] | 15 [133] **392** | 43 [381] **389** | 71 [628] **384** | 97 [858] **375** | 122 [1080] **364** | 149 [1319] **353** | 167 [1478] **346** | 218 [1929] **314** | 395 |
| 45 [12] | 11 [97] **470** | 37 [327] **465** | 70 [620] **458** | 94 [832] **449** | 120 [1062] **437** | 147 [1301] **429** | 162 [1434] **426** | 210 [1859] **398** | 473 |
| 53 [14] | | 33 [292] **550** | 60 [531] **545** | 87 [770] **532** | 118 [1044] **518** | 143 [1266] **510** | 160 [1416] **500** | 207 [1832] **473** | 552 |
| Max. Max. Inter. Cont. 61 [16] | | 27 [239] **628** | 55 [487] **622** | 82 [726] **611** | 114 [1009] **598** | 139 [1230] **584** | 150 [1328] **575** | 196 [1732] **552** | 631 |
| 76 [20] | | | 37 [327] **786** | 67 [593] **770** | 93 [823] **758** | 123 [1089] **732** | 138 [1221] **716** | 190 [1682] **670** | 789 |

Theoretical rpm

**Overall Efficiency -** 70 - 100% □ 40 - 69% ▒ 0 - 39% ■

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 13.0 [.510] | 32 [284] | 63 [555] | 95 [840] | 127 [1123] | 157 [1393] | 190 [1678] | 211 [1867] | 264 [2340] |

mm [in] Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS] P109601

## WD Product Line

### *125cc Displacement Performance*

**125**

123 cm³ [7.5 in³] / rev

Pressure - bar [psi]

| 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] |
|---|---|---|---|---|---|---|---|
| | | | | | Max. Cont. | | Max. Inter. |

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|
| 8 [2] | 31 [274] **60** | 64 [566] **57** | 102 [903] **54** | 136 [1204] **48** | 161 [1425] **44** | 193 [1708] **38** | 220 [1947] **34** | | 62 |
| 15 [4] | 30 [266] **120** | 63 [558] **118** | 101 [894] **115** | 138 [1221] **109** | 168 [1487] **102** | 201 [1779] **94** | 225 [1991] **87** | 274 [2425] **61** | 123 |
| 23 [6] | 30 [266] **183** | 62 [549] **179** | 99 [876] **175** | 137 [1212] **170** | 167 [1478] **165** | 202 [1788] **155** | 223 [1974] **148** | 272 [2407] **126** | 185 |
| 30 [8] | 28 [248] **242** | 59 [522] **240** | 96 [850] **237** | 134 [1186] **233** | 165 [1460] **228** | 199 [1761] **219** | 220 [1947] **205** | 269 [2381] **174** | 247 |
| 38 [10] | 22 [195] **301** | 54 [478] **299** | 93 [823] **295** | 130 [1151] **289** | 161 [1425] **282** | 191 [1690] **275** | 215 [1903] **265** | 263 [2328] **244** | 309 |
| 45 [12] | 15 [133] **362** | 48 [425] **360** | 86 [761] **356** | 124 [1097] **351** | 156 [1381] **345** | 184 [1628] **340** | 209 [1850] **329** | 257 [2274] **301** | 370 |
| 53 [14] | 9 [80] **424** | 41 [363] **422** | 80 [708] **419** | 117 [1035] **415** | 149 [1319] **410** | 176 [1558] **386** | 204 [1805] **376** | 243 [2151] **342** | 432 |
| Max. Inter. Cont. 61 [16] | 2 [18] **483** | 32 [283] **477** | 70 [620] **470** | 104 [920] **463** | 136 [1204] **454** | 165 [1460] **444** | 194 [1717] **437** | 233 [2062] **412** | 493 |
| 76 [20] | | 15 [133] **604** | 48 [425] **595** | 82 [726] **584** | 122 [1080] **573** | 153 [1354] **565** | 178 [1575] **556** | 224 [1982] **526** | 616 |

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

Rotor Width

16.8 [.660] mm [in]

Theoretical Torque - Nm [lb-in]

| 41 [363] | 80 [710] | 121 [1075] | 162 [1436] | 201 [1782] | 242 [2146] | 270 [2388] | 338 [2994] |
|---|---|---|---|---|---|---|---|

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

P109602

### *160cc Displacement Performance*

**160**

158 cm³ [9.6 in³] / rev

Pressure - bar [psi]

| 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] |
|---|---|---|---|---|---|---|---|
| | | | | | Max. Cont. | | Max. Inter. |

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 138 [2000] | 173 [2500] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|
| 8 [2] | 42 [372] **47** | 88 [779] **45** | 120 [1062] **42** | 168 [1487] **36** | 210 [1859] **28** | 246 [2177] **20** | | | 48 |
| 15 [4] | 39 [345] **94** | 85 [752] **92** | 125 [1106] **89** | 170 [1505] **85** | 211 [1867] **79** | 251 [2221] **72** | 284 [2513] **64** | 345 [3053] **35** | 96 |
| 23 [6] | 38 [336] **143** | 79 [699] **140** | 123 [1089] **136** | 168 [1487] **130** | 209 [1850] **124** | 248 [2195] **116** | 275 [2434] **107** | 351 [3106] **84** | 144 |
| 30 [8] | 33 [292] **191** | 74 [655] **188** | 118 [1044] **184** | 164 [1451] **178** | 207 [1832] **171** | 245 [2168] **162** | 270 [2390] **154** | 338 [2991] **134** | 192 |
| 38 [10] | 25 [221] **238** | 68 [602] **236** | 113 [1000] **233** | 159 [1407] **229** | 199 [1761] **224** | 241 [2133] **218** | 262 [2319] **205** | 326 [2885] **183** | 240 |
| 45 [12] | 14 [124] **287** | 59 [522] **285** | 105 [929] **283** | 150 [1328] **281** | 192 [1699] **276** | 233 [2062] **270** | 253 [2239] **261** | 307 [2717] **235** | 287 |
| 53 [14] | 5 [44] **335** | 50 [443] **334** | 92 [814] **332** | 140 [1239] **329** | 188 [1664] **324** | 217 [1920] **319** | 242 [2142] **311** | 298 [2637] **281** | 335 |
| Max. Inter. Cont. 61 [16] | | 35 [310] **383** | 75 [664] **382** | 120 [1062] **378** | 160 [1416] **372** | 205 [1814] **363** | 233 [2062] **358** | 289 [2558] **333** | 384 |
| 76 [20] | | 12 [106] **479** | 55 [487] **478** | 92 [814] **475** | 135 [1195] **469** | 183 [1620] **460** | 204 [1805] **455** | 276 [2443] **434** | 479 |

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

Rotor Width

20.8 [.820] mm [in]

Theoretical Torque - Nm [lb-in]

| 53 [468] | 103 [913] | 156 [1380] | 209 [1848] | 259 [2293] | 312 [2761] | 347 [3073] | 435 [3852] |
|---|---|---|---|---|---|---|---|

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

P109603

## WD Product Line

### *200cc Displacement Performance*

**200**

197 cm³ [12.0 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 103 [1500] | 124 [1800] | 166 [2400] |
|---|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | | | | | | | | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|
| 8 [2] | 52 [460] **38** | 109 [965] **35** | 164 [1451] **30** | 218 [1929] **23** | | | | 39 |
| 15 [4] | 50 [443] **76** | 112 [991] **74** | 167 [1478] **70** | 220 [1947] **64** | 270 [2390] **56** | 310 [2744] **48** | | 77 |
| 23 [6] | 48 [425] **115** | 110 [974] **113** | 165 [1460] **110** | 218 [1929] **105** | 274 [2425] **98** | 312 [2761] **92** | 411 [3637] **62** | 116 |
| 30 [8] | 46 [407] **153** | 102 [903] **150** | 159 [1407] **146** | 216 [1912] **138** | 268 [2372] **132** | 303 [2682] **120** | 406 [3593] **86** | 154 |
| 38 [10] | 36 [319] **192** | 92 [814] **190** | 151 [1336] **186** | 206 [1823] **181** | 258 [2283] **174** | 290 [2567] **163** | 398 [3522] **133** | 193 |
| 45 [12] | 22 [195] **230** | 80 [708] **226** | 142 [1257] **223** | 193 [1708] **218** | 236 [2089] **210** | 282 [2496] **200** | 386 [3416] **167** | 231 |
| 53 [14] | 5 [44] **268** | 70 [620] **266** | 130 [1151] **262** | 176 [1558] **258** | 215 [1903] **250** | 272 [2407] **240** | 374 [3310] **209** | 270 |
| 61 [16] (Max. Inter. / Max. Cont.) | | 58 [513] **308** | 118 [1044] **305** | 156 [1381] **299** | 198 [1752] **292** | 253 [2239] **284** | 360 [3186] **256** | 308 |
| 76 [20] | | 42 [372] **384** | 88 [779] **381** | 124 [1097] **376** | 173 [1531] **372** | 220 [1947] **358** | 328 [2903] **330** | 385 |

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

Rotor Width mm [in]: 25.9 [1.020]

Theoretical Torque - Nm [lb-in]

| 66 [582] | 128 [1135] | 194 [1717] | 260 [2298] | 322 [2852] | 388 [3434] | 519 [4597] |
|---|---|---|---|---|---|---|

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

P109604

### *250cc Displacement Performance*

**250**

241 cm³ [14.7 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 21 [300] | 41 [600] | 62 [900] | 83 [1200] | 97 [1400] | 103 [1500] | 138 [2000] | 155 [2250] |
|---|---|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | | | | | | | | | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|
| 8 [2] | 58 [513] **31** | 118 [1044] **30** | 193 [1708] **28** | 259 [2292] **23** | 300 [2655] **19** | | | | 32 |
| 15 [4] | 61 [540] **62** | 122 [1080] **61** | 190 [1682] **58** | 254 [2248] **55** | 302 [2673] **51** | 317 [2805] **47** | 414 [2513] **38** | 450 [3983] **27** | 63 |
| 23 [6] | 58 [513] **94** | 116 [1027] **93** | 185 [1637] **92** | 250 [2213] **87** | 295 [2611] **83** | 308 [2726] **81** | 412 [2434] **67** | 446 [3947] **57** | 94 |
| 30 [8] | 51 [451] **125** | 112 [991] **124** | 178 [1575] **121** | 245 [2168] **117** | 290 [2567] **113** | 304 [2690] **110** | 406 [2390] **97** | 439 [3885] **88** | 126 |
| 38 [10] | 40 [354] **158** | 98 [867] **156** | 169 [1496] **155** | 236 [2089] **151** | 284 [2513] **147** | 298 [2637] **145** | 390 [2319] **136** | 429 [3797] **121** | 158 |
| 45 [12] | 29 [257] **188** | 83 [735] **187** | 156 [1381] **186** | 230 [2036] **184** | 277 [2451] **180** | 282 [2496] **176** | 372 [2239] **164** | 414 [3664] **150** | 189 |
| 53 [14] | 22 [195] **220** | 67 [593] **219** | 138 [1221] **217** | 214 [1894] **214** | 262 [2319] **211** | 260 [2301] **209** | 355 [2142] **194** | 395 [3496] **181** | 220 |
| 61 [16] (Max. Inter. / Max. Cont.) | | 52 [460] **248** | 123 [1089] **244** | 190 [1682] **241** | 233 [2062] **237** | 244 [2159] **235** | 335 [2062] **223** | 376 [3328] **210** | 252 |
| 76 [20] | | 24 [212] **312** | 84 [743] **309** | 165 [1460] **305** | 202 [1788] **302** | 208 [1841] **300** | 298 [1805] **285** | 335 [2965] **268** | 315 |

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

Rotor Width mm [in]: 32.5 [1.280]

Theoretical Torque - Nm [lb-in]

| 80 [712] | 157 [1390] | 237 [2101] | 318 [2813] | 371 [3288] | 394 [3491] | 528 [4677] | 594 [5253] |
|---|---|---|---|---|---|---|---|

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

P109605

## WD Product Line

### *315cc Displacement Performance*

**315**

303 cm³ [18.5 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 21 [300] | 41 [600] | 62 [900] | 90 [1300] | 103 [1500] | 138 [2000] | 155 [2250] |
|---|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | | | | | | | | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|
| | 8 [2] | 88 [779] **25** | 174 [1540] **22** | 255 [2257] **20** | | | | 25 |
| | 15 [4] | 89 [788] **49** | 170 [1505] **47** | 263 [2328] **43** | 352 [3115] **35** | 396 [3505] **30** | | 50 |
| | 23 [6] | 78 [690] **74** | 162 [1434] **72** | 246 [2177] **69** | 345 [3053] **59** | 392 [3469] **54** | 532 [4708] **33** | 576 [5098] **22** | 75 |
| | 30 [8] | 60 [531] **101** | 151 [1336] **98** | 240 [2124] **95** | 339 [3000] **90** | 386 [3416] **84** | 526 [4655] **65** | 566 [5009] **53** | 100 |
| | 38 [10] | 60 [531] **125** | 142 [1257] **123** | 230 [2036] **121** | 335 [2965] **115** | 380 [3363] **112** | 514 [4549] **90** | 558 [4938] **80** | 125 |
| | 45 [12] | 37 [327] **147** | 128 [1133] **146** | 220 [1947] **143** | 325 [2876] **139** | 370 [3275] **132** | 500 [4425] **118** | 536 [4744] **105** | 150 |
| | 53 [14] | 15 [133] **175** | 108 [956] **174** | 208 [1841] **171** | 318 [2814] **166** | 355 [3142] **160** | 486 [4301] **138** | 516 [4567] **127** | 175 |
| Max. Inter. Cont. | 61 [16] | | 88 [779] **199** | 196 [1735] **197** | 300 [2655] **187** | 340 [3009] **182** | 465 [4115] **166** | 494 [4372] **152** | 200 |
| Max. | 76 [20] | | 60 [531] **250** | 180 [1593] **246** | 280 [2478] **240** | 326 [2885] **236** | 442 [3912] **217** | 468 [4142] **206** | 250 |

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

Rotor Width: 40.9 [1.610] mm [in]

Theoretical Torque - Nm [lb-in]

| 101 [897] | 198 [1752] | 299 [2649] | 435 [3846] | 497 [4401] | 666 [5896] | 748 [6623] |
|---|---|---|---|---|---|---|

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

P109606

### *400cc Displacement Performance*

**400**

386 cm³ [23.5 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 21 [300] | 41 [600] | 69 [1000] | 83 [1200] | 97 [1400] | 121 [1750] |
|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | | | | | | | Theoretical rpm |
|---|---|---|---|---|---|---|---|
| | 8 [2] | 105 [929] **19** | 218 [1929] **18** | 360 [3186] **14** | 417 [3960] **11** | | | 20 |
| | 15 [4] | 99 [876] **39** | 207 [1832] **37** | 344 [3044] **33** | 411 [3637] **28** | 480 [4248] **25** | 582 [5151] **17** | 39 |
| | 23 [6] | 91 [805] **59** | 195 [1726] **57** | 336 [2974] **52** | 403 [3567] **43** | 478 [4260] **39** | 575 [5089] **32** | 59 |
| | 30 [8] | 72 [637] **77** | 186 [1646] **75** | 325 [2876] **73** | 398 [3522] **67** | 466 [4124] **60** | 569 [5036] **49** | 79 |
| | 38 [10] | 62 [549] **100** | 178 [1575] **97** | 314 [2779] **93** | 394 [3487] **89** | 458 [4053] **81** | 560 [4956] **70** | 98 |
| | 45 [12] | 51 [451] **120** | 164 [1451] **117** | 310 [2744] **113** | 378 [3345] **109** | 448 [3965] **97** | 550 [4868] **84** | 118 |
| | 53 [14] | 38 [336] **137** | 142 [1257] **134** | 284 [2513] **131** | 360 [3186] **129** | 429 [3797] **124** | 532 [4708] **113** | 137 |
| Max. Inter. Cont. | 61 [16] | 20 [177] **150** | 121 [1071] **154** | 260 [2301] **151** | 338 [2991] **148** | 410 [3629] **138** | 511 [4522] **130** | 157 |
| Max. | 76 [20] | | 98 [867] **189** | 234 [2071] **187** | 308 [2726] **185** | 384 [3398] **182** | 486 [4301] **178** | 196 |

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

Rotor Width: 52.1 [2.050] mm [in]

Theoretical Torque - Nm [lb-in]

| 129 [1142] | 252 [2229] | 424 [3751] | 510 [4513] | 596 [5274] | 743 [6579] |
|---|---|---|---|---|---|

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

P109607

## WD 145/146 Series

### 145/146 Series Housings

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

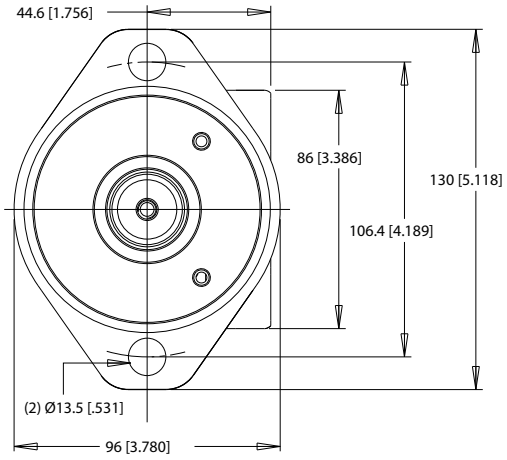
Dimensions are charted in *145/146 Series Technical Data* on page 30

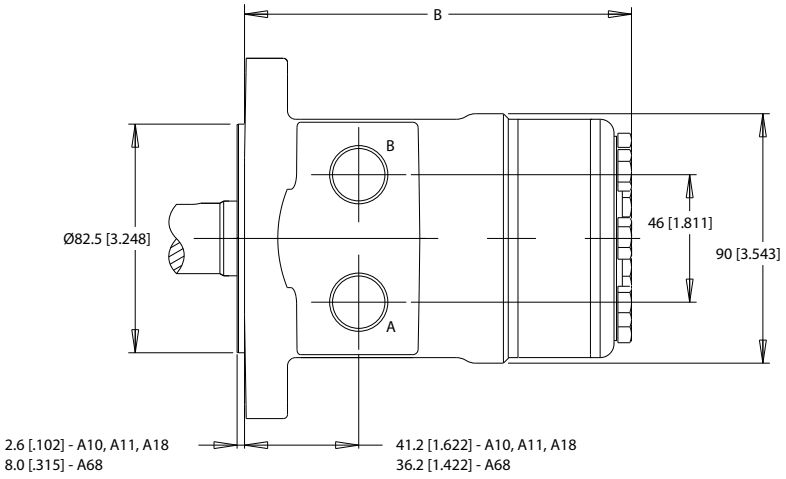
(TP) - Taller pilot height. Refer to detailed drawing for dimensional differences.

## WD Product Line

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

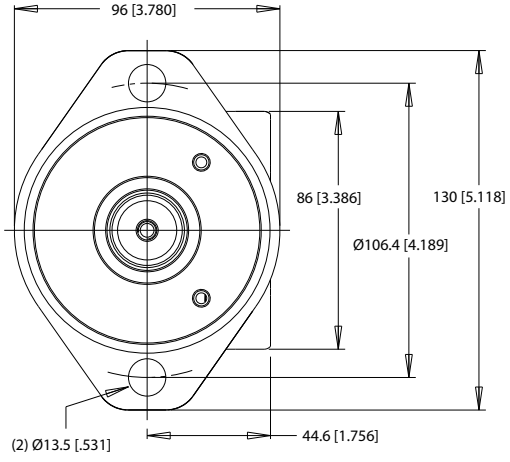
**A10** 1/2-14 NPT **A11** 7/8-14 UNF **A18** G 1/2 **A68** G 1/2 (TP)

