

ENGINEERING
TOMORROW



Technical Information

WD, WP and WR Series Orbital Motors



Revision history*Table of revisions*

Date	Changed	Rev
December 2019	Conversion to CMS/ET Danfoss layout.	0201
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Contents

Technical Information

Operating Recommendations.....	4
Oil Type.....	4
Fluid Viscosity and Filtration.....	4
Installation and Start-up.....	4
Motor Protection.....	4
Hydraulic Motor Safety Precaution.....	4
Motor/Brake Precaution.....	5
Motor Connections.....	6
Product Testing.....	7
Allowable Bearing and Shaft Loading.....	7
Vehicle Drive Calculations.....	9
Induced Side Load.....	12
Hydraulic Equations.....	13
Shaft Nut Information.....	14

Optional Motor Features

Speed Sensor Options.....	16
Freeturning Rotor Option.....	19
Valve Cavity Option.....	19
Slinger Seal Option.....	20

WD Product Line

WD Introduction.....	21
WD Functional Charts.....	22
WD 145/146 Series.....	28
145/146 Series Housings.....	28
145/146 Series Technical Data.....	30
145/146 Series Shafts.....	33
145/146 Series Order Codes.....	35

WP Product Line

WP Introduction.....	36
WP Functional Charts.....	37
155/156 Series.....	45
155/156 Series Housings.....	45
155/156 Series Technical Data.....	51
155/156 Series Shafts.....	55
155/156 Order Codes.....	57
WP 157 and 158 Series.....	60
WP 157 and 158 Series Housings.....	60
WP 157 and 158 Series Technical Information.....	60
WP 157 and 158 Series Shafts.....	62
WP 157 and 158 Series Ordering Information.....	64

WR Product Line

WR Product Line Introduction.....	65
WR Displacement Performance.....	66
WR 251 and 252 Series.....	75
WR 251 and 252 Series Housings.....	75
WR 251 and 252 Series Technical Information.....	76
WR 251 and 252 Series Shafts.....	79
WR 251 and 252 Series Ordering Information.....	80
WR 255 and 256 Series.....	81
WR 255 and 256 Series Housings.....	81
WR 255 and 256 Series Technical Information.....	85
WR 255 and 256 Series Shafts.....	89
WR 255 and 256 Series Ordering Information.....	91

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.

Technical Information

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.

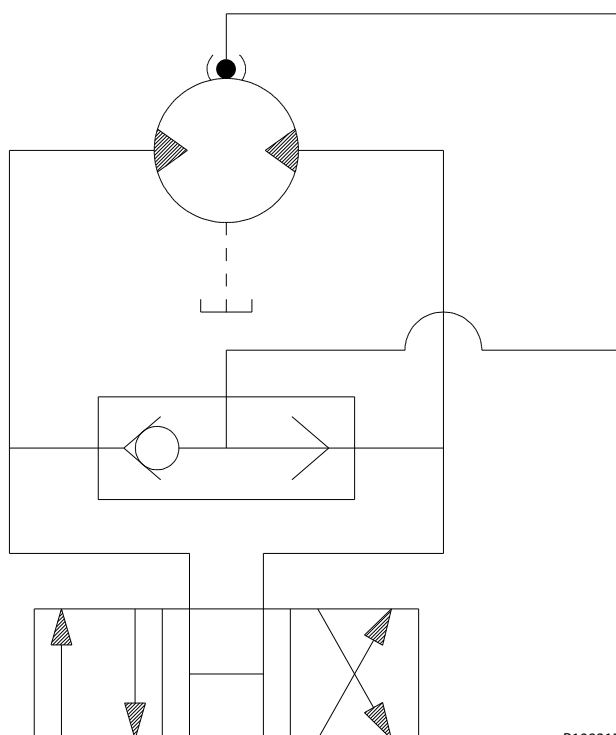
! Caution

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



P109317

Technical Information

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.

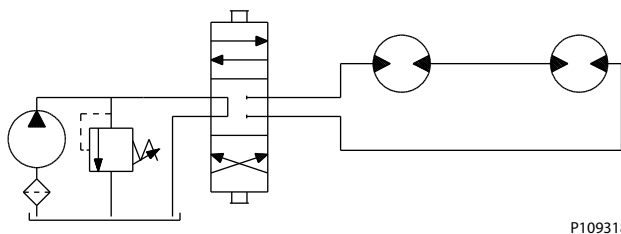
Motor Connections

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.