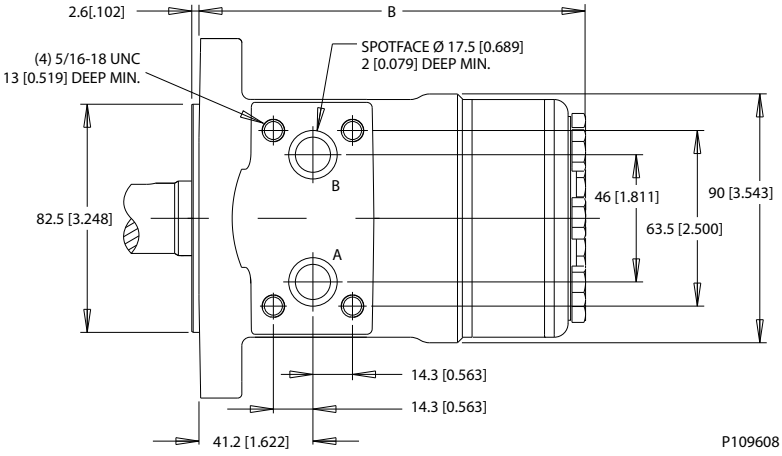



### 2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS

**A17** 1/2" Drilled

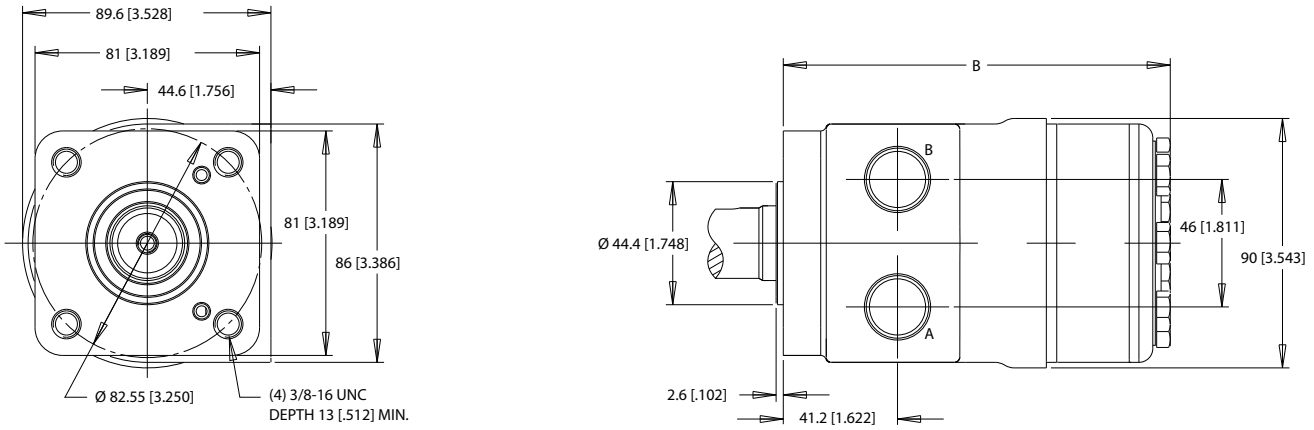


## WD Product Line

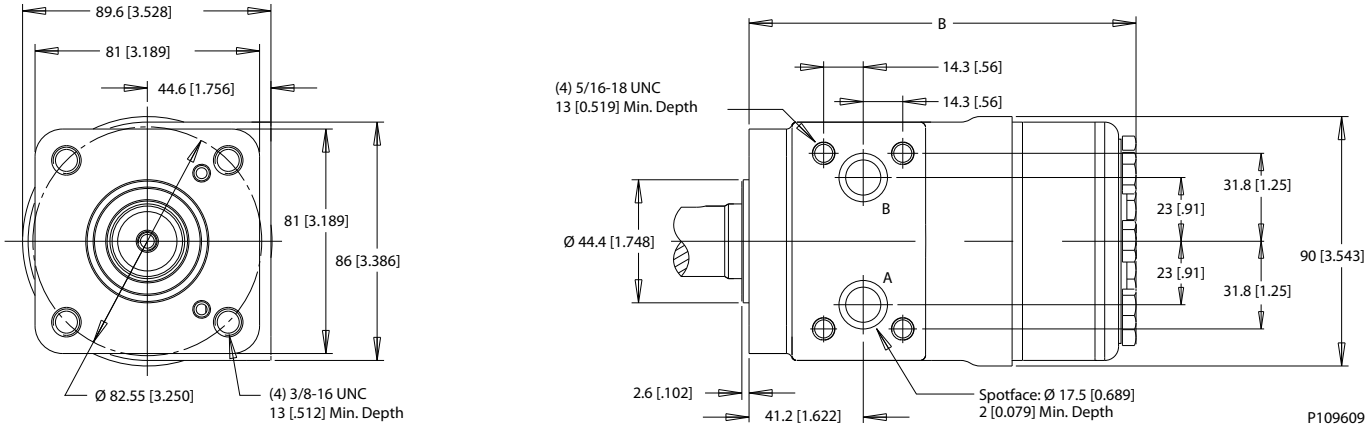
### 4-HOLE, SQUARE MOUNT, ALIGNED PORTS

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




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

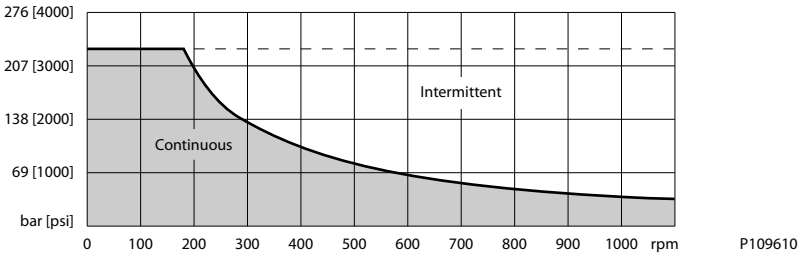
**F37** 1/2" Drilled




### 145/146 Series Technical Data

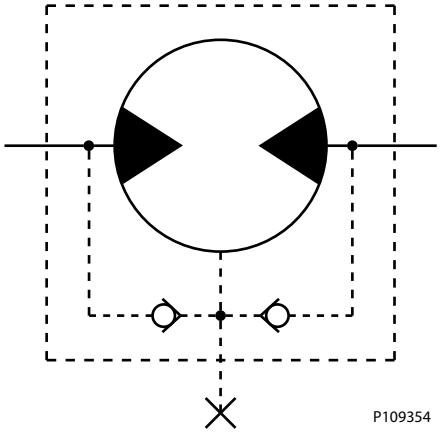
***Permissible Shaft Seal Press***

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.



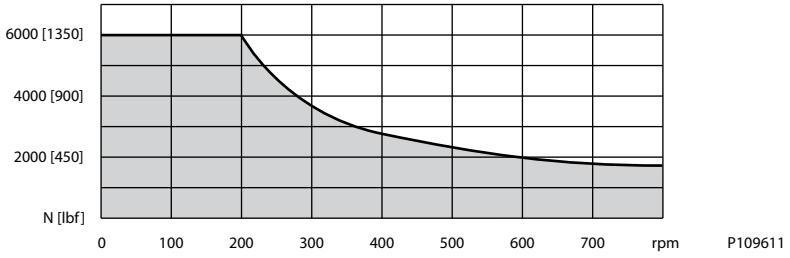
## WD Product Line

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.

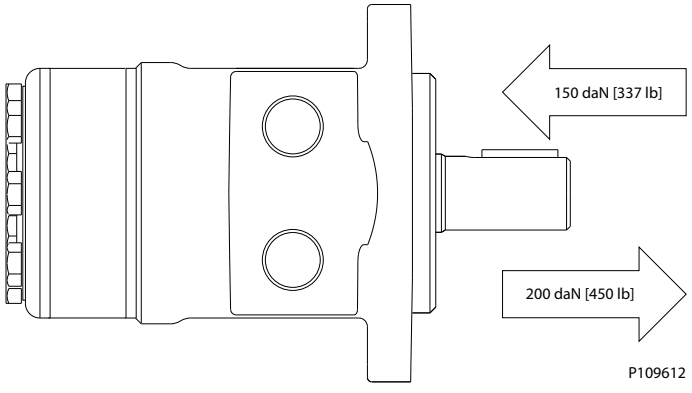



### *Allowable Shaft Load / Bearing Curve*

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.




### *Thrust Load*



## WD Product Line

### *Length and Weight Charts*

The overall motor weights listed in this chart were calculated using the heaviest of the housing options associated with that mounting flange to end of motor dimension. 145 & 146 series motor weights can vary ± 0.5 kg [1 lb] depending on model configurations such as housing, shaft, endcover, options etc.

Dimension B is the overall motor length from the rear of the motor to the mounting flange surface and is referenced on detailed housing drawings listed in *145/146 Series Housings* on page 28.

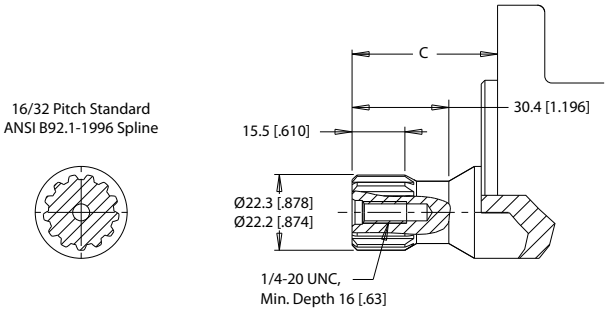
*Dimension B*

| # | 3mm Pilot | 8mm Pilot | Weight |
|---|---|---|---|
| | mm [in] | mm [in] | kg [lb] |
| 025 | 119 [4.67] | 114 [4.47] | 5.20 [11.5] |
| 032 | 120 [4.71] | 115 [4.51] | 5.24 [11.6] |
| 040 | 121 [4.77] | 116 [4.57] | 5.29 [11.7] |
| 050 | 121 [4.77] | 116 [4.57] | 5.29 [11.7] |
| 060 | 123 [4.83] | 118 [4.63] | 5.34 [11.8] |
| 080 | 125 [4.92] | 120 [4.72] | 5.42 [12.0] |
| 100 | 128 [5.02] | 123 [4.82] | 5.51 [12.2] |
| 125 | 131 [5.17] | 126 [4.97] | 5.65 [12.5] |
| 160 | 135 [5.33] | 130 [5.13] | 5.79 [12.8] |
| 200 | 141 [5.53] | 136 [5.33] | 5.97 [13.2] |
| 250 | 147 [5.79] | 142 [5.59] | 6.20 [13.7] |
| 315 | 156 [6.12] | 151 [5.92] | 6.49 [14.3] |
| 400 | 167 [6.56] | 162 [6.36] | 6.88 [15.2] |

## WD Product Line

### 145/146 Series Shafts

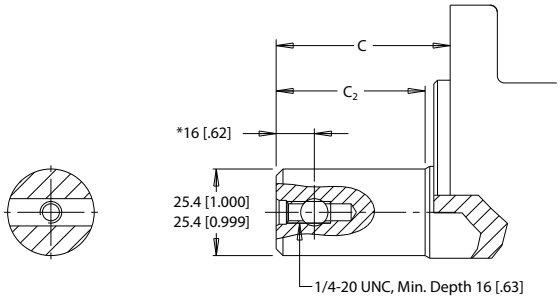
**01** 7/8″ 13 Tooth Spline




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

**53** 1″ - 10.3 [.406] Pinhole

**66** 1″ - 8.0 [.315] Pinhole

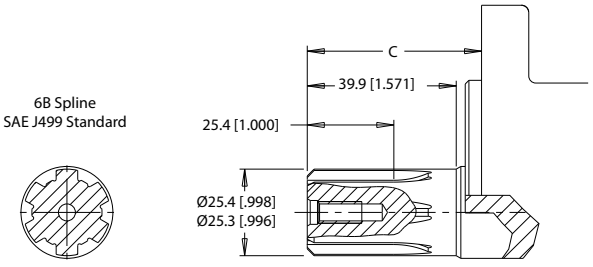



**Max. Torque: 678 Nm [6000 lb-in]**

▶ * Dimension for 66 shaft is 11.2 [.44]

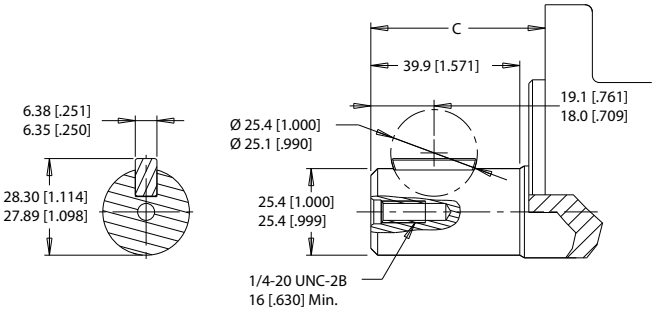
**02** 1″ 6B Spline, 1/4-20 Tap

**04** 1″ 6B Spline, M8x1.25 Tap




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

**B1** 1″ Straight, Woodruff Key

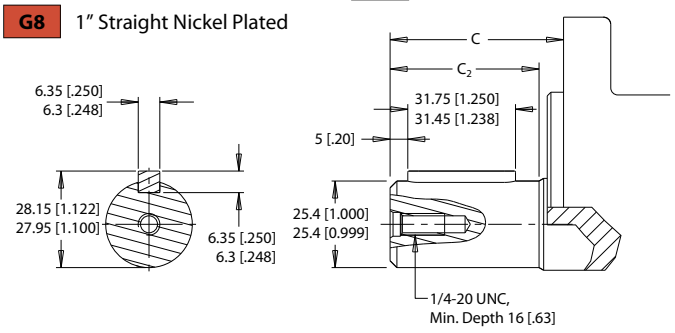



**Max. Torque: 655 Nm [5800 lb-in]**

**10** 1″ Straight

**G8** 1″ Straight Nickel Plated

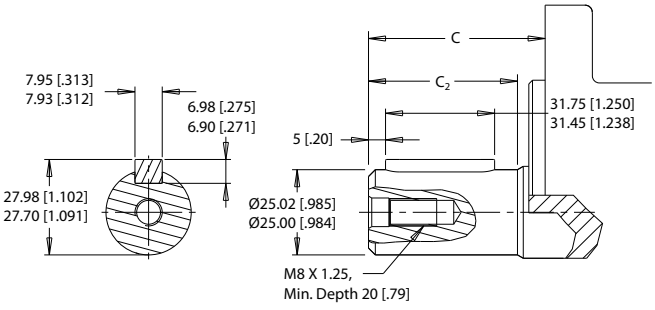
**15** 1″ Straight Extended




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

**12** 25mm Straight

**16** 25mm Straight Extended




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

### *Mounting / Shaft Length Chart*

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

Additional shaft length information, if necessary, is noted as $C_2$ and does not increase or decrease the listed C 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.

## WD Product Line

*Dimension C*

| # | 3mm Pilot | 8mm Pilot | $C_2$ |
|---|---|---|---|
| | mm [in] | mm [in] | mm [in] |
| 01 | 45.4 [1.803] | 50.8 [2.000] | N/A |
| 02 | 45.4 [1.803] | 50.8 [2.000] | N/A |
| 04 | 45.4 [1.803] | 50.8 [2.000] | N/A |
| 10 | 45.4 [1.803] | 50.8 [2.000] | 39.9 [1.571] |
| 12 | 45.4 [1.803] | 50.8 [2.000] | 39.9 [1.571] |
| 15 | 62.1 [2.445] | 67.5 [2.657] | 56.0 [2.205] |
| 16 | 62.1 [2.445] | 67.5 [2.657] | 56.0 [2.205] |
| 53 | 45.4 [1.803] | 50.8 [2.000] | 39.9 [1.571] |
| 66 | 50.4 [1.984] | 55.8 [2.197] | 44.9 [1.768] |
| B1 | 45.4 [1.803] | 50.8 [2.000] | N/A |
| G8 | 50.4 [1.984] | 55.8 [2.197] | 40.6 [1.599] |

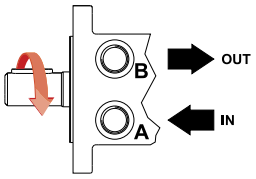
## WD Product Line

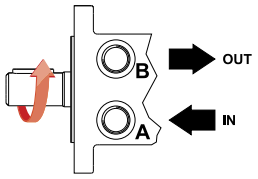
### 145/146 Series Order Codes

1 2 3 4 5 6 7 8

#### 1. CHOOSE SERIES DESIGNATION

| | |
|---|---|
| **145** | Standard Rotation |
| **146** | Reverse Rotation |




▶ The 145 & 146 series are bi-directional.

#### 2. SELECT A DISPLACEMENT OPTION

| | | | | | |
|---|---|---|---|---|---|
| **025** | 25 $cm^3$/rev | [1.5 $in^3$/rev] | **125** | 123 $cm^3$/rev | [7.5 $in^3$/rev] |
| **032** | 31 $cm^3$/rev | [1.9 $in^3$/rev] | **160** | 158 $cm^3$/rev | [9.6 $in^3$/rev] |
| **040** | 40 $cm^3$/rev | [2.4 $in^3$/rev] | **200** | 197 $cm^3$/rev | [12.0 $in^3$/rev] |
| **050** | 48 $cm^3$/rev | [2.9 $in^3$/rev] | **250** | 241 $cm^3$/rev | [14.7 $in^3$/rev] |
| **060** | 59 $cm^3$/rev | [3.6 $in^3$/rev] | **315** | 303 $cm^3$/rev | [18.5 $in^3$/rev] |
| **080** | 80 $cm^3$/rev | [4.9 $in^3$/rev] | **400** | 386 $cm^3$/rev | [23.5 $in^3$/rev] |
| **100** | 96 $cm^3$/rev | [5.9 $in^3$/rev] | | | |

#### 3. SELECT A MOUNT & PORT OPTION

| | |
|---|---|
| A10 | 2-Hole, SAE A Mount, Aligned Ports, 1/2-14 NPT |
| A11 | 2-Hole, SAE A Mount, Aligned Ports, 7/8-14 UNF |
| A17 | 2-Hole, SAE A Mount, Aligned Manifold Ports, 1/2" Drilled |
| A18 | 2-Hole, SAE A Mount, Aligned Ports, G 1/2 |
| A68 | 2-Hole, SAE A Mount, Aligned Ports, G 1/2 (TP) |
| 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 |

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

#### 4. SELECT A SHAFT OPTION

| | | | |
|---|---|---|---|
| **01** | 7/8" 13 Tooth Spline | **16** | 25mm Straight Extended |
| **02** | 1" 6B Spline, 1/4-20 Tap | **53** | 1" - 10.3 [.406] Pinhole |
| **04** | 1" 6B Spline, M8x1.25 Tap | **66** | 1" - 8.0 [.315] Pinhole |
| **10** | 1" Straight | **B1** | 1" Straight, Woodruff Key |
| **12** | 25mm Straight | **G8** | 1" Straight Nickel Plated |
| **15** | 1" Straight Extended | | |

▶ If the BE option is selected in Step 8, the G8 shaft is recommended for added shaft protection. 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 |

#### 7. SELECT AN ADD-ON OPTION

| | |
|---|---|
| **A** | Standard |
| **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 |
| **FB** | No Check Valves Installed |

P109614

## WP Product Line

### WP Introduction

#### 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

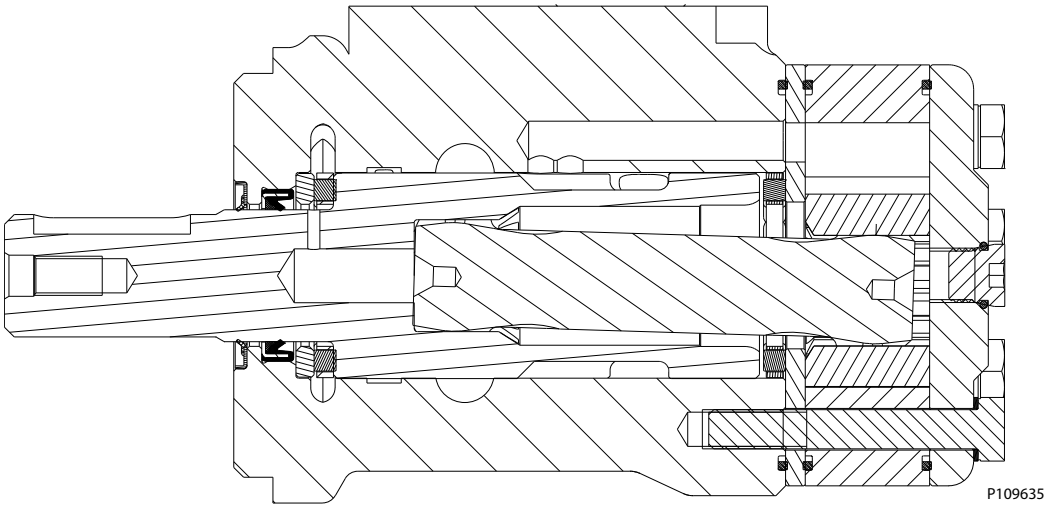
- Built-in check valves offer versatility and increased seal life.
- A variety of mounts and shafts provide flexibility in application design.
- Spool valve design gives superior performance and smooth operation over a wide speed and torque range.
- Standard high pressure shaft seals offer superior seal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

#### Typical Applications

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

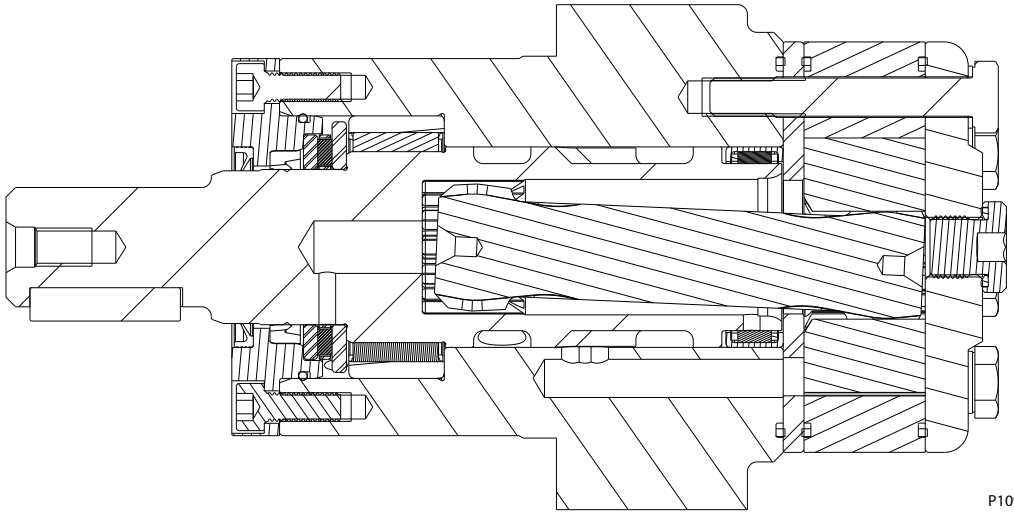
#### Series Descriptions

*155/156 - Hydraulic Motor (standard)*



## WP Product Line

*157/158 - Hydraulic Motor (with needle bearing)*




### Specifications

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.

| CODE | Displacement $cm^3$ [$in^3$] | 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] |

## WP Functional Charts

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 *Product Testing* on page 7.