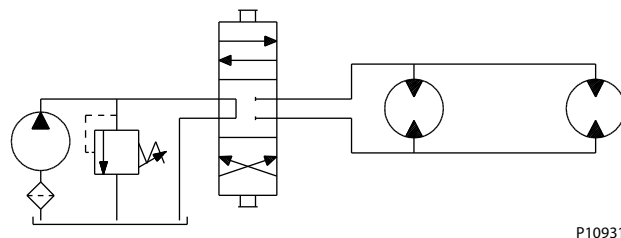
Series Circuit



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

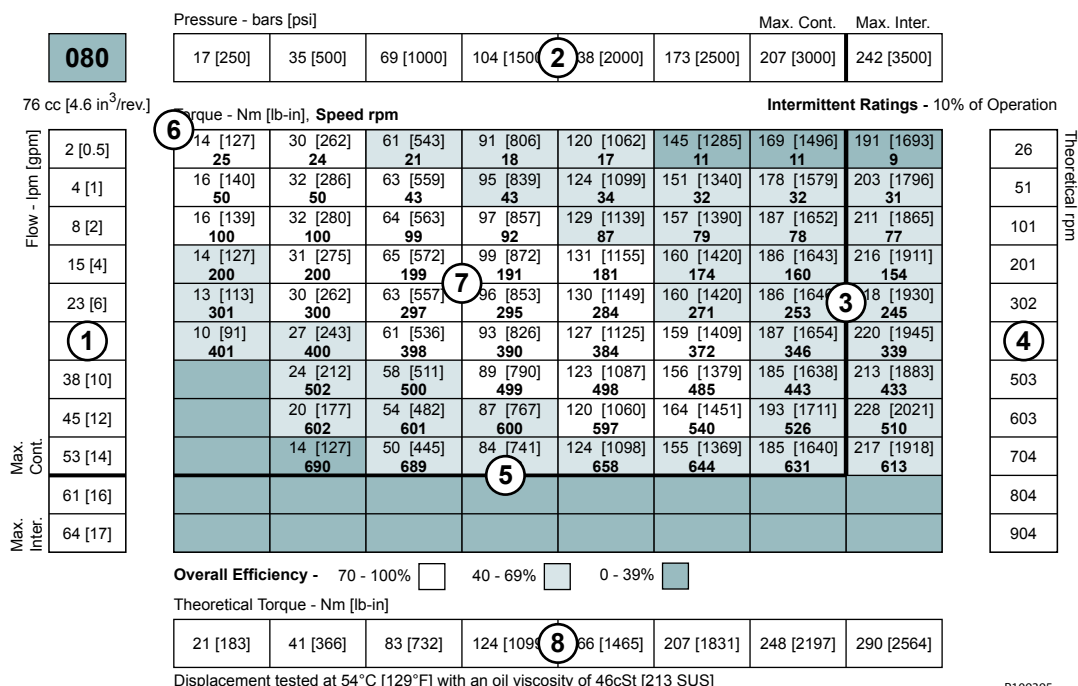


The motor circuits shown above are for illustration purposes only. Components and circuitry for actual applications may vary greatly and should be chosen based on the application.

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.



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

Allowable Bearing 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.

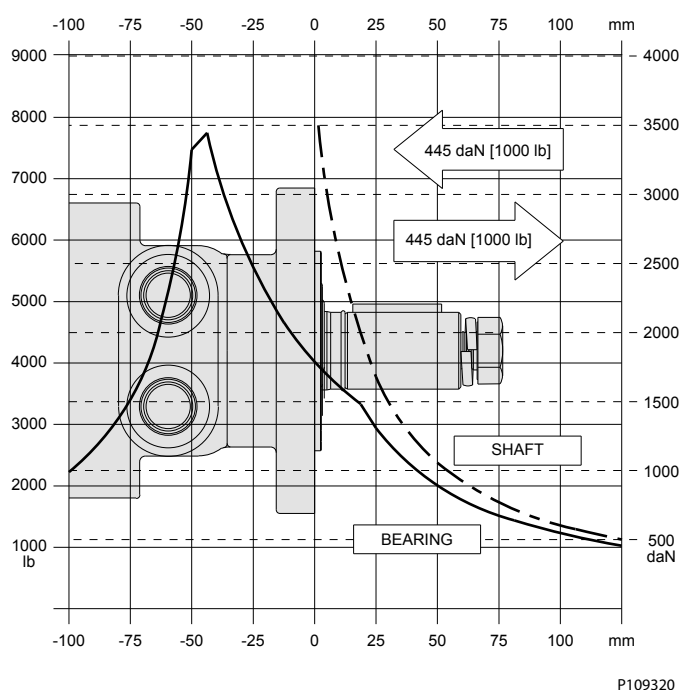
The bearing curves for each model are based on laboratory analysis and testing conducted at Danfoss. The shaft loading is based on a 3:1 safety factor and 330 Kpsi tensile strength. The allowable load is the lower of the curves at a given point. For instance, one inch in front of the mounting flange 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 [10 ⁶ revolutions]
L_{10}	nominal rating life
C	dynamic load rating

Technical Information

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

$$\text{RPM} = (2.65 \times \text{KPH} \times G) / r_m \text{ or } \text{RPM} = (168 \times \text{MPH} \times G) / r_i$$

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

$$\text{RPM} = (168 \times 5 \times 1) / 16 = 52.5$$

Technical Information

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:

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

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.

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

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.

Technical Information

To convert incline degrees to % Grade:

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

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

$$\text{Example: GR} = (20 / 100) \times 1500 \text{ lbs} = 300 \text{ lbs}$$

Step Three: Determine Acceleration Force

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

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

t time to maximum speed (seconds)

$$\text{Example: FA} = (5 \times 1500 \text{ lbs}) / (22 \times 10) = 34 \text{ lbs}$$

Step Four: Determine Drawbar Pull

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

Step Five: Determine Total Tractive Effort

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

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

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

Step Six: Determine Motor Torque

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

$$\text{T} = (\text{TE} \times r_m) / (M \times G) \text{ Nm per motor or } \text{T} = (\text{TE} \times r_i) / (M \times G) \text{ lb-in per motor}$$

M number of driving motors

$$\text{Example: T} = (367 \times 16) / (2 \times 1) \text{ lb-in/motor} = 2936 \text{ lb-in}$$

Step Seven: Determine Wheel Slip

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

$$\text{TS} = (W \times f \times r_m) / G \text{ (Nm per motor) or } \text{TS} = (W \times f \times r_i) / G \text{ (lb-in per motor)}$$

f coefficient of friction (see [Coefficient of friction \(f\)](#) on page 11)

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

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

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.

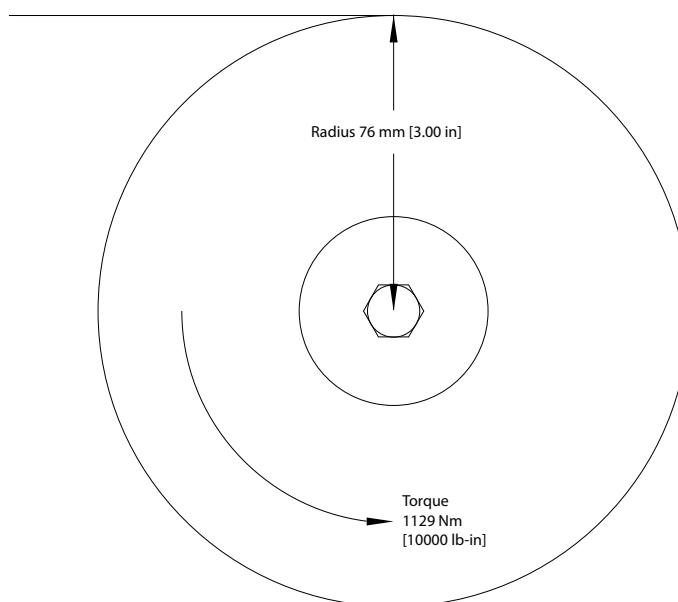
$$RL = \sqrt{W^2 + (T / r_i)^2} \text{ lb or } RL = \sqrt{W^2 + (T / r_m)^2} \text{ kg}$$