## WP Product Line

### *025 Displacement Performance*

**025**

25 cm³ [1.5 in³] / rev

| Pressure - bar [psi] | 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] |
|---|---|---|---|---|---|---|
| | | | | Max. Cont. | | Max. Inter. |

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 |
| Max. Inter. Cont. 40 [10.6] | 5 [44] **1570** | 15 [133] **1503** | 22 [195] **1476** | 31 [274] **1432** | 36 [319] **1394** | 41 [363] **1359** | 1600 |
| 45 [11.9] | | 13 [115] **1687** | 20 [177] **1636** | 28 [248] **1600** | 34 [301] **1558** | 39 [345] **1516** | 1800 |

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | |
|---|---|---|---|---|---|---|
| 4.1 [.160] | 12 [106] | 24 [211] | 32 [282] | 40 [352] | 48 [423] | 56 [493] |

mm [in]

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

P109333

### *032 Displacement Performance*

**032**

32 cm³ [2.0 in³] / rev

| Pressure - bar [psi] | 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] |
|---|---|---|---|---|---|---|
| | | | | Max. Cont. | | Max. Inter. |

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 |
| Max. Inter. Cont. 50 [13.2] | 5 [44] **1550** | 16 [142] **1526** | 24 [212] **1500** | 31 [274] **1478** | 40 [354] **1452** | 46 [407] **1418** | 1563 |
| 55 [14.5] | | 12 [106] **1674** | 20 [177] **1641** | 28 [248] **1617** | 34 [301] **1584** | 39 [345] **1555** | 1719 |

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | |
|---|---|---|---|---|---|---|
| 5.1 [.200] | 15 [135] | 31 [271] | 41 [361] | 51 [451] | 61 [541] | 71 [631] |

mm [in]

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

P109334

## WP Product Line

### *040 Displacement Performance*

**040**

40 cm³ [2.5 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] Max. Cont. | 140 [2030] Max. Inter. |
|---|---|---|---|---|---|

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 |
| 60 [15.8] Max. Cont. | 4 [35] **1471** | 23 [204] **1428** | 34 [301] **1411** | 46 [407] **1387** | 56 [496] **1369** | 68 [602] **1341** | 1500 |
| 70 [18.5] Max. Inter. | | 16 [142] **1670** | 30 [265] **1653** | 41 [363] **1627** | 52 [460] **1612** | 64 [566] **1598** | 2000 |

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | |
|---|---|---|---|---|---|---|
| 6.6 [.260] mm [in] | 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]

P109335

### *050 Displacement Performance*

**050**

50 cm³ [3.0 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] Max. Cont. | 160 [2320] | 175 [2540] Max. Inter. |
|---|---|---|---|---|---|---|---|

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 |
| 60 [15.8] Max. Cont. | 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 |
| 75 [19.8] Max. Inter. | | 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%

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6.6 [.260] mm [in] | 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]

P109336

## WP Product Line

### *060 Displacement Performance*

**060**

59 cm³ [3.6 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] | 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] | 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%

Rotor Width 8.0 [.314] mm [in]

Theoretical Torque - Nm [lb-in]

| 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]

P109337

### *080 Displacement Performance*

**080**

78 cm³ [4.8 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] | 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] | 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%

Rotor Width 10.4 [.410] mm [in]

Theoretical Torque - Nm [lb-in]

| 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]

P109338

## WP Product Line

### *100 Displacement Performance*

**100**

96 cm³ [5.9 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] | Max. Cont. 160 [2320] | Max. Inter. 175 [2540] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|
| Torque - Nm [lb-in], **Speed rpm** | | | | | | **Intermittent Ratings** - 10% of Operation | | |
| 43 [381] **51** | 82 [726] **42** | 109 [965] **35** | 131 [1159] **25** | | | | | 52 |
| 43 [381] **99** | 84 [743] **93** | 108 [956] **84** | 133 [1177] **72** | 152 [1345] **62** | 180 [1593] **48** | 197 [1743] **24** | | 104 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |

Flow - lpm [gpm]: 5 [1.3], 10 [2.6], 20 [5.3], 30 [7.9], 40 [10.6], 50 [13.2], 60 [15.8] (Max. Cont.), 70 [18.5], 75 [19.8] (Max. Inter.)

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

**Rotor Width**: 13.0 [.510] mm [in]

Theoretical Torque - Nm [lb-in]: 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]

P109339

### *125 Displacement Performance*

**125**

125 cm³ [7.6 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] | Max. Cont. 160 [2320] | Max. Inter. 175 [2540] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|
| Torque - Nm [lb-in], **Speed rpm** | | | | | | **Intermittent Ratings** - 10% of Operation | | |
| 52 [460] **38** | 95 [841] **35** | 135 [1195] **32** | 168 [1487] **27** | | | | | 40 |
| 50 [442] **78** | 98 [867] **74** | 138 [1221] **69** | 172 [1522] **62** | 190 [1681] **54** | 234 [2071] **45** | 258 [2283] **35** | | 80 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| 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 |
| | 40 [354] **599** | 71 [628] **594** | 128 [1133] **588** | 158 [1398] **576** | 192 [1699] **565** | 199 [1761] **536** | 224 [1982] **524** | 600 |

Flow - lpm [gpm]: 5 [1.3], 10 [2.6], 20 [5.3], 30 [7.9], 40 [10.6], 50 [13.2], 60 [15.8] (Max. Cont.), 70 [18.5], 75 [19.8] (Max. Inter.)

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

**Rotor Width**: 16.8 [.660] mm [in]

Theoretical Torque - Nm [lb-in]: 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]

P109340

## WP Product Line

### *160 Displacement Performance*

**160**

159 cm³ [9.7 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 120 [1740] | 140 [2030] | 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] | Max. Cont. 160 [2320] | Max. Inter. 175 [2540] | 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%

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 20.8 [.820] | 74 [651] | 147 [1302] | 196 [1736] | 245 [2170] | 282 [2496] | 343 [3038] | 392 [3472] | 429 [3798] |

mm [in]

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

P109341

### *200 Displacement Performance*

**200**

190 cm³ [11.6 in³] / rev

Pressure - bar [psi]

| 30 [435] | 60 [870] | 80 [1160] | 100 [1450] | 115 [1670] | 140 [2030] | 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] | Max. Cont. 150 [2180] | Max. Inter. 175 [2540] | 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%

| **Rotor Width** | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 25.9 [1.020] | 91 [803] | 182 [1611] | 242 [2142] | 303 [2677] | 348 [3079] | 424 [3748] | 454 [4016] | 529 [4685] |

mm [in]

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

P109342

## WP Product Line

### *250 Displacement Performance*

**250**

240 cm³ [14.6 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 30 [435] | 60 [870] | 85 [1230] | 100 [1450] | 125 [1810] | 140 [2030] | 160 [2320] | 175 [2540] |
|---|---|---|---|---|---|---|---|

**Intermittent Ratings -** 10% of Operation

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

| 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%

**Rotor Width**

32.5 [1.280] mm [in]

Theoretical Torque - Nm [lb-in]

| 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]

P109343

### *315 Displacement Performance*

**315**

303 cm³ [18.5 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 30 [435] | 50 [725] | 70 [1015] | 85 [1230] | 100 [1450] | 120 [1740] | 140 [2030] | 160 [2320] |
|---|---|---|---|---|---|---|---|

**Intermittent Ratings -** 10% of Operation

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

| 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%

**Rotor Width**

40.9 [1.610] mm [in]

Theoretical Torque - Nm [lb-in]

| 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]

P109344

## WP Product Line

*400 Displacement Performance*

| 400 | Pressure - bar [psi] | | | | | Max. Cont. | | Max. Inter. |
|---|---|---|---|---|---|---|---|---|
| | 30 [435] | 45 [650] | 55 [800] | 65 [940] | 80 [1160] | 95 [1380] | 110 [1595] | 125 [1810] |

388 cm³ [23.7 in³] / rev

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | | | | | | | | | 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%

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 52.1 [2.050] | 185 [1640] | 278 [2460] | 340 [3007] | 402 [3554] | 494 [4374] | 587 [5194] | 680 [6014] | 772 [6834] |

mm [in]

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

P109345

## WP Product Line

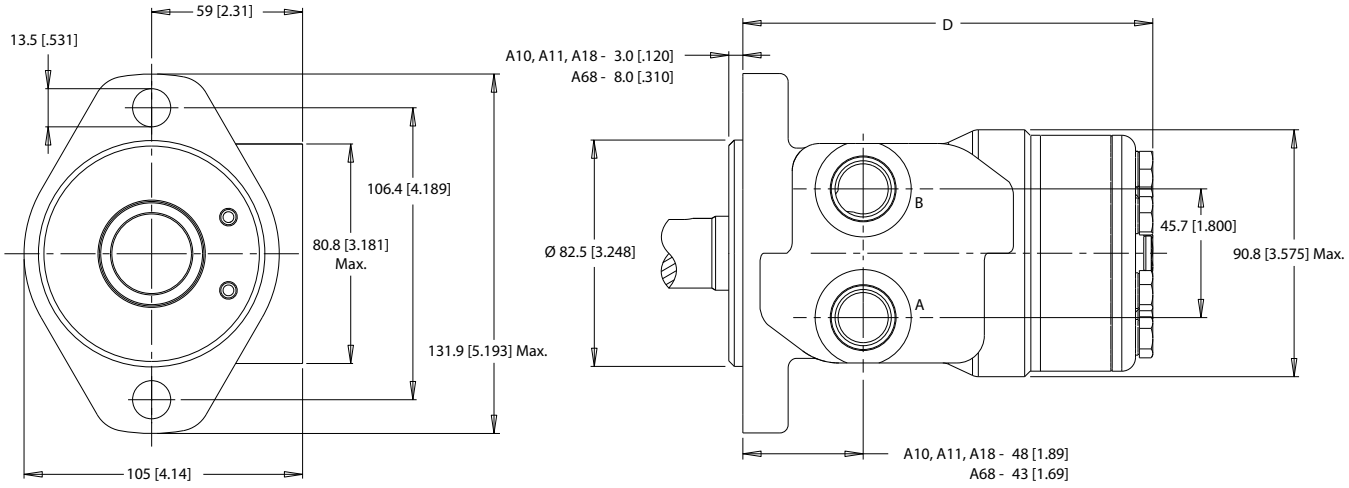
### 155/156 Series

#### 155/156 Series Housings

Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].
Dimensions are charted in *155/156 Series Technical Data* on page 51.
(TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

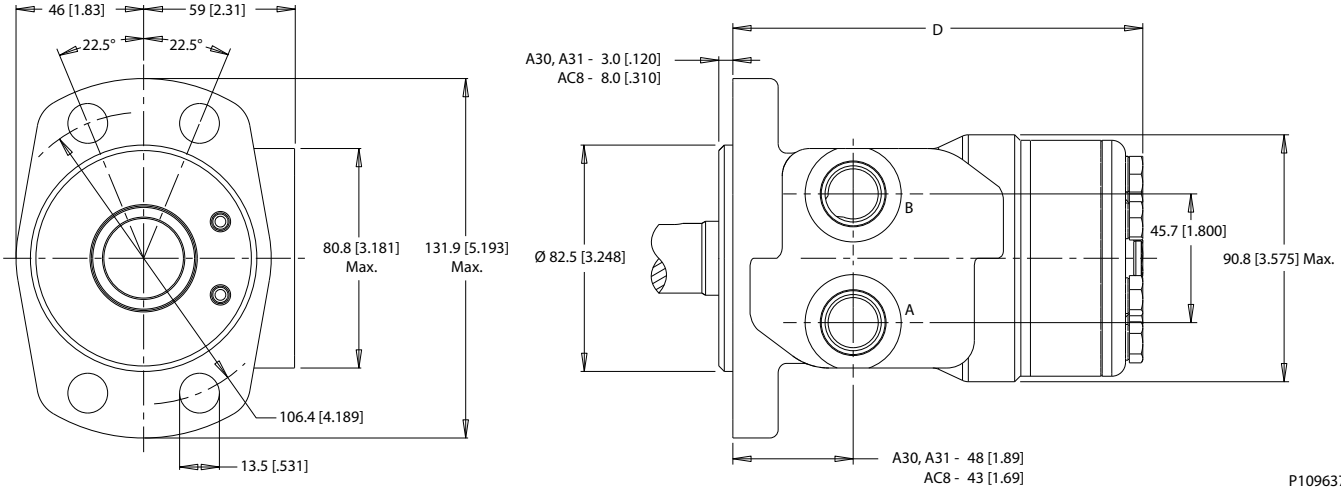
**2-HOLE, SAE A MOUNT, ALIGNED PORTS**

**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**

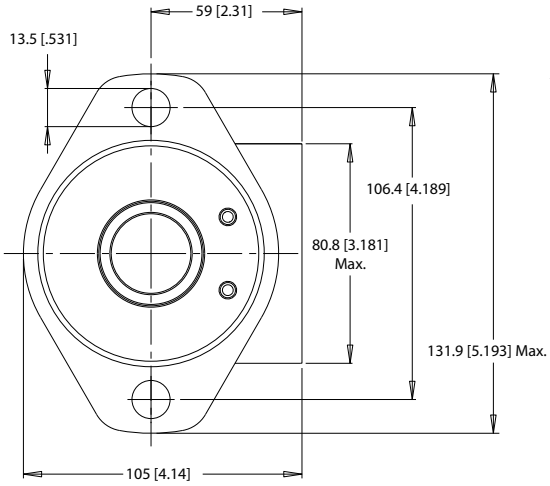
**A30** 1/2-14 NPT **A31** 7/8-14 UNF **AC8** G 1/2 (TP)

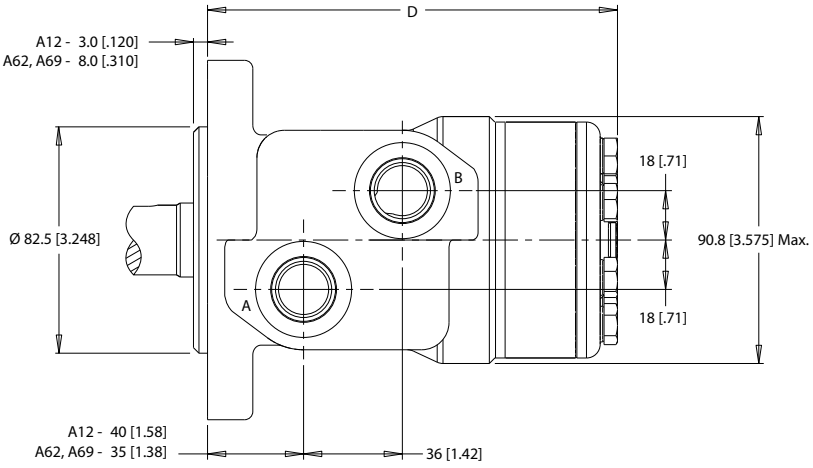


## WP Product Line

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

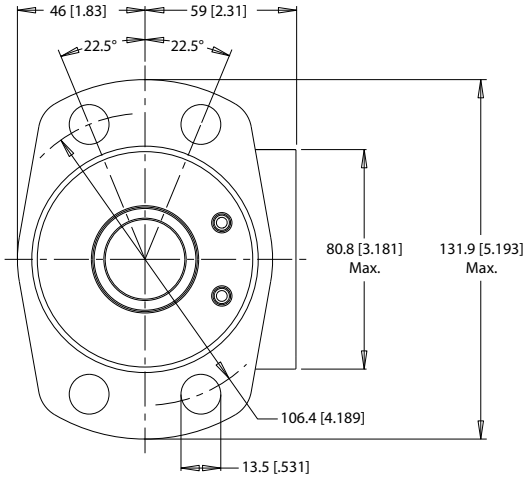
**A12** G 1/2 **A62** G 1/2 (TP) **A69** 7/8-14 UNF (TP)

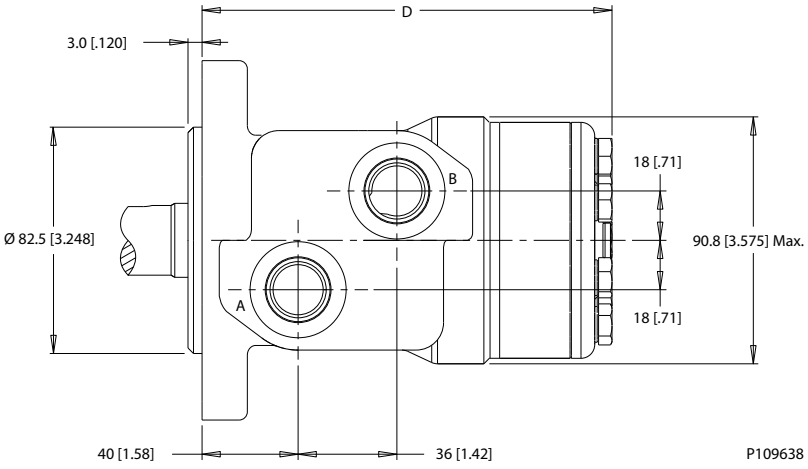



### 4-HOLE, MAGNETO MOUNT, OFFSET PORTS

**A32** G 1/2

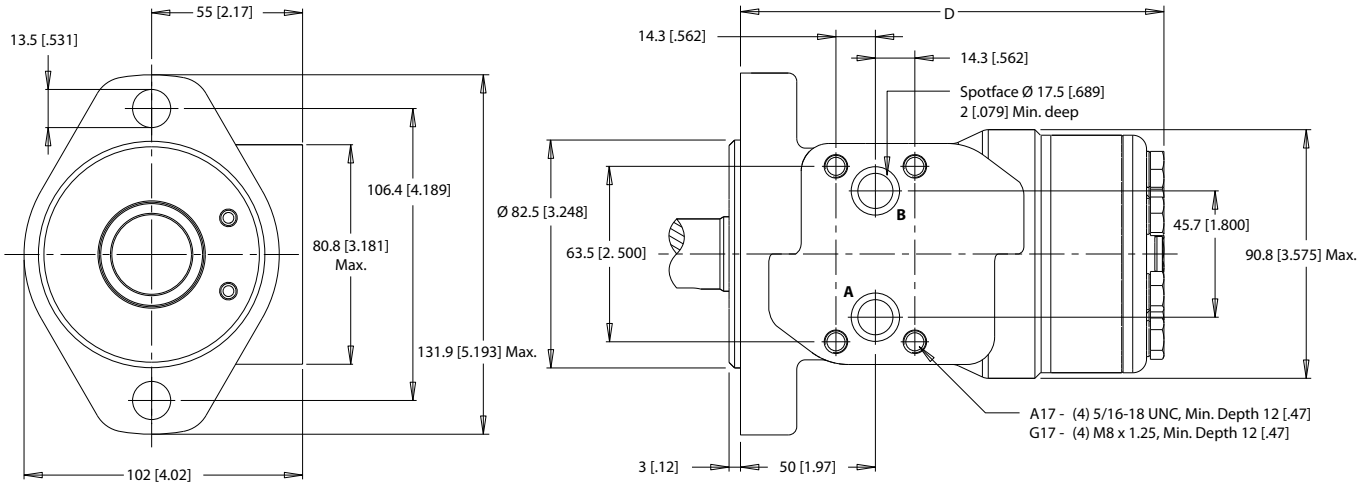


## WP Product Line

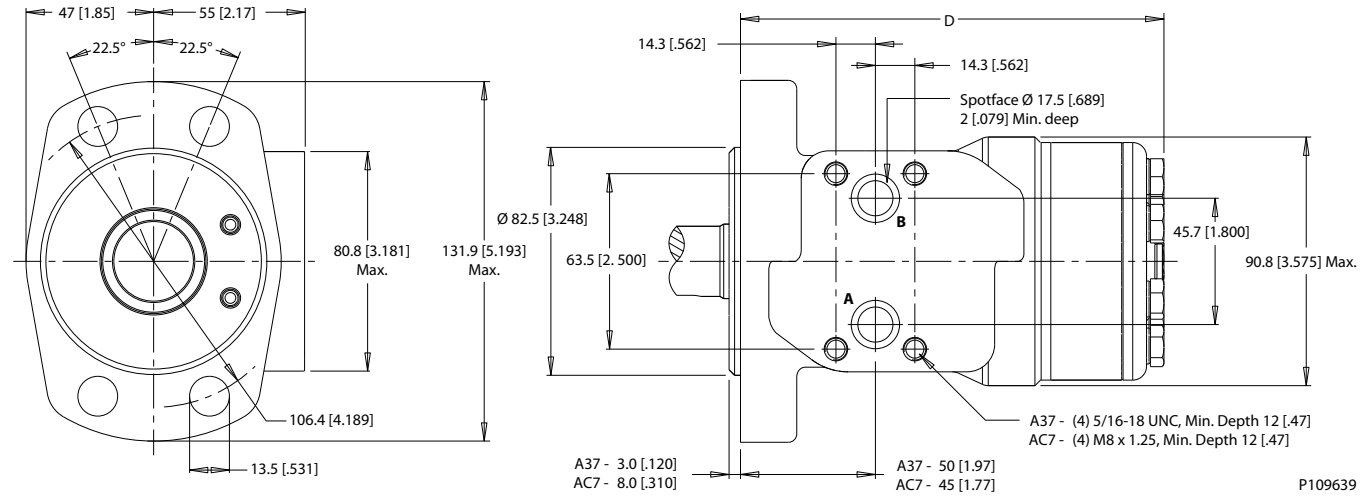
### 2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS

**A17** 1/2″ Drilled **G17** 1/2″ Drilled




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

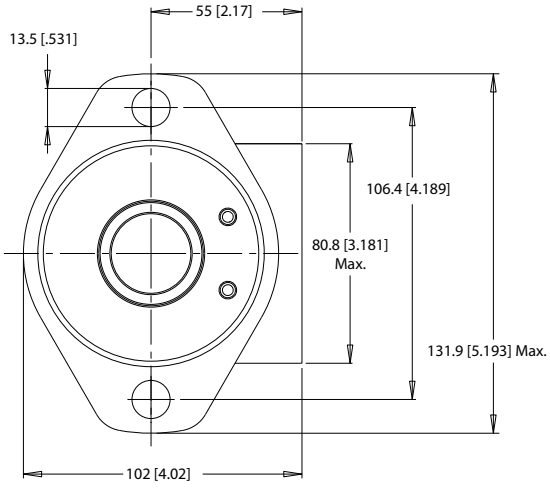
**A37** 1/2″ Drilled **AC7** 1/2″ Drilled (TP)

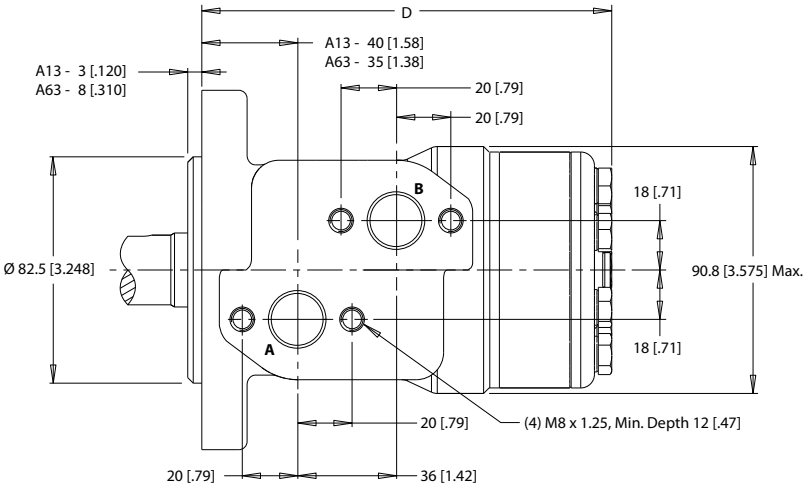


## WP Product Line

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

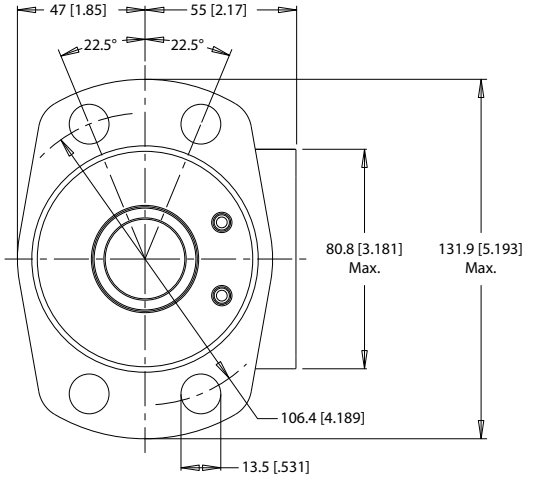
**A13** G 1/2 **A63** G 1/2 (TP)