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

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

Induced Side Load

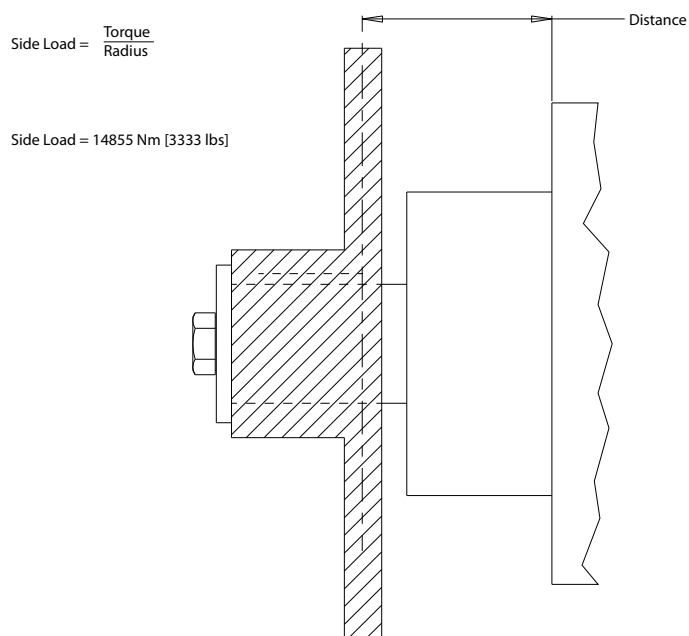
In many cases, pulleys or sprockets may be used to transmit the torque produced by the motor. Use of these components will create a torque induced side load on the motor shaft and bearings. It is important that this load be taken into consideration when choosing a motor with sufficient bearing and shaft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



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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



P109322

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

Theo. Torque (lb-in) $(\text{Bar} \times \text{Disp. (cm}^3/\text{rev)}) / 20 \text{ pi}$
 $(\text{PSI} \times \text{Disp. (in}^3/\text{rev)}) / 6.28$

Power In (HP) $(\text{Bar} \times \text{LPM}) / 600$
 $(\text{PSI} \times \text{GPM}) / 1714$

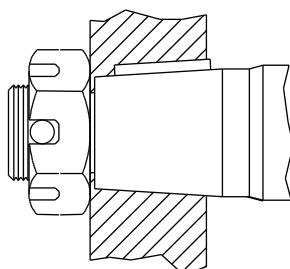
Power Out (HP) $(\text{Torque (Nm)} \times \text{RPM}) / 9543$
 $(\text{Torque (lb-in)} \times \text{RPM}) / 63024$

Technical Information

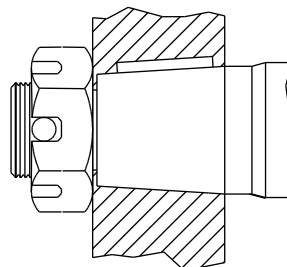
Shaft Nut Information

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



Incorrect



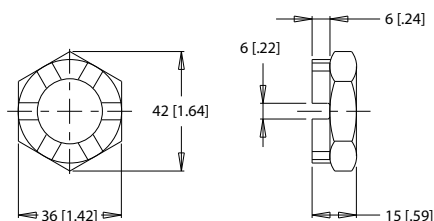
Correct

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Technical Information

35MM TAPERED SHAFTS M24 x 1.5 Thread

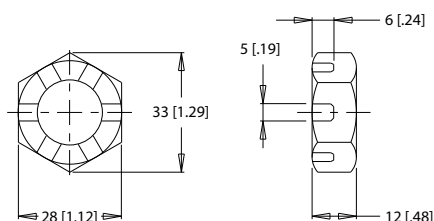
A Slotted Nut



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

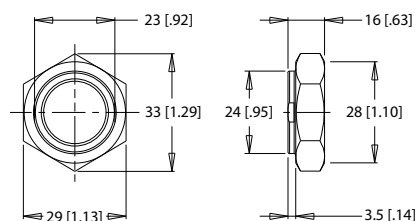
1" TAPERED SHAFTS 3/4-28 Thread

A Slotted Nut



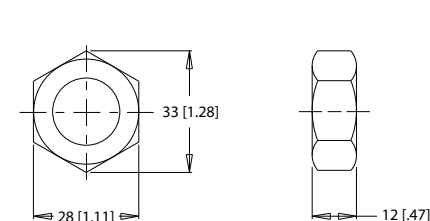
Torque Specifications: 20 - 23 daNm [150 - 170 ft.lb.]