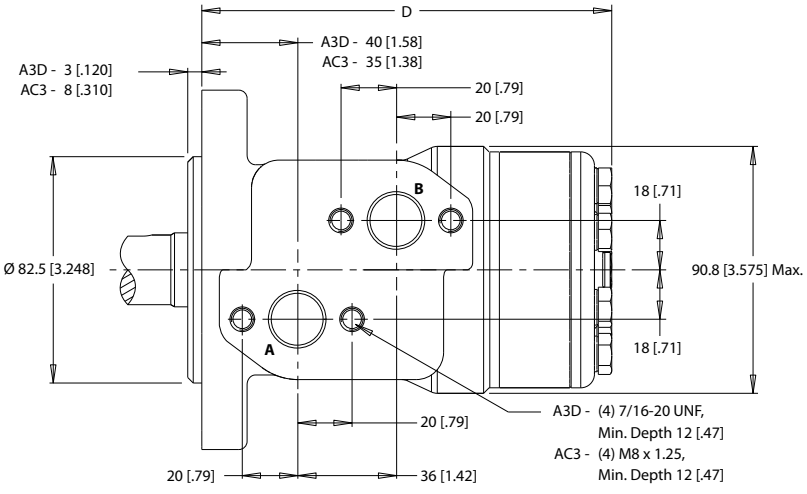



### 4-HOLE, MAGNETO, OFFSET MANIFOLD PORTS

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



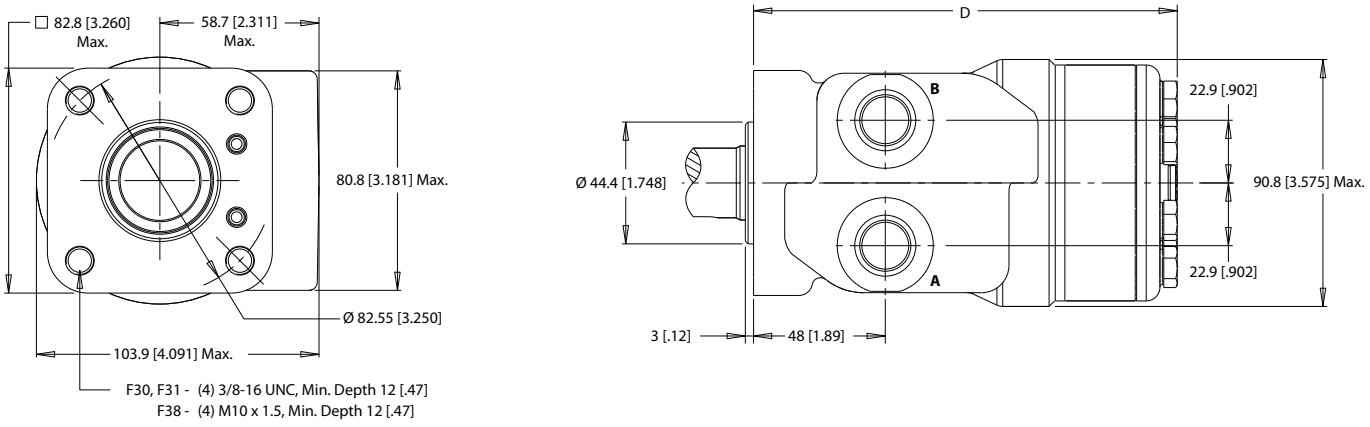




P109640

## WP Product Line

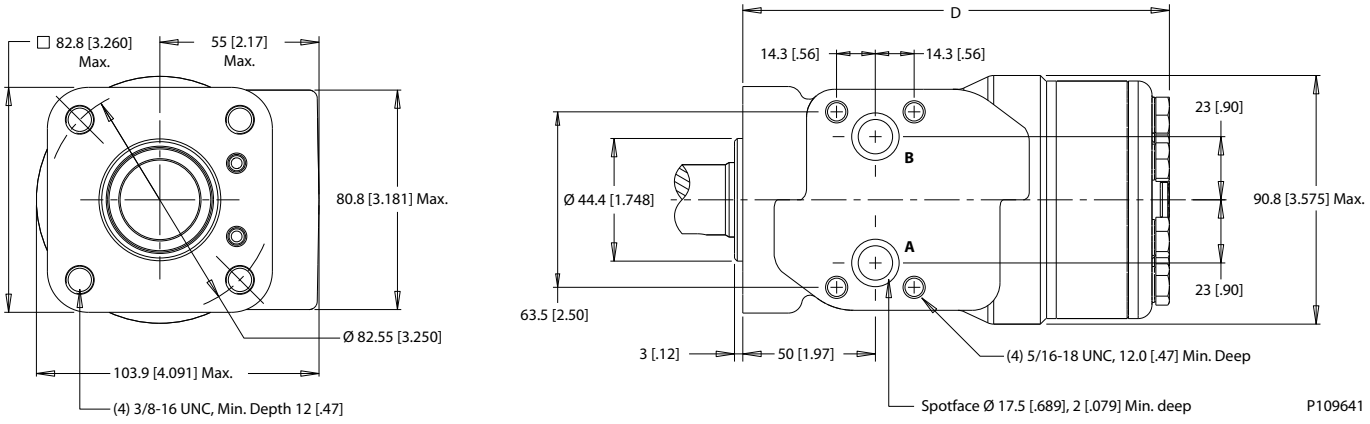
### 4-HOLE, SQUARE MOUNT, ALIGNED PORTS

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




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

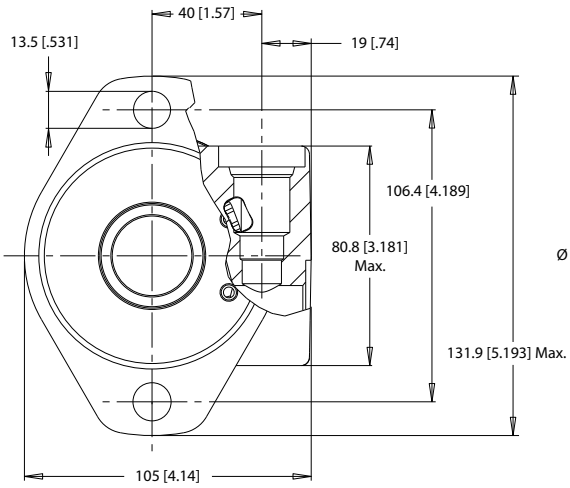
**F37** 1/2″ Drilled

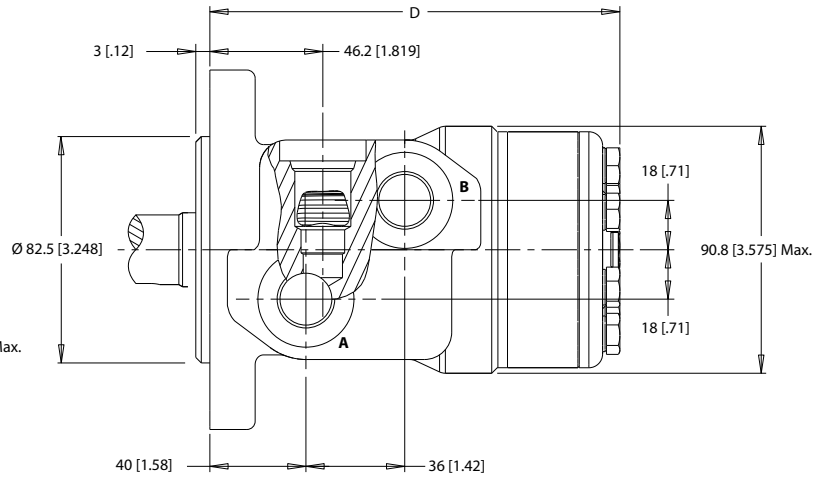


## WP Product Line

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

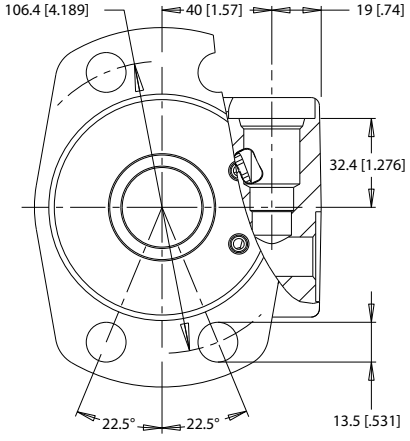
**A19** 7/8-14 UNF

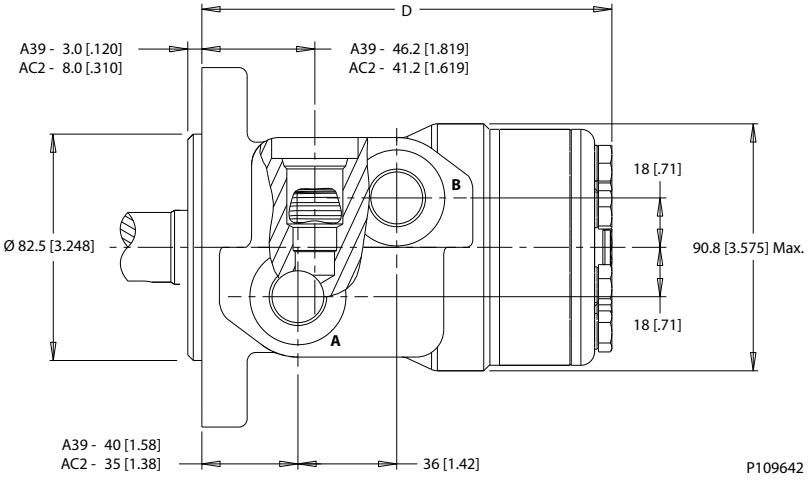



### 4-HOLE, MAGNETO MOUNT, OFFSET PORTS, VALVE CAVITY

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

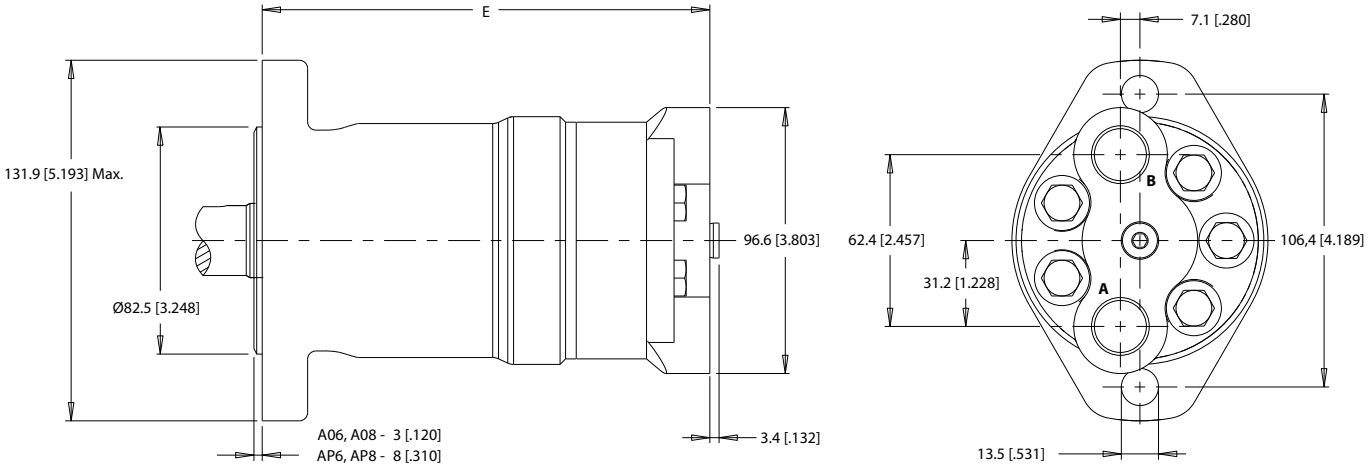


## WP Product Line

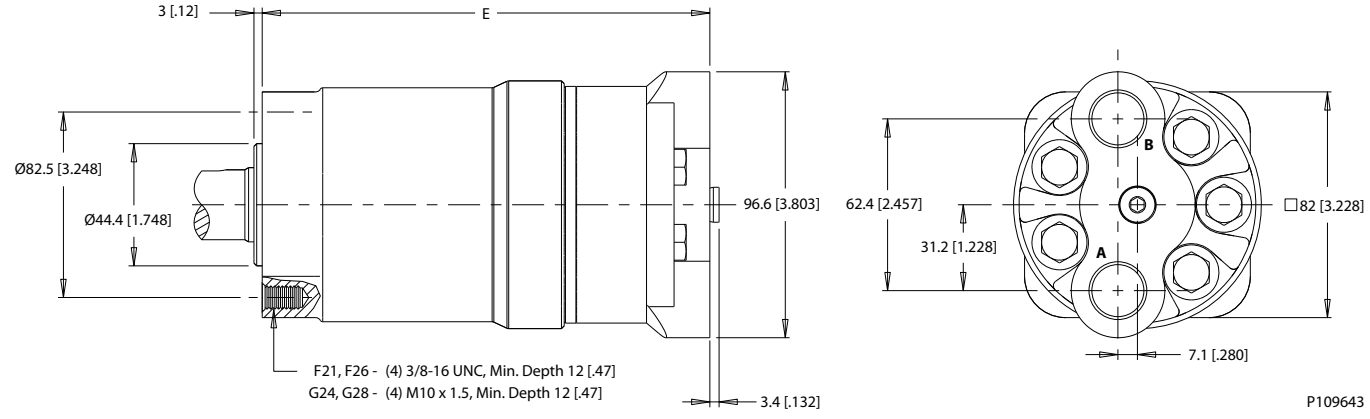
**2-HOLE, SAE A MOUNT, ALIGNED END PORTS**

**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

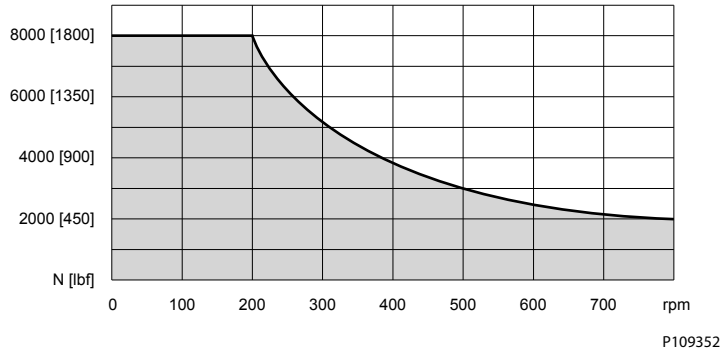



### 155/156 Series Technical Data

***Allowable Shaft Load / Bearing Curve***

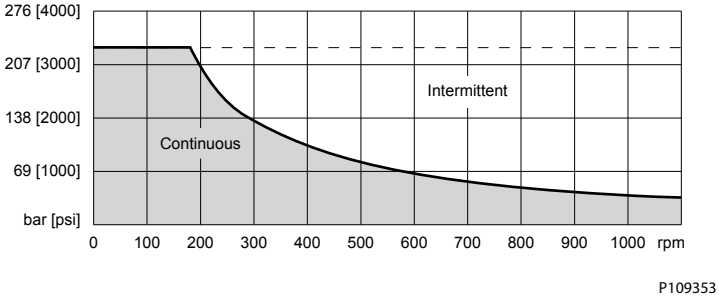
The bearing curve below represents the side load capacity of the motor at the centerline of the key for various motor speeds. Operating conditions within the shaded area will maintain acceptable oil film lubrication with recommended fluids. Operating conditions outside the shaded area are susceptible 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.

## WP Product Line

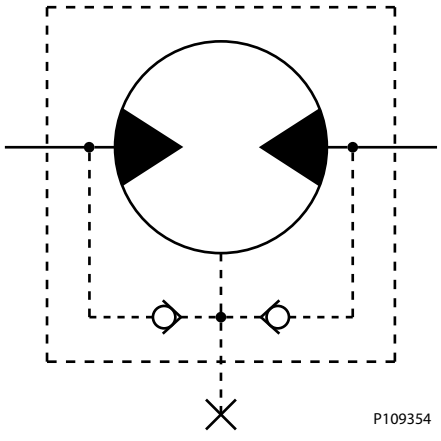



### *Permissible Shaft Seal Pressure*

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.

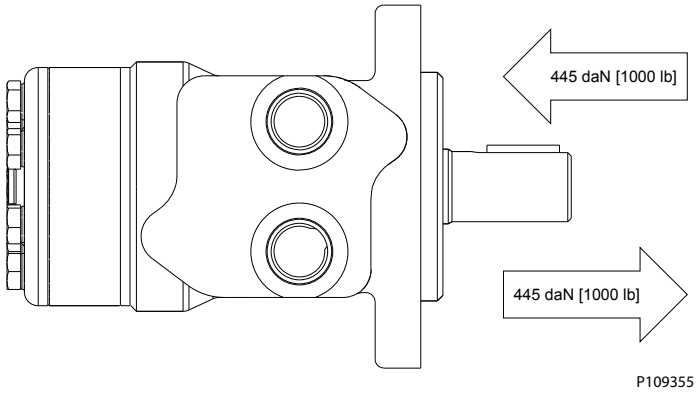



With check valves and drain connection, the shaft seal pressure equals pressure in the drain line. With check valves and no drain connection, shaft seal pressure is identical to output pressure. No check valves and no drain connection, the shaft seal pressure is identical to the average value of input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



## WP Product Line

### *Thrust Load*




### *Length and Weight Charts*

The overall motor weights listed in each chart 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.

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 in *155/156 Series Housings* on page 45.

*Dimension D*

| # | 3 mm Pilot | 8 mm 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 in *155/156 Series Housings* on page 45.

*Dimension E*

| # | 3 mm Pilot | 8 mm 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] |

## WP Product Line

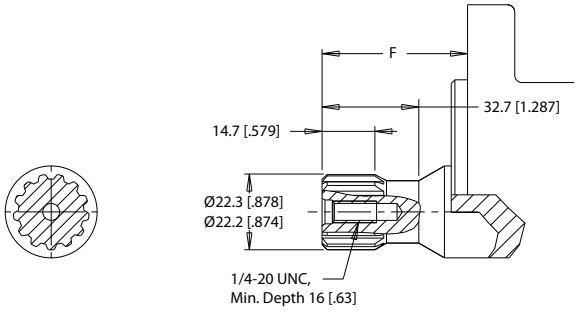
*Dimension E (continued)*

| # | 3 mm Pilot | 8 mm Pilot | Weight |
|---|---|---|---|
| | mm [in] | mm [in] | kg [lb] |
| 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] |

## WP Product Line

### 155/156 Series Shafts

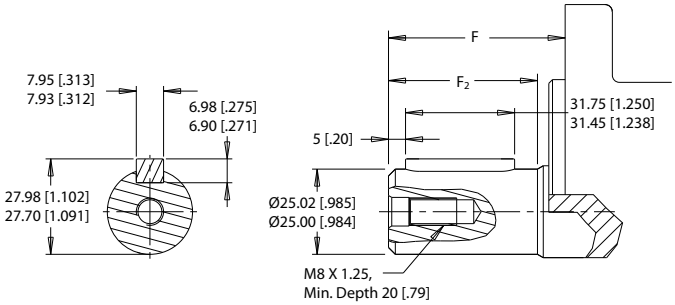
**01** 7/8″ 13 Tooth Spline




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

**12** 25mm Straight

**16** 25mm Straight Extended



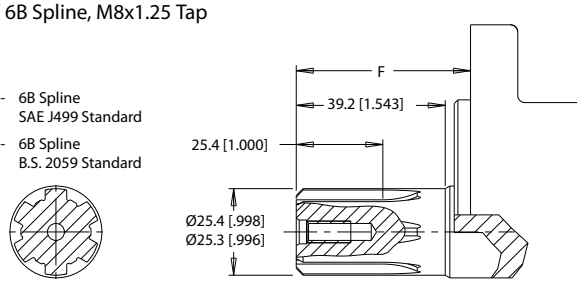

**Max. Torque: 655 Nm [5800 lb-in]**

**02** 1″ 6B Spline, 1/4-20 Tap

**04** 1″ 6B Spline, M8x1.25 Tap

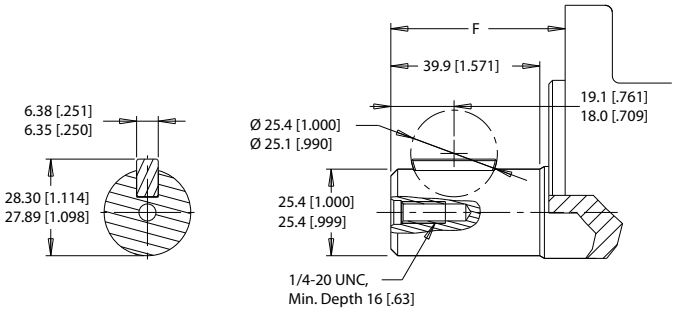
**F3** 1″ 6B Spline, M8x1.25 Tap

02, 04 - 6B Spline
SAE J499 Standard
F3 - 6B Spline
B.S. 2059 Standard




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

**B1** 1″ Straight, Woodruff Key

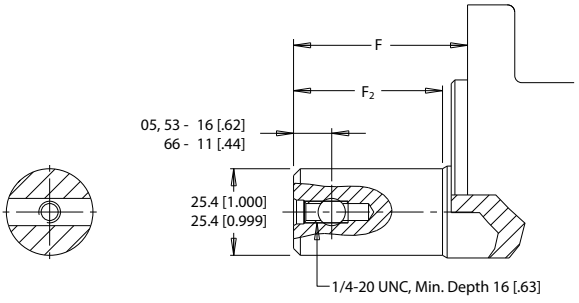



**Max. Torque: 655 Nm [5800 lb-in]**

**05** 1″ - 9.5 [.375] Pinhole

**53** 1″ - 10.3 [.406] Pinhole

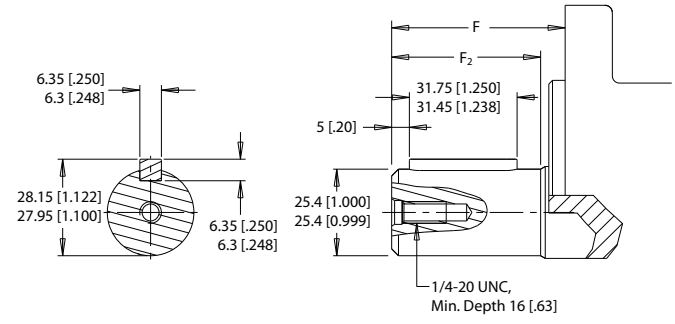
**66** 1″ - 8.0 [.315] Pinhole




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

**10** 1″ Straight

**15** 1″ Straight Extended




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

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### *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.

## WP Product Line

*Dimension F*

| # | 3 mm Pilot | 8 mm 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 |

## WP Product Line

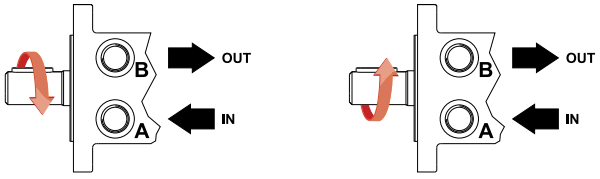
### 155/156 Order Codes

## WP Product Line

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] | **125** | 125 $cm^3$/rev | [7.6 $in^3$/rev] |
| **032** | 32 $cm^3$/rev | [2.0 $in^3$/rev] | **160** | 154 $cm^3$/rev | [9.4 $in^3$/rev] |
| **040** | 40 $cm^3$/rev | [2.5 $in^3$/rev] | **200** | 190 $cm^3$/rev | [11.6 $in^3$/rev] |
| **050** | 50 $cm^3$/rev | [3.0 $in^3$/rev] | **250** | 240 $cm^3$/rev | [14.6 $in^3$/rev] |
| **060** | 59 $cm^3$/rev | [3.6 $in^3$/rev] | **315** | 303 $cm^3$/rev | [18.5 $in^3$/rev] |
| **080** | 78 $cm^3$/rev | [4.8 $in^3$/rev] | **400** | 388 $cm^3$/rev | [23.7 $in^3$/rev] |
| **100** | 96 $cm^3$/rev | [5.9 $in^3$/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 | **15** | 1" Straight Extended |
| **02** | 1" 6B Spline, 1/4-20 Tap | **16** | 25mm Straight Extended |
| **04** | 1" 6B Spline, M8x1.25 Tap | **53** | 1" - 10.3 [.406] Pinhole |
| **05** | 1" - 9.5 [.375] Pinhole | **66** | 1" - 8.0 [.315] Pinhole |
| **10** | 1" Straight | **B1** | 1" Straight, Woodruff Key |
| **12** | 25mm Straight | **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 | **E** | 104 bar [1500 psi] Relief |
| **B** | Valve Cavity Only | **F** | 121 bar [1750 psi] Relief |
| **C** | 69 bar [1000 psi] Relief | **G** | 138 bar [2000 psi] Relief |
| **D** | 86 bar [1250 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 | **DS** | Groove In Mounting Flange |
| **AC** | Freeturning Rotor | **FB** | No Check Valves Installed |
| **BE** | Slinger Seal | | |

P109358

## WP Product Line

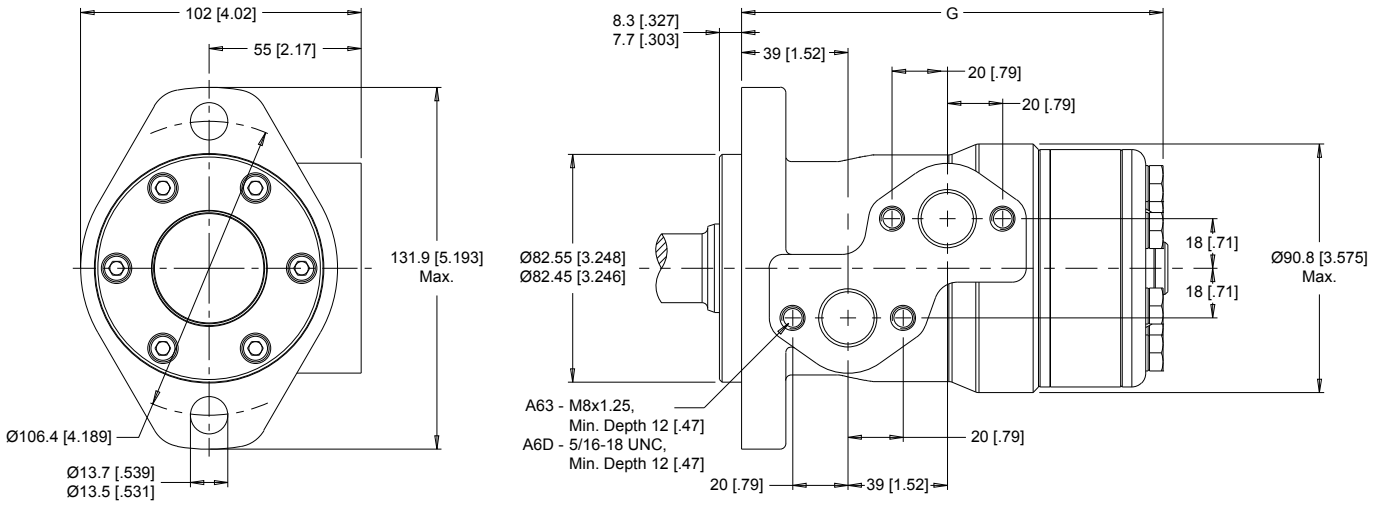
## WP Product Line

### WP 157 and 158 Series

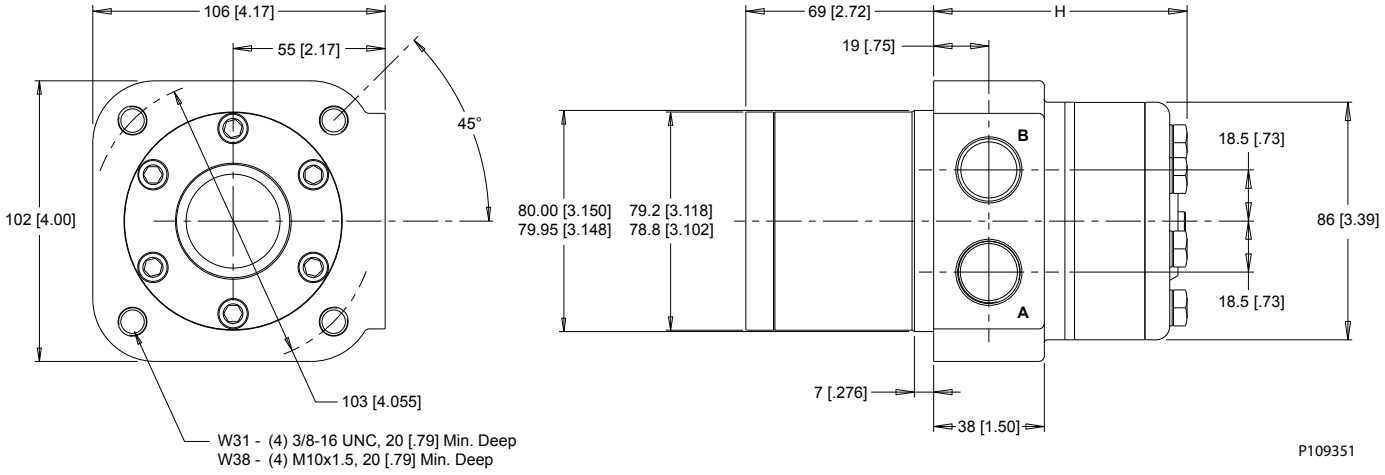
#### WP 157 and 158 Series Housings

Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].
Dimensions are charted in *WP 157 and 158 Series Technical Information* on page 60.

**2-HOLE, SAE A MOUNT, OFFSET MANIFOLD PORTS** **A63** G 1/2 **A6D** 7/8-14 UNF




**4-HOLE, WHEEL MOUNT, ALIGNED PORTS** **W31** 7/8-14 UNF **W38** G 1/2



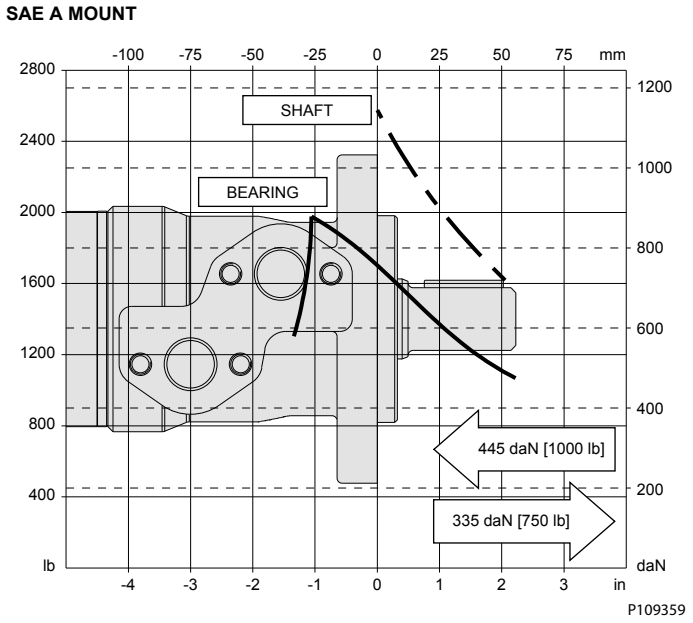

#### WP 157 and 158 Series Technical Information

***Allowable Shaft Load / Bearing Curve***

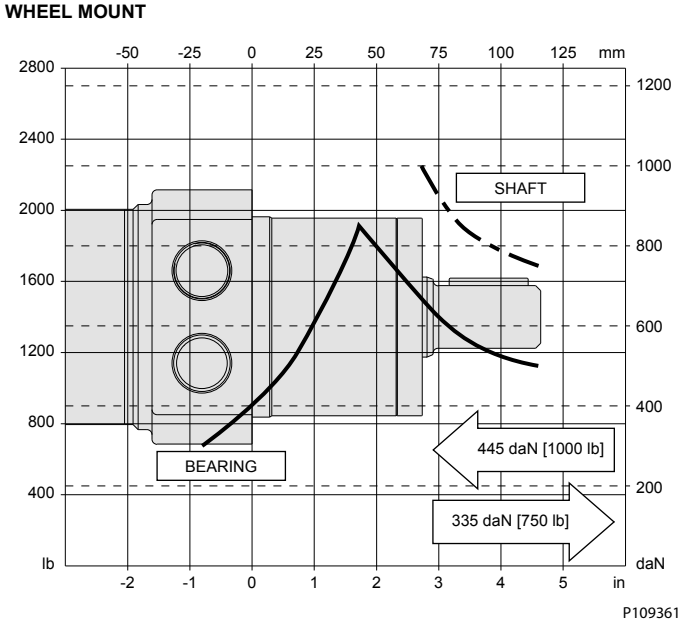
The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an $L_{10}$ life of 2,000 hours at 100 rpm. Radial loads for speeds other than 100 rpm may be calculated using the multiplication factor table in *Vehicle Drive Calculations* on page 9.

## WP Product Line

*SAE A Mount*




*Wheel Mount*




### *Length and Weight Chart*

Dimension G is the overall motor length from the rear of the motor to the mounting flange surface.

## WP Product Line

*Dimension G*

| # | Length | Weight |
|---|---|---|
| | mm [in] | kg [lb] |
| 025 | 133 [5.24] | 6.0 [13.3] |
| 032 | 134 [5.28] | 6.1 [13.4] |
| 040 | 136 [5.33] | 6.1 [13.5] |
| 050 | 136 [5.33] | 6.1 [13.5] |
| 060 | 137 [5.39] | 6.2 [13.6] |
| 080 | 139 [5.48] | 6.2 [13.6] |
| 100 | 142 [5.59] | 6.3 [13.9] |
| 125 | 146 [5.74] | 6.4 [14.2] |
| 160 | 150 [5.89] | 6.6 [14.5] |
| 200 | 155 [6.09] | 6.7 [14.9] |
| 250 | 161 [6.35] | 7.0 [15.3] |
| 315 | 170 [6.69] | 7.2 [15.9] |
| 400 | 181 [7.13] | 7.6 [16.8] |

Dimension H is the overall motor length from the rear of the motor to the mounting flange surface.

*Dimension H*

| # | Length | Weight |
|---|---|---|
| | mm [in] | kg [lb] |
| 025 | 72 [2.83] | 6.4 [14.1] |
| 032 | 73 [2.87] | 6.5 [14.4] |
| 040 | 75 [2.95] | 6.6 [14.5] |
| 050 | 75 [2.95] | 6.6 [14.5] |
| 060 | 76 [2.99] | 6.7 [14.8] |
| 080 | 78 [3.07] | 6.8 [15.0] |
| 100 | 81 [3.19] | 6.9 [15.2] |
| 125 | 85 [3.35] | 7.0 [15.5] |
| 160 | 89 [3.50] | 7.1 [15.6] |
| 200 | 94 [3.70] | 7.2 [15.9] |
| 250 | 100 [3.94] | 7.4 [16.4] |
| 315 | 109 [4.29] | 7.7 [17.0] |
| 400 | 120 [4.72] | 8.1 [17.8] |

### WP 157 and 158 Series Shafts

#### *Mounting / Shaft Length Chart*

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

*Dimension J*

| # | SAE and A Mounts | Wheel Mounts |
|---|---|---|
| | mm [in] | mm [in] |
| 10 | 55 [2.18] | 116 [4.57] |
| 11 | 55 [2.18] | 116 [4.57] |

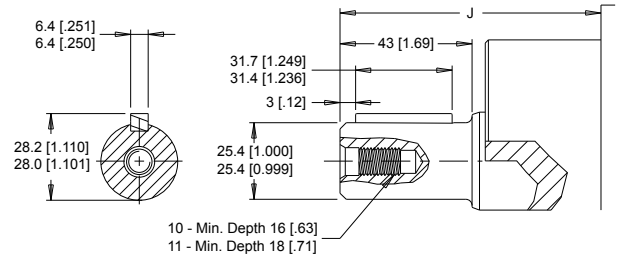
## WP Product Line

*Dimension J (continued)*

| # | SAE and A Mounts | Wheel Mounts |
|---|---|---|
| | mm [in] | mm [in] |
| 12 | 55 [2.18] | 116 [4.57] |
| 13 | 66 [2.60] | 127 [5.00] |
| F3 | 55 [2.18] | 116 [4.57] |
| N9 | 58 [2.29] | 119 [4.69] |

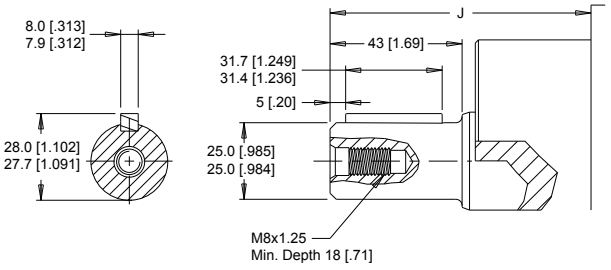
**10** 1" Straight, 1/4-20 Tap

**11** 1" Straight, M8x1.25 Tap



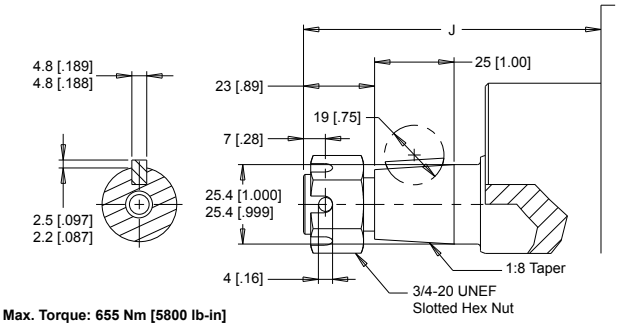

**Max. Torque: 655 Nm [5800 lb-in]**

**12** 25mm Straight



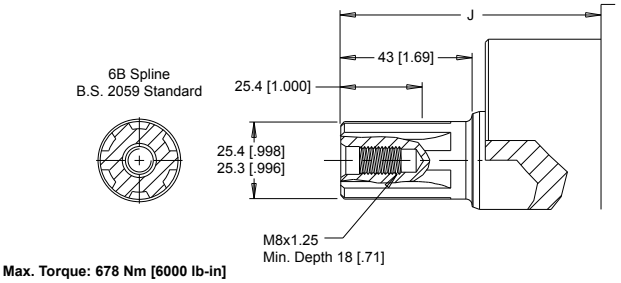

**Max. Torque: 655 Nm [5800 lb-in]**

**13** 1" Tapered



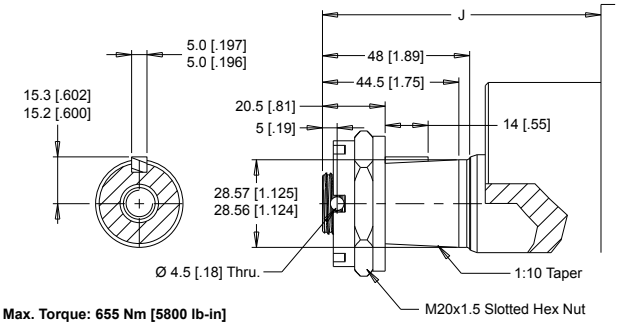

**Max. Torque: 655 Nm [5800 lb-in]**

**F3** 1" 6B Spline




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

**N9** 28.5mm Tapered




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

P109397

## WP Product Line

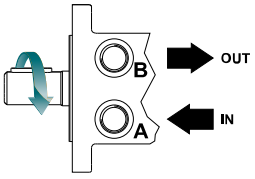
### WP 157 and 158 Series Ordering Information

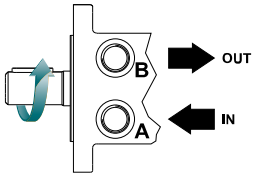
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

1 2 3 4 5 6 7 8

#### 1. CHOOSE SERIES DESIGNATION

| | |
|---|---|
| **157** | Clockwise Rotation |
| **158** | Counterclockwise Rotation |




▶ The 157 & 158 series are bi-directional. Reversing the inlet hose will reverse shaft rotation.

#### 2. SELECT A DISPLACEMENT OPTION

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

#### 3. SELECT A MOUNT & PORT OPTION

| | |
|---|---|
| **A63** | 2-Hole, SAE A Mount, Offset Manifold Ports, G 1/2 |
| **A6D** | 2-Hole, SAE A Mount, Offset Manifold Ports, 7/8-14 UNF |
| **W31** | 4-Hole, Wheel Mount, Aligned Ports, 7/8-14 UNF |
| **W38** | 4-Hole, Wheel Mount, Aligned Ports, G 1/2 |

#### 4. SELECT A SHAFT OPTION

| | | | |
|---|---|---|---|
| **10** | 1” Straight, 1/4-20 Tap | **13** | 1” Tapered |
| **11** | 1” Straight, M8x1.25 Tap | **F3** | 1” 6B Spline |
| **12** | 25mm Straight | **N9** | 28.5mm Tapered |

#### 5. SELECT A PAINT OPTION

| | |
|---|---|
| **A** | Black |
| **B** | Black, Unpainted Mounting Surface |

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

| | |
|---|---|
| **A** | None |

#### 7. SELECT AN ADD-ON OPTION

| | |
|---|---|
| **A** | Standard |

#### 8. SELECT A MISCELLANEOUS OPTION

| | |
|---|---|
| **AA** | None |
| **AC** | Freeturning Rotor |

P109363

## WR Product Line

### WR Product Line Introduction

#### Overview

The WR Series motors incorporate the latest advances for smooth performance, efficiency and durability. Featuring an optimized Roller Stator® 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® geometry provides a smooth running high efficient product.

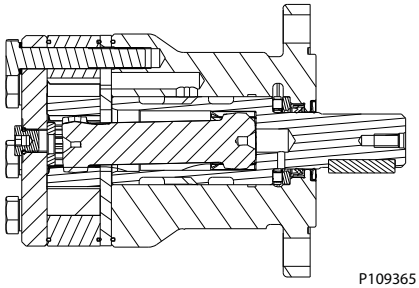
#### Typical Applications

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

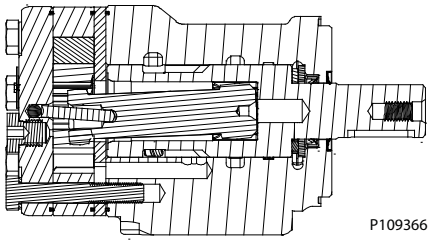
*Standard*



P109365

255/256 - Hydraulic Motor

*Standard*



P109366

## WR Product Line

### Specifications

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.

| CODE | Displacement cm³ [in³] | 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] |

## WR Displacement Performance

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 *Product Testing* on page 7.

**040**

40 cm³ [2.5 in³] / rev

Pressure - bar [psi] — Max. Cont. — Max. Inter.