B Lock Nut



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

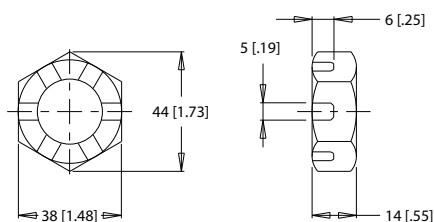
C Solid Nut



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

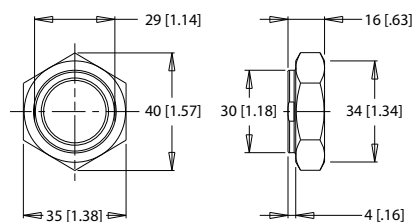
1-1/4" TAPERED SHAFTS 1-20 Thread

A Slotted Nut



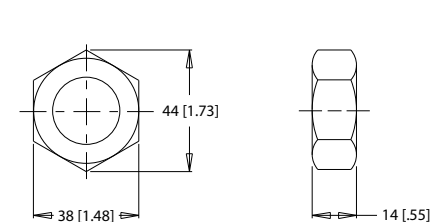
Torque Specifications: 38 daNm [280 ft.lb.] Max.

B Lock Nut



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

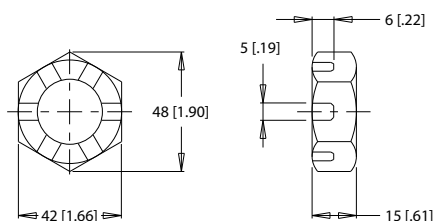
C Solid Nut



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

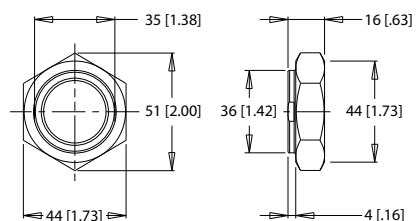
1-3/8" & 1-1/2" TAPERED SHAFTS 1 1/8-18 Thread

A Slotted Nut



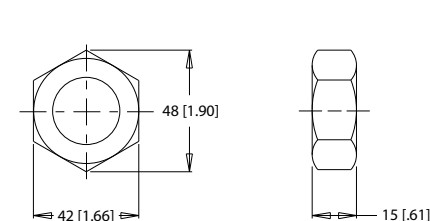
Torque Specifications: 41 - 54 daNm [300 - 400 ft.lb.]

B Lock Nut



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

C Solid Nut



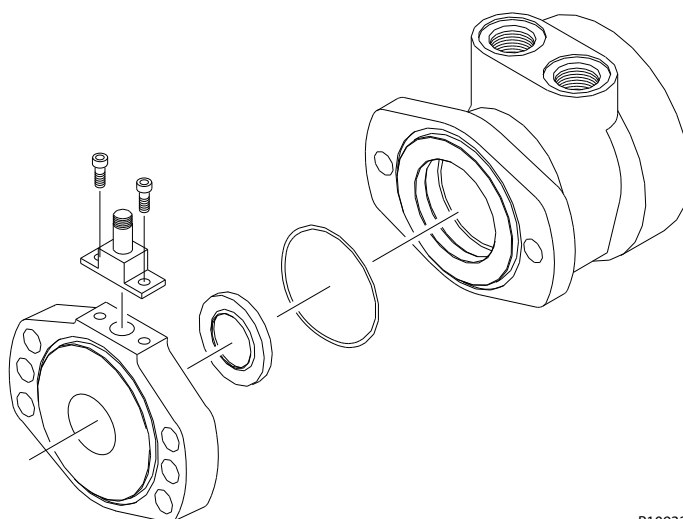
Torque Specifications: 41 - 54 daNm [300 - 400 ft.lb.]

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.



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

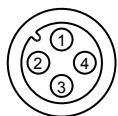
Supply voltages	7.5-24 Vdc
Maximum output off voltage	24 V
Maximum continuous output current	< 25 ma
Signal levels (low, high)	0.8 to supply voltage
Operating Temp	-30°C to 83°C [-22°F to 181°F]

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

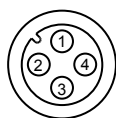


P109326

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

Optional Motor Features

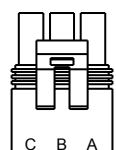
X Option



P109327

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

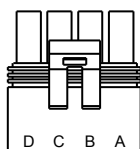
Y Option



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.

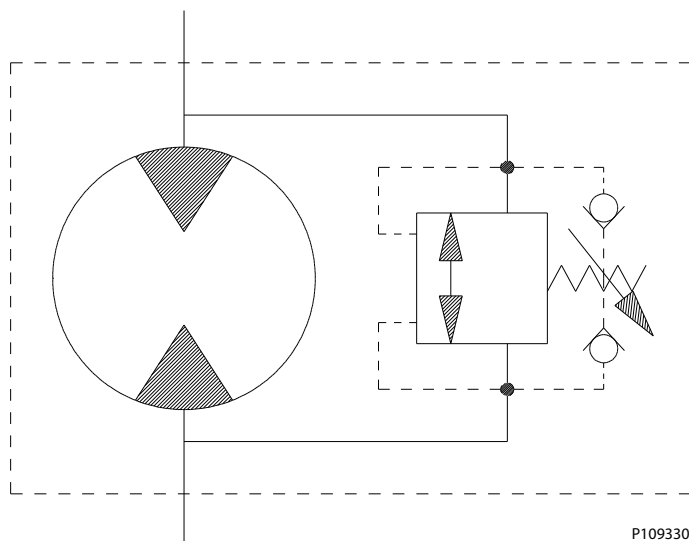
Freeturning Rotor Option

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.

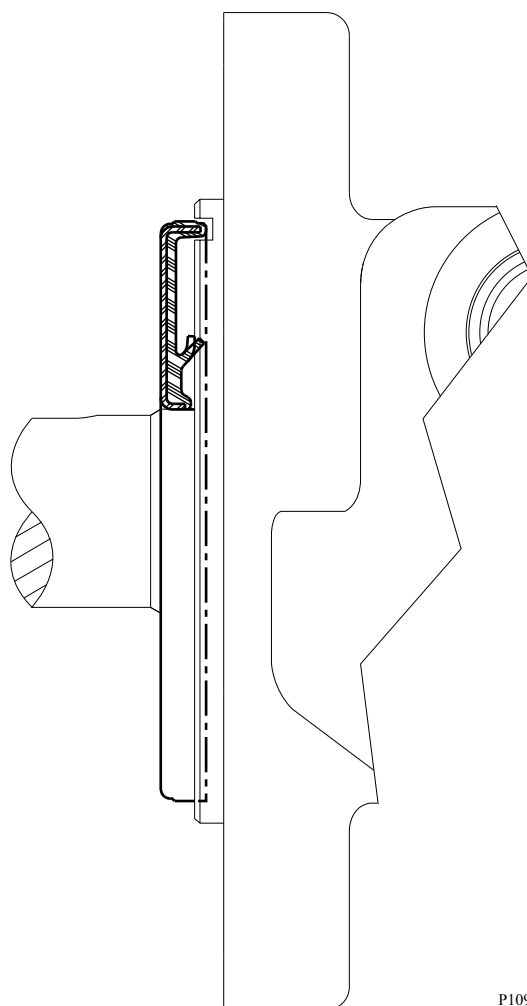


Optional Motor Features

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 extended shaft/shaft seal protection by preventing a buildup of material around the circumference of the shaft which can lead to premature shaft seal failures. The Danfoss slinger seals are designed to be larger in diameter than competitive products, providing greater surface speed and 'slinging action'.