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| Max. Inter. 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% 40 - 69% 0 - 39%

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.1 [.317] | 11 [97] | 22 [195] | 34 [301] | 45 [398] | 56 [496] | 67 [593] | 78 [690] | 90 [796] | 101 [894] | 112 [991] | 132 [1167] |

mm [in]

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

P109367

## WR Product Line

### 050

50 cm³ [3.1 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 207 [3000] |
|---|---|---|---|---|---|---|---|---|---|---|

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

Flow - lpm [gpm] / Max. Cont. / Max. Inter.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

Theoretical rpm

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9.9 [.389] | 14 [122] | 27 [195] | 41 [301] | 55 [398] | 69 [496] | 82 [593] | 96 [690] | 110 [796] | 124 [894] | 137 [1215] | 165 [1458] |

mm [in]

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

P109368

### 060

59 cm³ [3.6 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 207 [3000] |
|---|---|---|---|---|---|---|---|---|---|---|

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

Flow - lpm [gpm] / Max. Cont. / Max. Inter.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 [0.5] | 12 [106] **28** | 26 [230] **22** | 34 [301] **15** | 45 [398] **12** | | | | | | | | 34 |
| 4 [1] | 13 [115] **60** | 29 [257] **56** | 42 [372] **50** | 56 [496] **44** | 62 [549] **33** | 68 [602] **16** | | | | | | 67 |
| 8 [2] | 14 [124] **134** | 31 [274] **129** | 46 [407] **125** | 58 [513] **118** | 74 [655] **113** | 94 [832] **107** | 110 [974] **97** | 121 [1071] **87** | 137 [1212] **73** | 148 [1310] **58** | 168 [1487] **50** | 135 |
| 15 [4] | 12 [106] **250** | 30 [266] **245** | 45 [398] **240** | 60 [531] **232** | 75 [664] **225** | 95 [841] **217** | 108 [956] **208** | 122 [1080] **198** | 138 [1221] **185** | 150 [1328] **174** | 170 [1505] **168** | 253 |
| 23 [6] | 11 [97] **384** | 30 [266] **380** | 44 [389] **376** | 59 [522] **370** | 74 [655] **364** | 93 [823] **356** | 106 [938] **345** | 124 [1097] **331** | 138 [1221] **318** | 152 [1345] **307** | 172 [1522] **298** | 387 |
| 30 [8] | 10 [89] **502** | 29 [257] **496** | 43 [381] **494** | 58 [513] **490** | 72 [637] **485** | 92 [814] **478** | 104 [920] **468** | 123 [1089] **460** | 135 [1195] **450** | 148 [1310] **438** | 170 [1505] **431** | 505 |
| 38 [10] | 9 [80] **635** | 28 [248] **632** | 42 [372] **629** | 55 [487] **628** | 70 [620] **619** | 90 [797] **611** | 102 [903] **598** | 121 [1071] **589** | 133 [1177] **578** | 146 [1292] **561** | 168 [1487] **513** | 640 |
| 45 [12] | 8 [71] **755** | 24 [212] **748** | 39 [345] **745** | 52 [460] **741** | 69 [611] **735** | 87 [770] **729** | 100 [885] **718** | 118 [1044] **705** | 130 [1151] **688** | 145 [1283] **676** | 164 [1451] **659** | 758 |
| 53 [14] | 6 [53] **890** | 23 [204] **888** | 38 [336] **884** | 48 [425] **880** | 65 [575] **874** | 84 [743] **865** | 98 [867] **852** | 114 [1009] **840** | 127 [1124] **831** | 138 [1221] **820** | 162 [1434] **802** | 892 |
| 61 [16] | | 17 [150] **1021** | 29 [257] **1018** | 44 [389] **1011** | 62 [549] **1007** | 78 [690] **1000** | 90 [797] **993** | 106 [938] **984** | 121 [1071] **974** | 136 [1204] **962** | 160 [1416] **956** | 1026 |
| 68 [18] | | 10 [89] **1142** | 26 [230] **1140** | 40 [354] **1129** | 57 [504] **1112** | 73 [646] **1097** | 86 [761] **1085** | 102 [903] **1074** | 115 [1018] **1060** | 130 [1151] **1044** | 158 [1398] **1020** | 1145 |

Theoretical rpm

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

| Rotor Width | Theoretical Torque - Nm [lb-in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11.8 [.463] | 16 [142] | 33 [292] | 49 [434] | 65 [575] | 81 [717] | 98 [867] | 114 [1009] | 131 [1150] | 147 [1292] | 164 [1442] | 179 [1584] |

mm [in]

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

P109369

## WR Product Line

**070**

71 cm³ [4.3 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] |
|---|---|---|---|---|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 [0.5] | 13 [115] **26** | 30 [266] **23** | | | | | | | | | | 28 |
| 4 [1] | 14 [124] **55** | 32 [283] **50** | 66 [584] **40** | 73 [646] **34** | | | | | | | | 57 |
| 8 [2] | 16 [142] **112** | 34 [301] **106** | 70 [620] **94** | 88 [779] **89** | 104 [920] **81** | 120 [1062] **73** | 134 [1186] **66** | 149 [1319] **51** | | | | 113 |
| 15 [4] | 15 [133] **211** | 33 [292] **206** | 71 [628] **194** | 87 [770] **186** | 107 [947] **178** | 123 [1089] **172** | 139 [1230] **163** | 158 [1398] **152** | 171 [1513] **143** | 196 [1735] **125** | 211 [1867] **110** | 213 |
| 23 [6] | 14 [124] **324** | 31 [274] **319** | 66 [584] **306** | 83 [735] **298** | 104 [920] **288** | 124 [1097] **280** | 138 [1221] **270** | 157 [1389] **260** | 176 [1558] **248** | 192 [1699] **232** | 207 [1832] **221** | 326 |
| 30 [8] | 13 [115] **425** | 30 [266] **418** | 67 [593] **403** | 84 [743] **394** | 104 [920] **386** | 123 [1089] **376** | 137 [1212] **364** | 159 [1407] **350** | 174 [1540] **339** | 193 [1708] **326** | 203 [1797] **312** | 426 |
| 38 [10] | 10 [89] **539** | 29 [257] **537** | 65 [575] **529** | 82 [726] **520** | 103 [903] **508** | 115 [1018] **500** | 135 [1195] **486** | 152 [1345] **474** | 172 [1522] **458** | 186 [1646] **440** | 204 [1805] **425** | 539 |
| 45 [12] | 7 [62] **638** | 25 [221] **634** | 63 [558] **622** | 82 [726] **614** | 98 [867] **604** | 117 [1035] **594** | 132 [1168] **578** | 152 [1345] **566** | 169 [1496] **552** | 189 [1673] **538** | 199 [1761] **522** | 638 |
| 53 [14] | 5 [44] **752** | 21 [186] **751** | 58 [513] **743** | 75 [664] **736** | 94 [832] **728** | 115 [1018] **718** | 131 [1159] **705** | 147 [1301] **690** | 167 [1478] **675** | 187 [1655] **650** | 204 [1805] **630** | 752 |
| Max. Cont. 61 [16] | | 17 [150] **865** | 54 [478] **854** | 73 [646] **843** | 91 [805] **831** | 107 [947] **818** | 128 [1133] **807** | 143 [1266] **795** | 160 [1416] **782** | 177 [1566] **766** | 194 [1717] **750** | 865 |
| 68 [18] | | 16 [142] **965** | 48 [425] **960** | 70 [620] **956** | 88 [779] **945** | 106 [938] **932** | 122 [1080] **920** | 139 [1230] **902** | 156 [1381] **888** | 173 [1531] **876** | 191 [1690] **850** | 965 |
| Max. Inter. 76 [20] | | 12 [106] **1078** | 47 [416] **1070** | 65 [575] **1062** | 81 [717] **1048** | 100 [885] **1036** | 118 [1044] **1014** | 138 [1221] **1000** | 152 [1345] **988** | 173 [1531] **960** | 189 [1673] **944** | 1078 |

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

**Rotor Width**

13.8 [.542] mm [in]

Theoretical Torque - Nm [lb-in]

| 19 [169] | 39 [348] | 77 [685] | 97 [854] | 117 [1033] | 136 [1202] | 155 [1371] | 174 [1540] | 194 [1719] | 213 [1888] | 232 [2056] |
|---|---|---|---|---|---|---|---|---|---|---|

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

P109370

**080**

79 cm³ [4.9 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] |
|---|---|---|---|---|---|---|---|---|---|---|

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| Max. Inter. 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 |

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

**Rotor Width**

15.7 [.617] mm [in]

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]

P109371

## WR Product Line

### 090

88 cm³ [5.4 in³] / rev

Pressure - bar [psi]

| Max. Cont. | Max. Inter. |
|---|---|
| 172 [2500] | 190 [2750] | 207 [3000] |

**Intermittent Ratings -** 10% of Operation

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

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| Max. Inter. 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 |

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

| Rotor Width mm [in] | Theoretical Torque - Nm [lb-in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17.3 [.682] | 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]

P109372

### 100

100 cm³ [6.1 in³] / rev

Pressure - bar [psi]

| Max. Cont. | Max. Inter. |
|---|---|
| 172 [2500] | 190 [2750] | 207 [3000] |

**Intermittent Ratings -** 10% of Operation

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

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| 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 |
| Max. Inter. 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 |

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

| Rotor Width mm [in] | Theoretical Torque - Nm [lb-in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19.7 [.777] | 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]

P109373

## WR Product Line

**100**

100 cm³ [6.1 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| 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 |
| Max. Inter. 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 |

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

**Rotor Width**

Theoretical Torque - Nm [lb-in]

| 19.7 [.777] | 27 [239] | 56 [496] | 110 [974] | 137 [1212] | 166 [1469] | 193 [1708] | 220 [1947] | 247 [2186] | 275 [2434] | 303 [2682] | 330 [2921] |
|---|---|---|---|---|---|---|---|---|---|---|---|

mm [in]

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

P109373

**130**

129 cm³ [7.9 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| 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 |
| Max. Inter. 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 |

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

**Rotor Width**

Theoretical Torque - Nm [lb-in]

| 25.4 [1.002] | 35 [310] | 71 [628] | 142 [1257] | 177 [1566] | 212 [1876] | 248 [2195] | 283 [2504] | 318 [2814] | 354 [3133] | 389 [3442] | 425 [3761] |
|---|---|---|---|---|---|---|---|---|---|---|---|

mm [in]

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

P109375

## WR Product Line

### 160

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 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] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| 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 |
| Max. Inter. 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 |

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

**Rotor Width** 31.8 [1.252] mm [in]

Theoretical Torque - Nm [lb-in]

| 43 [383] | 89 [789] | 176 [1556] | 219 [1939] | 265 [2345] | 308 [2728] | 352 [3111] | 395 [3495] | 441 [3901] | 484 [4284] | 527 [4667] |
|---|---|---|---|---|---|---|---|---|---|---|

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

P109376

### 200

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 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] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 [0.5] | 38 [336] **10** | 87 [770] **8** | 172 [1522] **6** | 201 [1779] **5** | | | | | | | | 10 |
| 4 [1] | 47 [416] **20** | 103 [912] **19** | 164 [1451] **14** | 201 [1779] **12** | 244 [2159] **9** | 295 [2611] **6** | 328 [2903] **3** | | | | | 20 |
| 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** | | | 40 |
| 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** | 76 |
| 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** | 116 |
| 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** | 152 |
| 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** | 192 |
| 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** | 227 |
| 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** | 268 |
| Max. Cont. 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** | 308 |
| 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** | 343 |
| Max. Inter. 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** | 384 |

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

**Rotor Width** 39.4 [1.553] mm [in]

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] |
|---|---|---|---|---|---|---|---|---|---|---|

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

P109377

## WR Product Line

**240**

236 cm³ [14.4 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 [0.5] | 47 [416] **7** | 98 [867] **6** | 197 [1743] **3** | 247 [2186] **3** | | | | | | | | 8 |
| 4 [1] | 50 [443] **14** | 105 [929] **13** | 210 [1859] **11** | 260 [2301] **9** | 310 [2717] **7** | 354 [3133] **4** | 404 [3575] **4** | | | | | 16 |
| 8 [2] | 53 [469] **29** | 111 [982] **28** | 224 [1982] **26** | 277 [2451] **24** | 329 [2894] **21** | 377 [3336] **19** | 424 [3752] **16** | 469 [4151] **11** | 511 [4522] **8** | 582 [5151] **8** | | 32 |
| 15 [4] | 52 [460] **60** | 114 [1000] **59** | 236 [2062] **56** | 290 [2575] **53** | 346 [3062] **50** | 399 [3531] **47** | 449 [3974] **44** | 496 [4390] **40** | 541 [4788] **36** | 598 [5292] **33** | 638 [5646] **28** | 63 |
| 23 [6] | 47 [416] **93** | 109 [956] **91** | 227 [2009] **88** | 285 [2522] **85** | 342 [3027] **81** | 397 [3513] **77** | 449 [3974] **71** | 500 [4425] **66** | 548 [4850] **60** | 595 [5266] **55** | 642 [5682] **52** | 95 |
| 30 [8] | 42 [372] **125** | 104 [903] **123** | 221 [1956] **119** | 280 [2469] **116** | 336 [2974] **111** | 391 [3460] **106** | 445 [3938] **100** | 497 [4398] **93** | 547 [4841] **87** | 592 [5248] **79** | 640 [5664] **73** | 126 |
| 38 [10] | 35 [310] **158** | 95 [832] **155** | 213 [1885] **150** | 272 [2398] **147** | 328 [2903] **142** | 384 [3398] **137** | 437 [3867] **131** | 489 [4328] **123** | 541 [4788] **115** | 587 [5195] **106** | 635 [5620] **99** | 158 |
| 45 [12] | 23 [204] **189** | 85 [752] **186** | 203 [1797] **182** | 262 [2319] **178** | 319 [2823] **174** | 375 [3319] **168** | 428 [3788] **160** | 480 [4248] **153** | 531 [4699] **145** | 575 [5089] **134** | 623 [5514] **125** | 189 |
| 53 [14] | | 75 [655] **218** | 192 [1699] **214** | 250 [2213] **210** | 308 [2726] **205** | 365 [3310] **201** | 418 [3699] **191** | 470 [4160] **183** | 520 [4602] **174** | 564 [4991] **164** | 611 [5407] **154** | 220 |
| Max. Cont. 61 [16] | | 68 [593] **249** | 180 [1593] **245** | 238 [2106] **242** | 295 [2611] **236** | 350 [3106] **230** | 405 [3584] **222** | 458 [4053] **215** | 510 [4496] **205** | 551 [4876] **195** | 600 [5310] **184** | 252 |
| 68 [18] | | 56 [487] **279** | 165 [1460] **273** | 221 [1956] **270** | 281 [2469] **267** | 335 [2965] **260** | 388 [3434] **251** | 440 [3894] **241** | 490 [4337] **231** | 545 [4797] **221** | 590 [5222] **208** | 283 |
| Max. Inter. 76 [20] | | 40 [354] **315** | 154 [1345] **307** | 210 [1841] **303** | 264 [2336] **295** | 320 [2832] **290** | 376 [3310] **282** | 428 [3770] **272** | 480 [4221] **261** | 530 [4691] **250** | 580 [5133] **238** | 315 |

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

| Rotor Width mm [in] | Theoretical Torque - Nm [lb-in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 47.4 [1.865] | 66 [584] | 132 [1168] | 265 [2345] | 331 [2929] | 397 [3513] | 463 [4097] | 529 [4681] | 595 [5265] | 661 [5850] | 728 [6442] | 794 [7027] |

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

P109378

**250**

250 cm³ [15.3 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

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

**Intermittent Ratings -** 10% of Operation

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | 207 [3000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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] **179** | 198 [1752] **178** | 254 [2248] **177** | 312 [2761] **174** | 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 |
| Max. Cont. 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 |
| Max. Inter. 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 [2133] **220** | 304 |

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

| Rotor Width mm [in] | Theoretical Torque - Nm [lb-in] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 49.2 [1.938] | 69 [608] | 137 [1215] | 275 [2431] | 343 [3039] | 412 [3646] | 481 [4254] | 549 [4862] | 618 [5469] | 687 [6077] | 755 [6685] | 824 [7292] |

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

P109379

## WR Product Line

**290**

291 cm³ [17.8 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] |
|---|---|---|---|---|---|---|---|---|---|---|

**Intermittent Ratings -** 10% of Operation

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

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | 190 [2750] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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] **100** | 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 |
| Max. Cont. 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 |
| 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 |
| Max. Inter. 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% ☐ 40 - 69% ☐ 0 - 39% ■

**Rotor Width**

57.2 [2.252] mm [in]

Theoretical Torque - Nm [lb-in]

| 80 [707] | 160 [1415] | 240 [2122] | 320 [2829] | 400 [3537] | 480 [4244] | 560 [4952] | 639 [5659] | 719 [6366] | 799 [7074] | 879 [7781] |
|---|---|---|---|---|---|---|---|---|---|---|

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

P109380

**320**

322 cm³ [19.6 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

| 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] |
|---|---|---|---|---|---|---|---|---|---|

**Intermittent Ratings -** 10% of Operation

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

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | 155 [2250] | 172 [2500] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 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 |
| 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 |
| Max. Inter. 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 |

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

**Rotor Width**

63.5 [2.502] mm [in]

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] |
|---|---|---|---|---|---|---|---|---|---|

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

P109381

## WR Product Line

**400** — 400 cm³ [24.4 in³] / rev

Pressure - bar [psi] | Max. Cont. | Max. Inter.

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

| Flow - lpm [gpm] | 17 [250] | 35 [500] | 52 [750] | 69 [1000] | 86 [1250] | 104 [1500] | 121 [1750] | 138 [2000] | Theoretical rpm |
|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Max. Cont. 61 [16] | | 113 [1000] **152** | 191 [1690] **147** | 298 [2641] **145** | 390 [3448] **139** | 496 [4393] **130** | 560 [4959] **127** | 606 [5364] **121** | 153 |
| 68 [18] | | 96 [850] **170** | 178 [1575] **164** | 263 [2328] **163** | 365 [3230] **156** | 478 [4228] **146** | 517 [4572] **142** | 580 [5133] **137** | 170 |
| Max. Inter. 76 [20] | | 74 [655] **190** | 150 [1327] **185** | 240 [2122] **180** | 342 [3027] **174** | 436 [3855] **165** | 493 [4365] **160** | 560 [4956] **156** | 190 |

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

**Rotor Width** 78.9 [3.106] mm [in]

Theoretical Torque - Nm [lb-in]

| 112 [992] | 224 [1984] | 336 [2976] | 448 [3968] | 560 [4960] | 673 [5952] | 785 [6944] | 897 [7935] |
|---|---|---|---|---|---|---|---|

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

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## WR Product Line

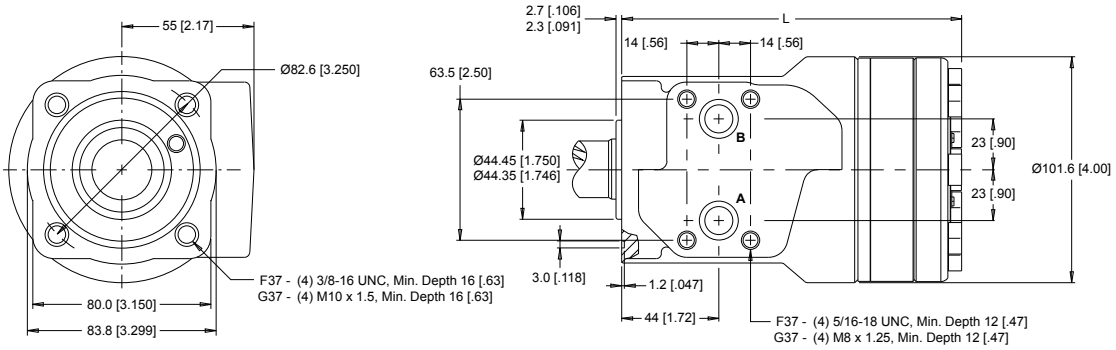
### WR 251 and 252 Series

#### WR 251 and 252 Series Housings

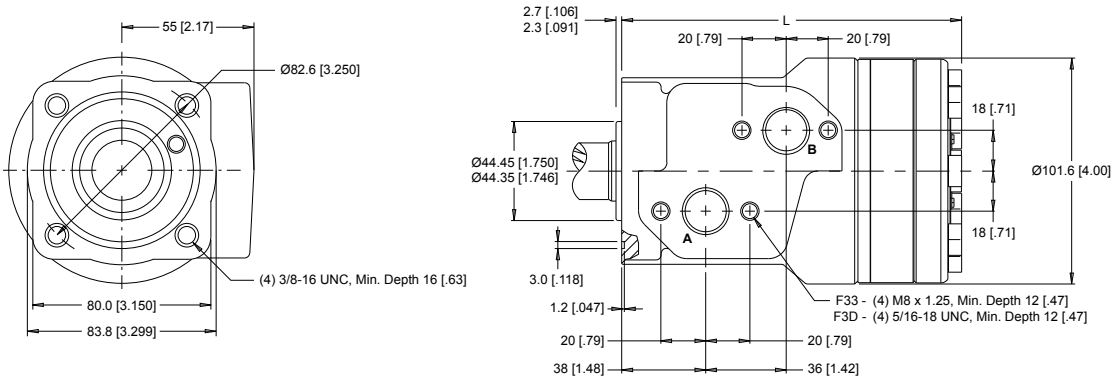
Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

Dimensions are charted in *WR 251 and 252 Series Technical Information* on page 76.

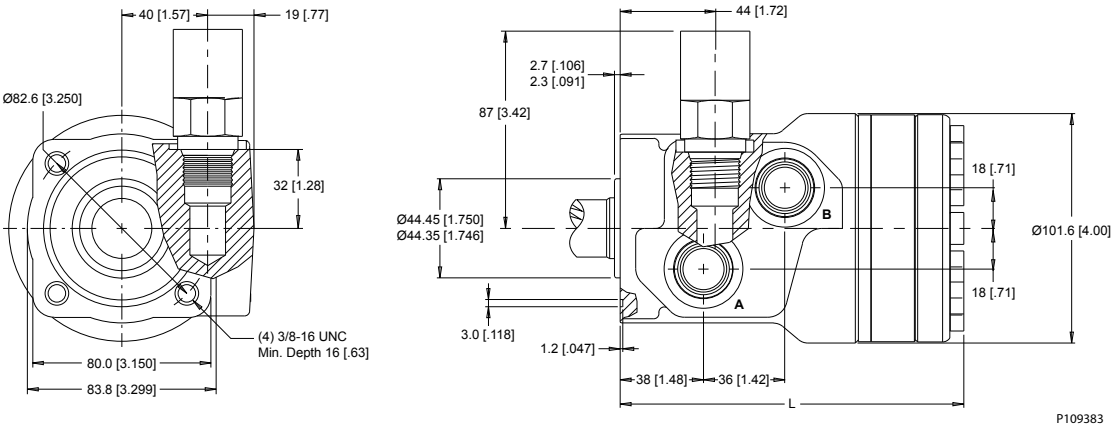
**4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS** **F37** 1/2" Drilled **G37** 1/2" Drilled




**4-HOLE, SQUARE MOUNT, OFFSET MANIFOLD PORTS** **F33** G 1/2 **F3D** 7/8-14 UNF



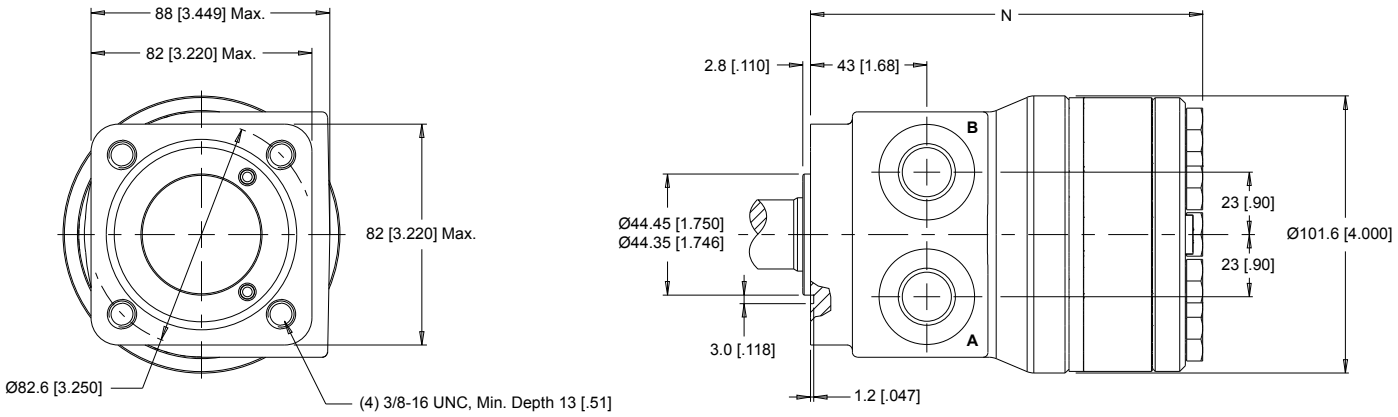

**4-HOLE, SQUARE MOUNT, OFFSET PORTS, VALVE CAVITY** **F39** 7/8-14 UNF



## WR Product Line

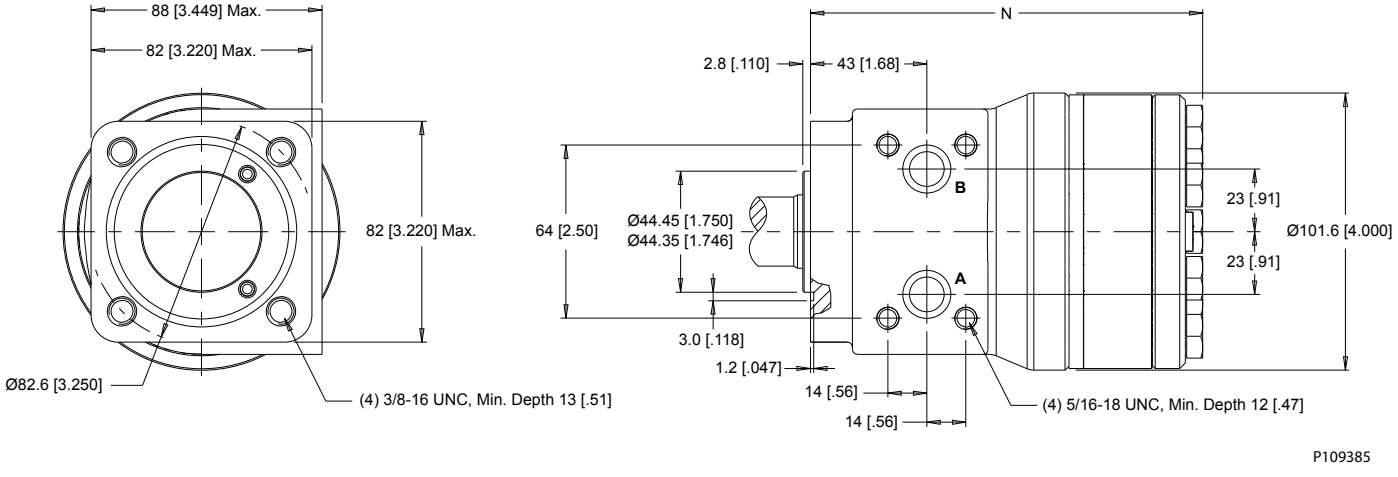
### 4-HOLE, SQUARE MOUNT, ALIGNED PORTS

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




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

**F37** 1/2" Drilled

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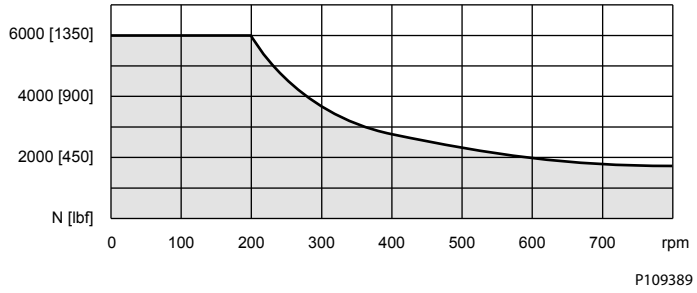
### WR 251 and 252 Series Technical Information

***Allowable Shaft Load / Bearing Curve***

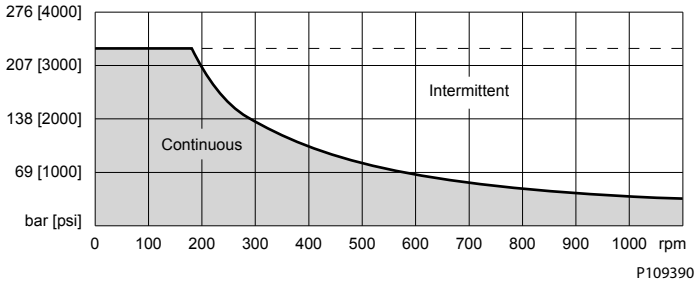
The bearing curve below represents the side load capacity of the motor at the centerline of the key for various motor speeds. Operating conditions within the shaded area will maintain acceptable oil film lubrication with recommended fluids. Operating conditions outside the shaded area are susceptible 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.

## WR Product Line

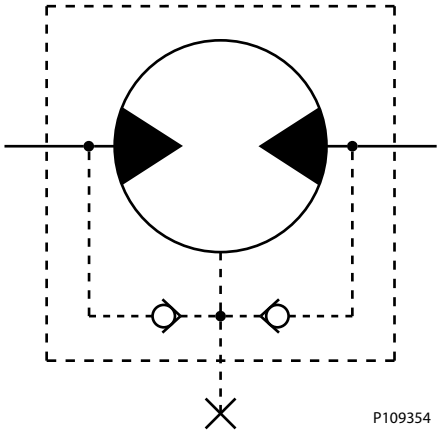



### *Permissible Shaft Seal Pressure*

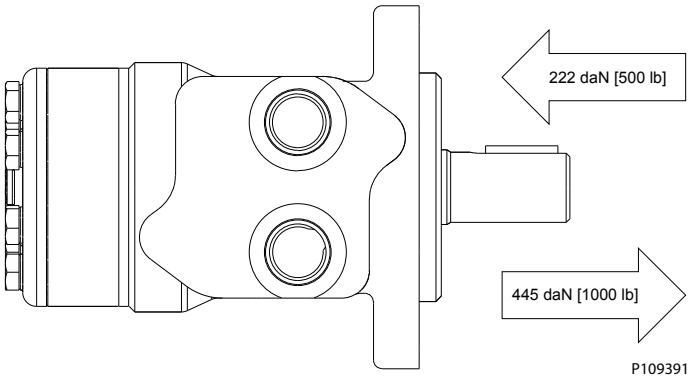
The curve below represents allowable seal pressure at various speeds. Operation in the gray area results in maintaining the rated life of the shaft seal. Actual shaft seal pressure depends on motor configuration.




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.



## WR Product Line




### *Length and Weight Chart*

251 and 252 series motor weights can vary ± 0.5 kg [1 lb] depending on model configurations such as housing, shaft, endcover, options etc.

Dimension N is the overall motor length from the rear of the motor to the mounting flange surface and is referenced on detailed housing drawings listed in *WR 251 and 252 Series Housings* on page 75.

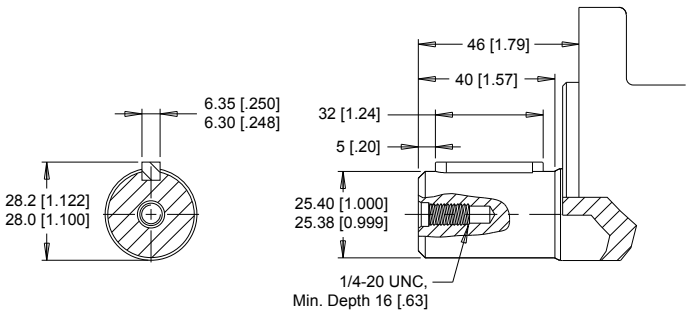
*Dimension N*

| # | Length | Weight |
|---|---|---|
| | mm [in] | kg [lb] |
| 040 | 127 [4.98] | 6.3 [14.0] |
| 050 | 128 [5.06] | 6.4 [14.2] |
| 060 | 130 [5.13] | 6.5 [14.3] |
| 070 | 132 [5.21] | 6.6 [14.5] |
| 080 | 134 [5.28] | 6.7 [14.8] |
| 090 | 136 [5.34] | 6.8 [14.9] |
| 100 | 138 [5.44] | 6.9 [15.1] |
| 115 | 141 [5.54] | 7.0 [15.3] |
| 130 | 144 [5.67] | 7.1 [15.6] |
| 160 | 150 [5.92] | 7.4 [16.2] |
| 200 | 158 [6.22] | 7.7 [17.0] |
| 240 | 166 [6.53] | 8.0 [17.7] |
| 250 | 168 [6.60] | 8.1 [17.9] |
| 290 | 176 [6.92] | 8.5 [18.7] |
| 320 | 182 [7.17] | 8.7 [19.2] |
| 400 | 197 [7.77] | 9.4 [20.7] |

## WR Product Line

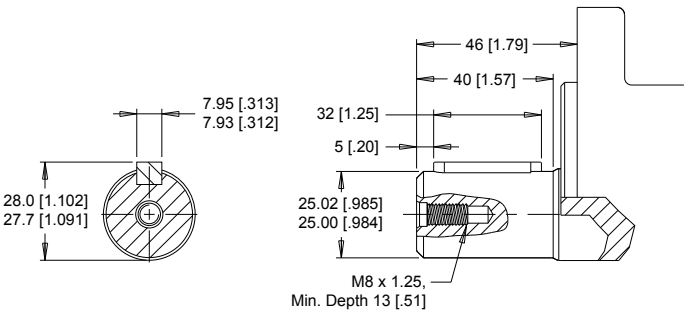
### WR 251 and 252 Series Shafts

**10** 1" Straight




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

**12** 25mm Straight

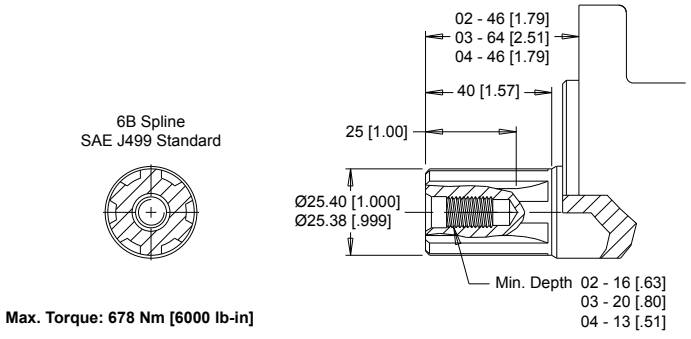



**Max. Torque: 678 Nm [6000 lb-in]**

**02** 1" 6B Spline, 1/4-20 Tap

**04** 1" 6B Spline, M8x1.25 Tap

**03** 1" 6B Spline, 5/16-18




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

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## WR Product Line

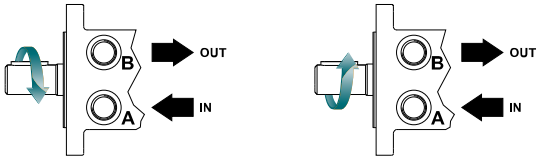
### WR 251 and 252 Series Ordering Information

□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

1 2 3 4 5 6 7 8

#### 1. CHOOSE SERIES DESIGNATION

| | |
|---|---|
| **251** | Standard Rotation |
| **252** | Reverse Rotation |




▶ The 251 & 252 series are bi-directional.

#### 2. SELECT A DISPLACEMENT OPTION

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

#### 3. SELECT A MOUNT & PORT OPTION

| | |
|---|---|
| **A10** | 2-Hole, SAE A Mount, Aligned Ports, 1/2-14 NPT |
| **A11** | 2-Hole, SAE A Mount, Aligned Ports, 7/8-14 UNF |
| **A17** | 2-Hole, SAE A Mount, Aligned Manifold Ports, 1/2” Drilled |
| **A18** | 2-Hole, SAE A Mount, Offset Manifold Ports, G 1/2 |
| **A71** | 2-Hole, SAE A Mount, Aligned Side Ports, 7/8-14 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 |

#### 4. SELECT A SHAFT OPTION

| | |
|---|---|
| **02** | 6B Spline, 1/4 Tap |
| **03** | 6B Spline, 5/16 Tap (Ext) |
| **04** | 6B Spline, M8 Tap |
| **10** | 1” Straight |
| **12** | 25mm Straight |

▶ The 03 extended shaft is 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 |

#### 7. SELECT AN ADD-ON OPTION

| | |
|---|---|
| **A** | Standard |
| **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 |

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## WR Product Line

### WR 255 and 256 Series

#### WR 255 and 256 Series Housings

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

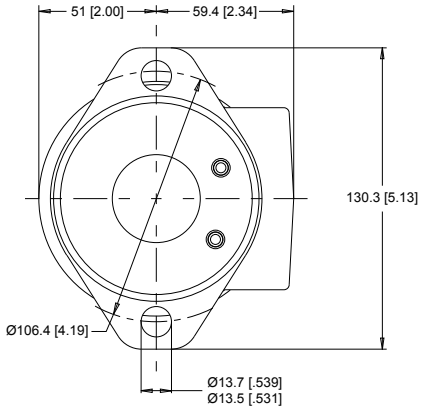
Dimensions are charted in *WR 255 and 256 Series Technical Information* on page 85.

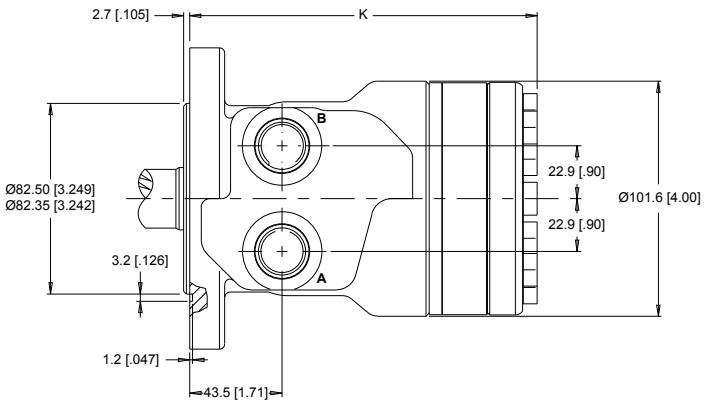
(TP) - Taller Pilot Height. Refer to detailed drawing for dimensional differences.

## WR Product Line

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

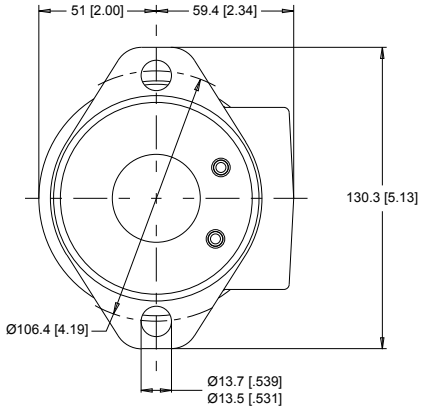
**A10** 1/2-14 NPT **A11** 7/8-14 UNF

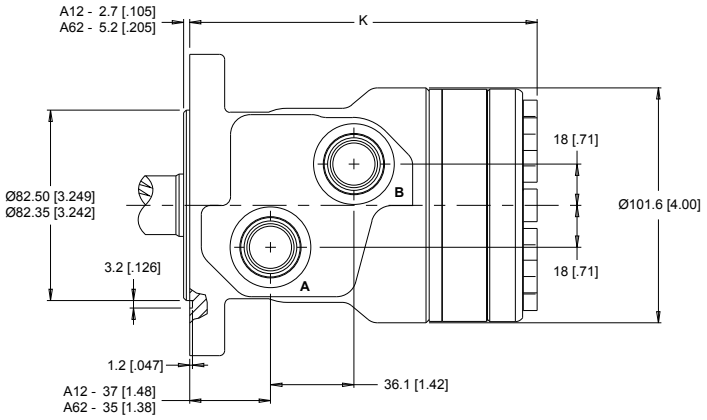



### 2-HOLE, SAE A MOUNT, OFFSET PORTS

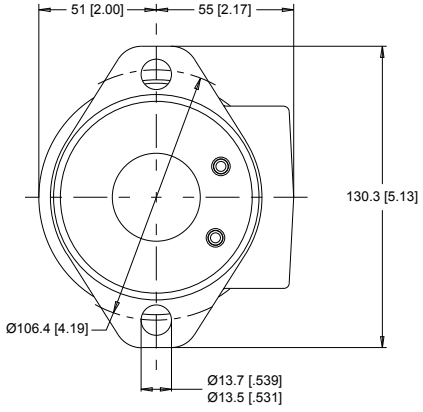
**A12** G 1/2 **A62** G 1/2 (TP)

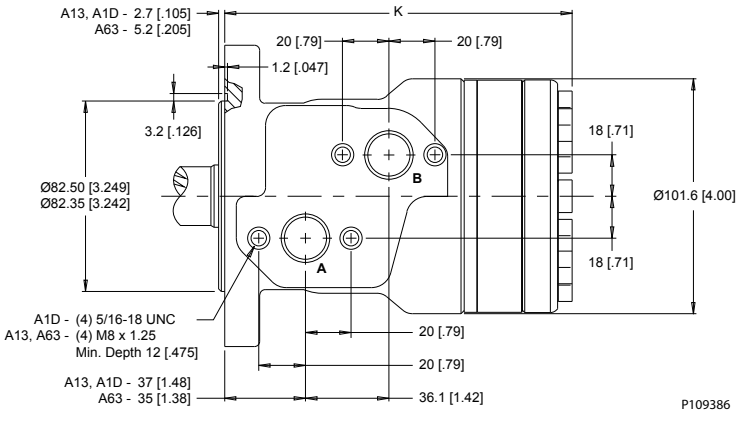



### 2-HOLE, SAE A MOUNT, OFFSET MANIFOLD PORTS

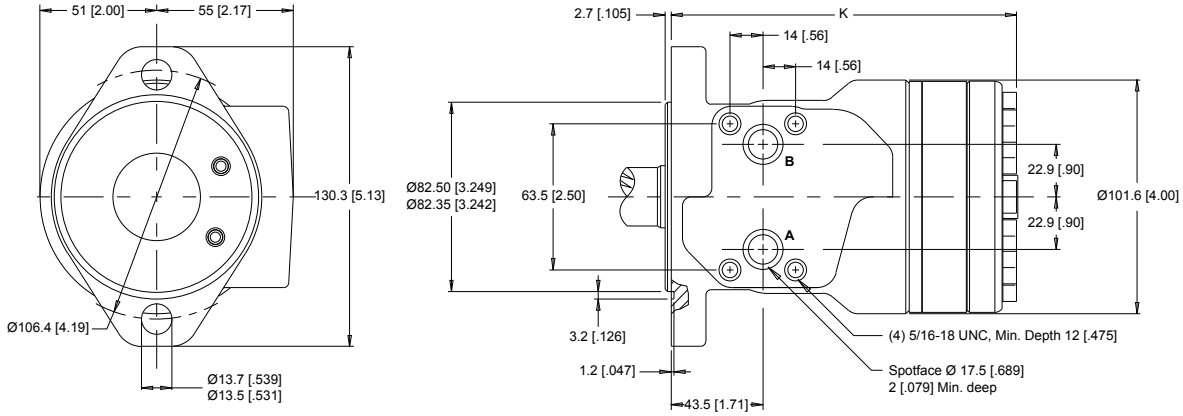
**A13** G 1/2 **A1D** 7/8-14 UNF **A63** G 1/2 (TP)