P109331

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

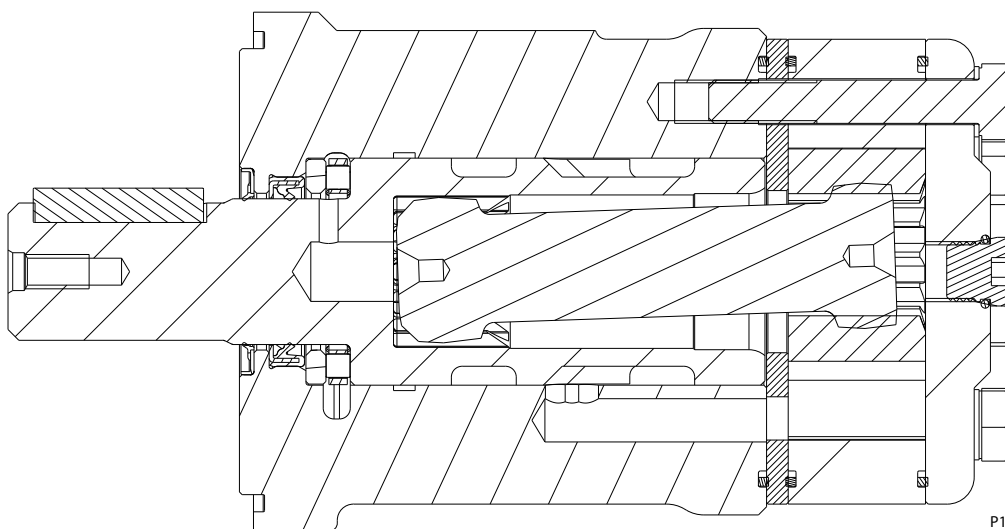
- Built-in check valves offer versatility and increased seal life.
- A variety of mounts and shafts provide flexibility in application design.
- Spool valve design gives superior performance and smooth operation over a wide speed and torque range.
- Integral rotor design provides smooth performance, 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)



P109594

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

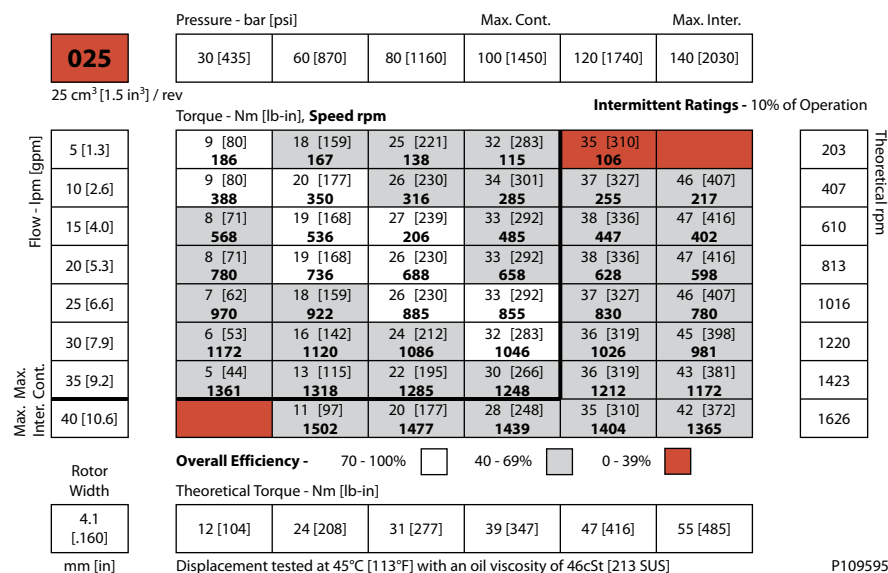
Specifications

CODE	Displacement 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	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.