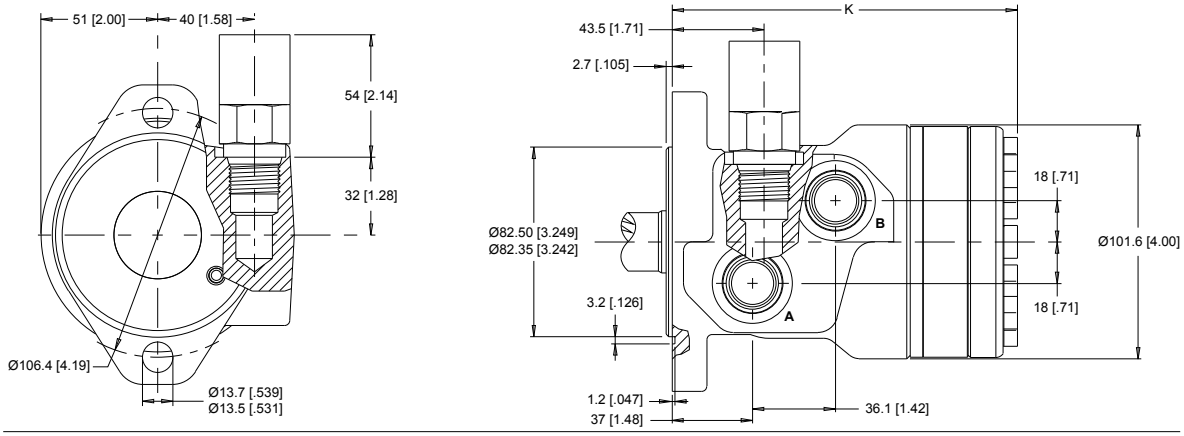



## WR Product Line

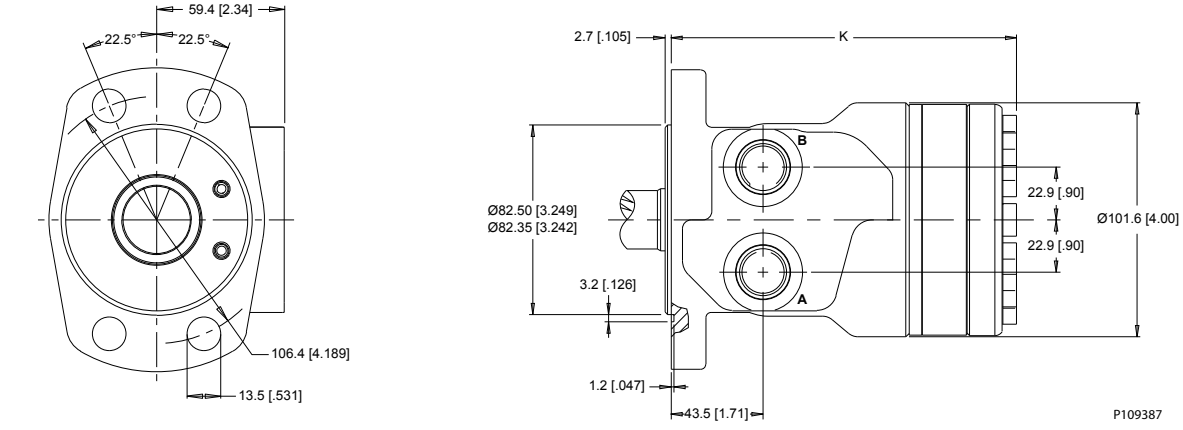
### 2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS — A17 1/2" Drilled




### 2-HOLE, SAE A MOUNT, OFFSET PORTS, VALVE CAVITY — A19 7/8-14 UNF



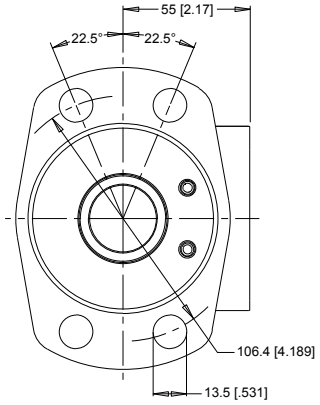

### 4-HOLE, MAGNETO MOUNT, ALIGNED PORTS — A30 1/2-14 NPT — A31 7/8-14 UNF

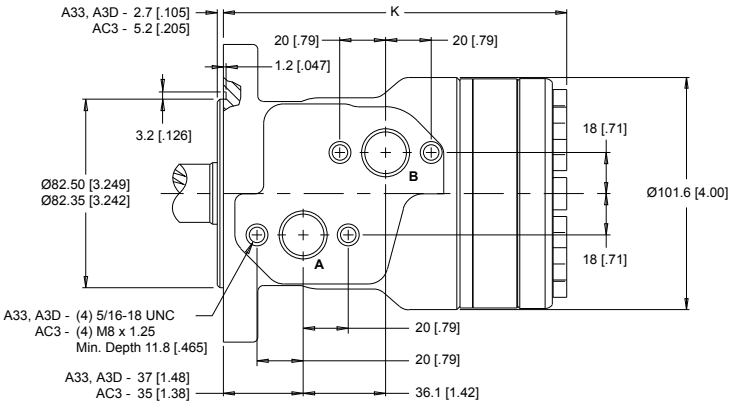


## WR Product Line

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

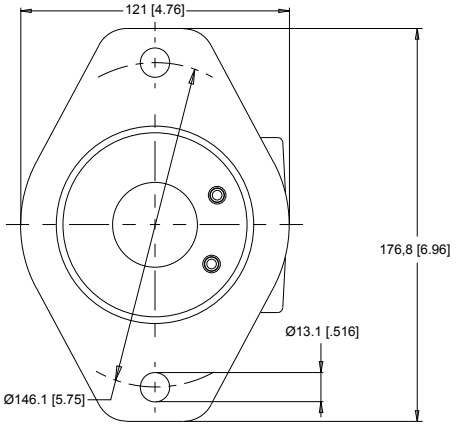
**A33** G 1/2 **A3D** 7/8-14 UNF **AC3** G 1/2 (TP)

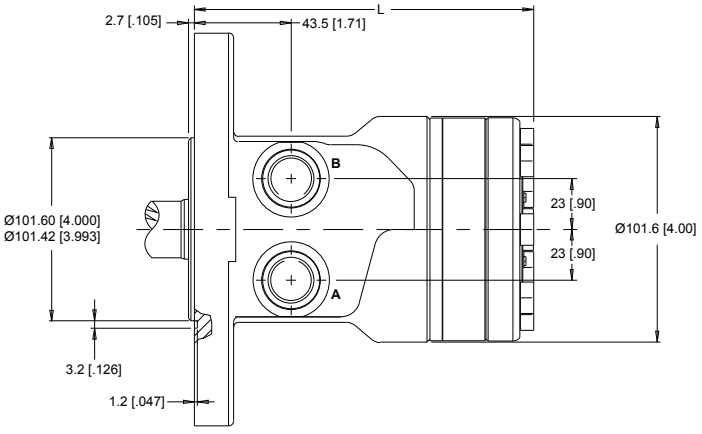



### 2-HOLE, SAE B MOUNT, ALIGNED PORTS

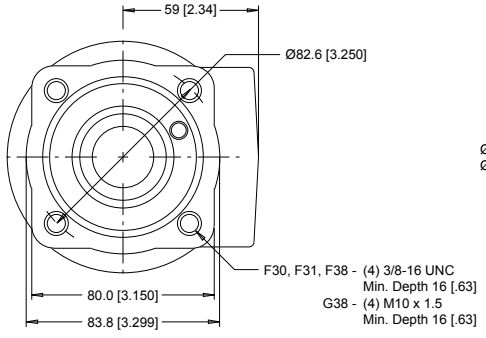
**B11** 7/8-14 UNF **B18** G 1/2

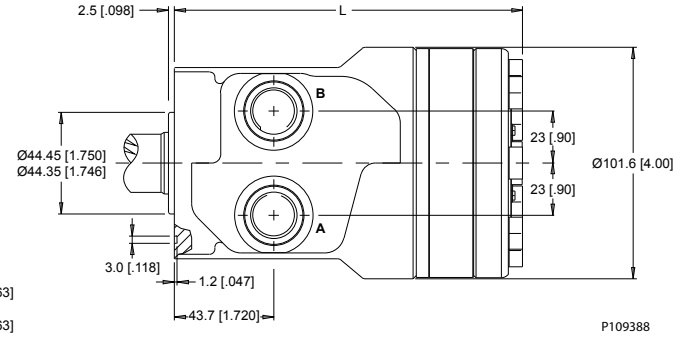



### 4-HOLE, SQUARE MOUNT, ALIGNED PORTS

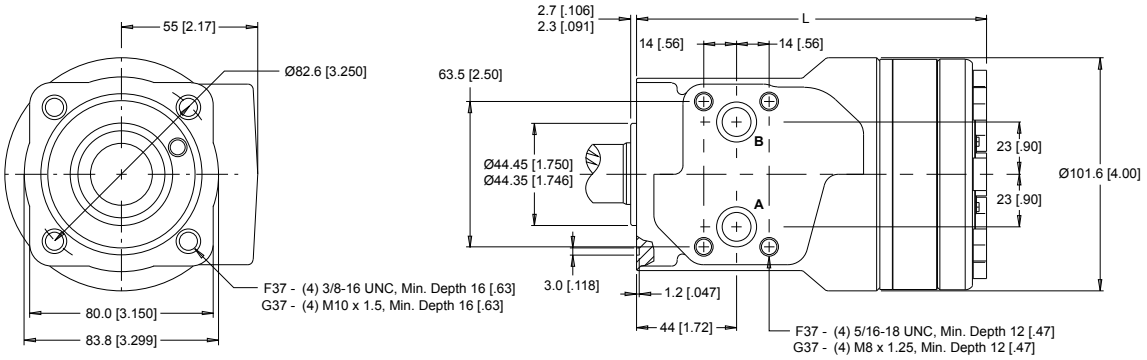
**F30** 1/2-14 NPT **F31** 7/8-14 UNF **F38** G 1/2 **G38** G 1/2



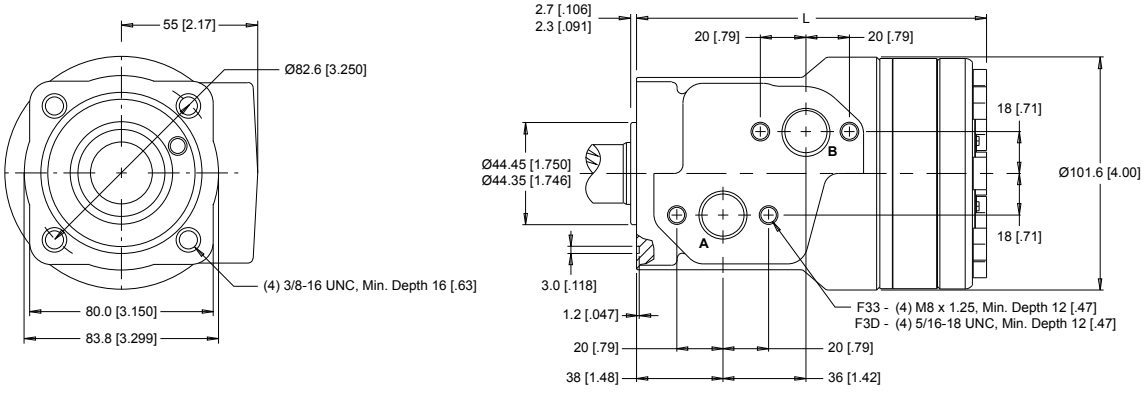



## WR Product Line

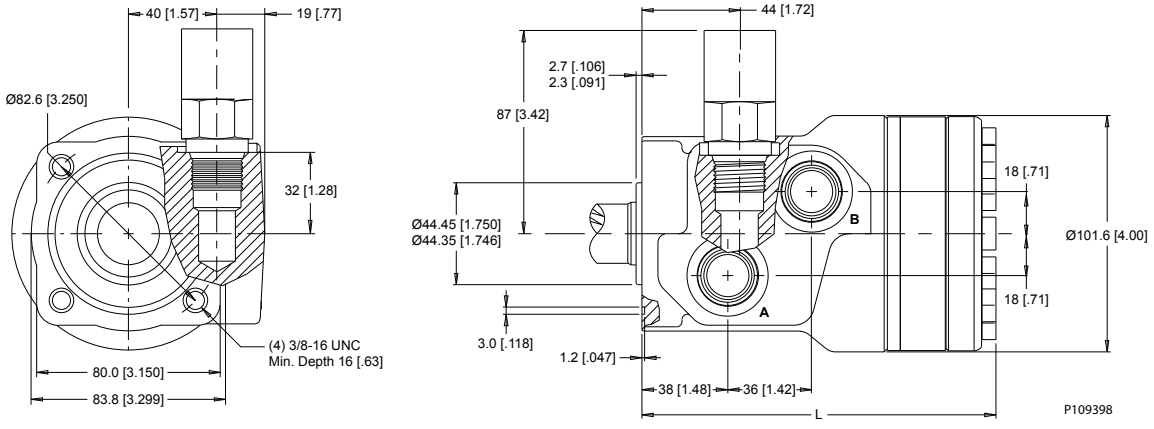
**4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS** **F37** 1/2" Drilled **G37** 1/2" Drilled




**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



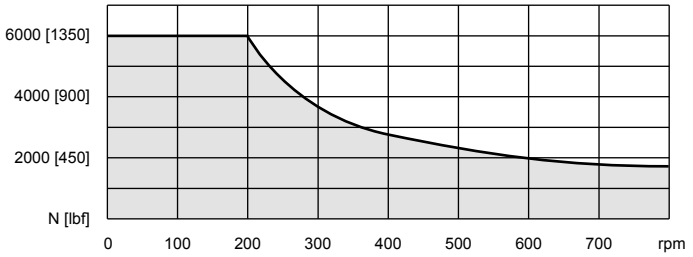

**WR 255 and 256 Series Technical Information**

***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

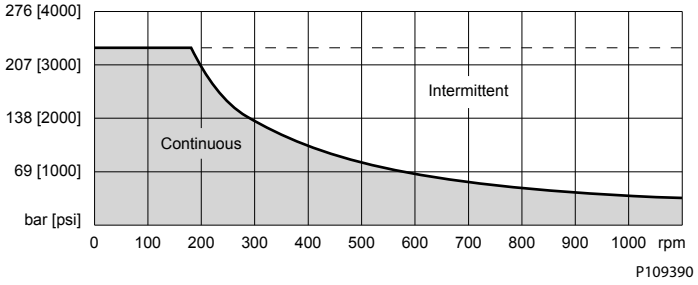
## WR Product Line

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.

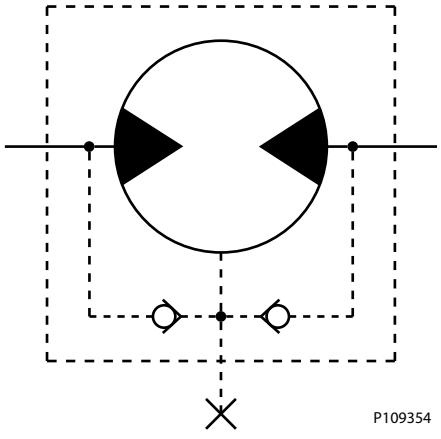



### *Permissible Shaft Seal Pressure*

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.

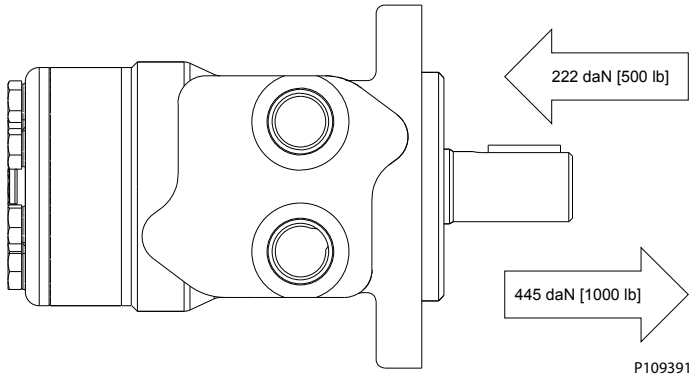



With check valves and drain connection, the shaft seal pressure equals pressure in the drain line. With check valves and no drain connection, shaft seal pressure is identical to output pressure. No check valves and no drain connection, the shaft seal pressure is identical to the average value of input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



## WR Product Line

### *Thrust Load*




### *Length and Weight Chart*

255 and 256 series motor weights can vary ± 0.5 kg [1 lb] depending on model configurations such as housing, shaft, endcover, options etc.

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 in *WR 255 and 256 Series Housings* on page 81.

*Dimension K*

| # | 3 mm Pilot | 8 mm 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 in *WR 255 and 256 Series Housings* on page 81.

## WR Product Line

*Dimension L*

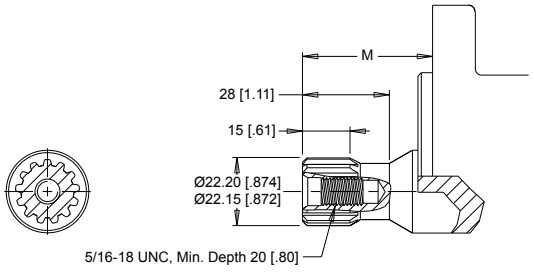
| # | Square and B Mounts | B Mount Weight | Sq. Mount Weight |
|---|---|---|---|
| | mm [in] | kg [lb] | kg [lb] |
| 040 | 142 [5.60] | 7.8 [17.2] | 5.3 [11.8] |
| 050 | 144 [5.67] | 7.8 [17.2] | 5.3 [11.9] |
| 060 | 146 [5.74] | 7.9 [17.4] | 5.4 [11.9] |
| 070 | 147 [5.80] | 7.9 [17.4] | 5.4 [11.9] |
| 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] |

## WR Product Line

### WR 255 and 256 Series Shafts

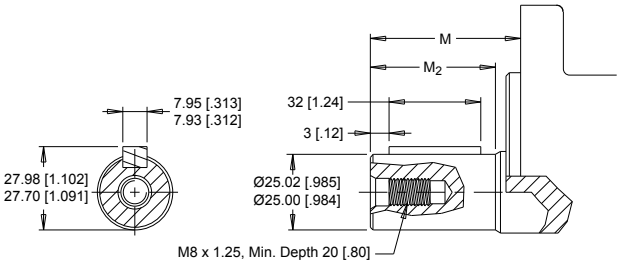
***Mounting / Shaft Length Chart***

**01** 7/8" 13 Tooth Spline



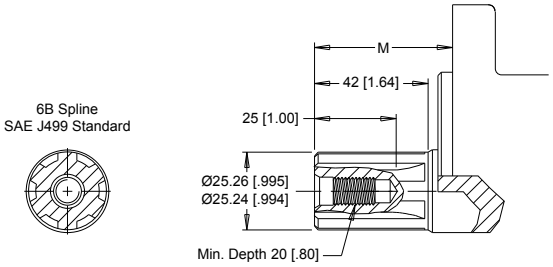

**Max. Torque: 170 Nm [1500 lb-in]**

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



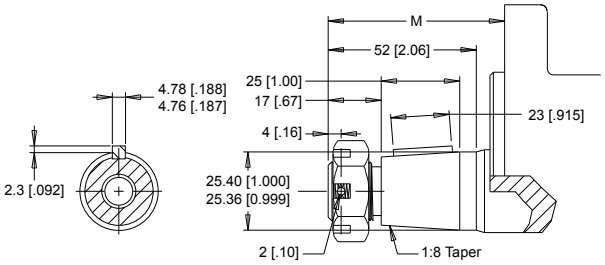

**Max. Torque: 678 Nm [6000 lb-in]**

**02** 1" 6B Spline, 5/16-18 Tap **04** 1" 6B Spline, M8x1.25 Tap




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

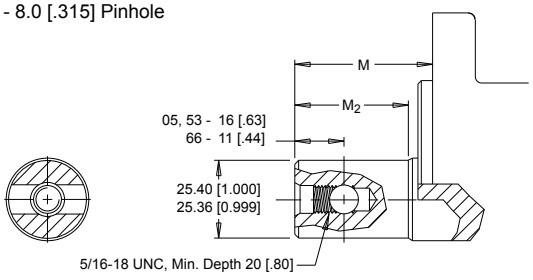
**13** 1" Tapered




▶ A slotted hex nut is standard on this shaft.

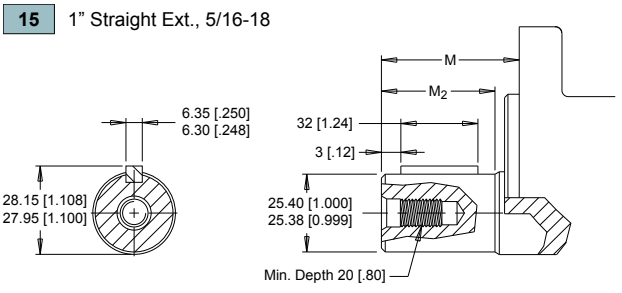
**Max. Torque: 655 Nm [5800 lb-in]**

**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, 5/16-18 Tap **11** 1" Straight, M8x1.25 Tap
**15** 1" Straight Ext., 5/16-18




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

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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 $M_2$ 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.

| # | 3 mm Pilot | 5 mm Pilot | $M_2$ |
|---|---|---|---|
| | 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] |

## WR Product Line

| # | 3 mm Pilot | 5 mm Pilot | $M_2$ |
|---|---|---|---|
| | mm [in] | mm [in] | mm [in] |
| 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] |

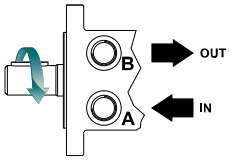
## WR Product Line

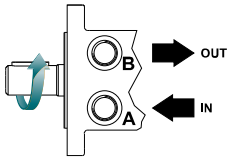
### WR 255 and 256 Series Ordering Information

1 2 3 4 5 6 7 8

#### 1. CHOOSE SERIES DESIGNATION

| | |
|---|---|
| **255** | Standard Rotation |
| **256** | Reverse Rotation |




▶ The 255 & 256 series are bi-directional.

#### 2. SELECT A DISPLACEMENT OPTION

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

#### 3. SELECT A MOUNT & PORT OPTION

| | |
|---|---|
| **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 |
| **A1D** | 2-Hole, SAE A Mount, Offset Manifold Ports, 7/8-14 UNF |
| **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 |
| **A33** | 4-Hole, Magneto Mount, Offset Manifold Ports, G 1/2 |
| **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) |
| **AC3** | 4-Hole, Magneto Mount, Offset Manifold Ports, G 1/2 (TP) |
| **B11** | 2-Hole, SAE B Mount, Aligned Ports, 7/8-14 UNF |
| **B18** | 2-Hole, SAE B Mount, Aligned Ports, G 1/2 |
| **F30** | 4-Hole, Square Mount, Aligned Ports, 1/2-14 NPT |
| **F31** | 4-Hole, Square Mount, Aligned Ports, 7/8-14 UNF |
| **F33** | 4-Hole, Square Mount, Offset Manifold Ports, G 1/2 |
| **F37** | 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

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

#### 4. SELECT A SHAFT OPTION

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

| | |
|---|---|
| **A** | Black |
| **B** | Black, Unpainted Mounting Surface |

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

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

▶ Valve cavity is only available on the A19 & F39 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 |
| **EG** | Viton Shaft Seal |

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Krokamp 35
D-24539 Neumünster, Germany
Phone: +49 4321 871 0

**Danfoss**
**Power Solutions ApS**
Nordborgvej 81
DK-6430 Nordborg, Denmark
Phone: +45 7488 2222

**Danfoss**
**Power Solutions Trading (Shanghai) Co., Ltd.**
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