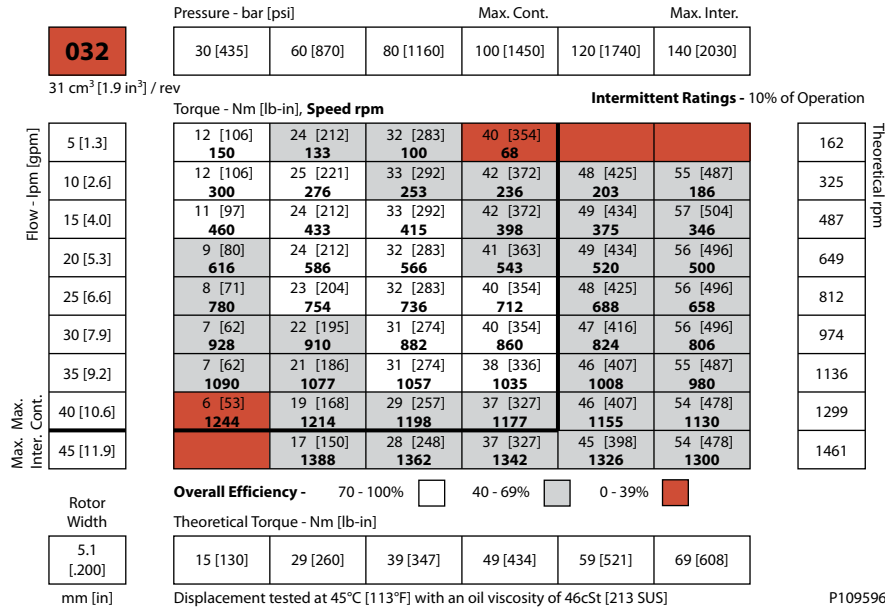
025 Displacement Performance



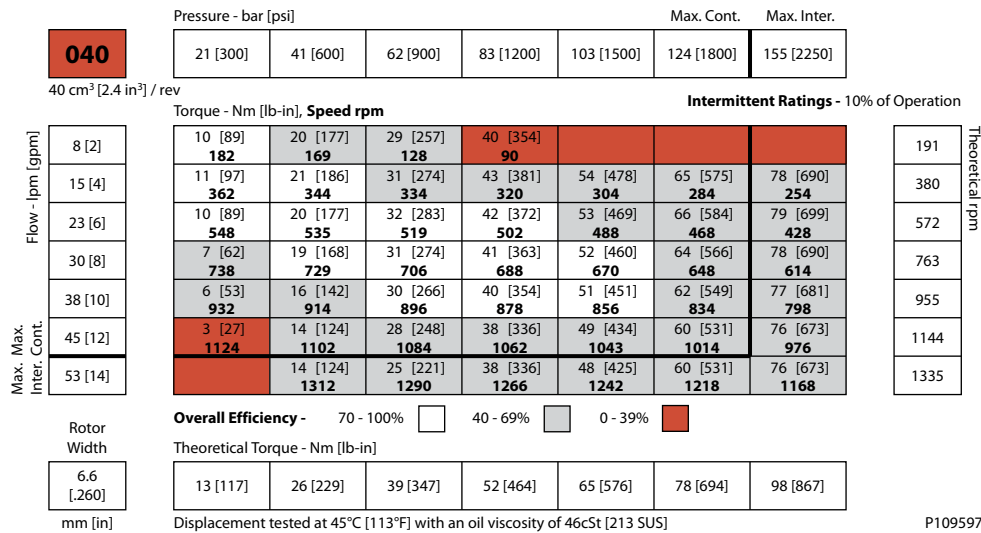
Technical Information Orbital Motors Type WD, WP and WR

WD Product Line

032cc Displacement Performance



040cc Displacement Performance



WD Product Line

050cc Displacement Performance

550

48 cm³ [2.9 in³] / rev

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

21 [300]	41 [600]	62 [900]	83 [1200]	103 [1500]	124 [1800]	138 [2000]	173 [2500]
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Torque - Nm [lb-in], **Speed rpm** **Intermittent Ratings - 10% of Operation**

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

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

Theoretical Torque - Nm [lb-in]

6.6 [260]	16 [143]	31 [278]	48 [422]	64 [564]	79 [700]	95 [842]	106 [937]	133 [1175]
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mm [in] Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

060cc Displacement Performance

060

59 cm³ [3.6 in³] / rev

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

21 [300]	41 [600]	62 [900]	83 [1200]	103 [1500]	124 [1800]	138 [2000]	173 [2500]
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Torque - Nm [lb-in], **Speed rpm** **Intermittent Ratings - 10% of Operation**

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	254
23 [6]	15 [133] 371	29 [257] 367	47 [416] 360	66 [584] 347	81 [717] 330	99 [876] 315	107 [947] 304	382
30 [8]	12 [106] 496	26 [230] 492	44 [389] 484	62 [549] 470	79 [699] 457	96 [850] 436	105 [929] 425	510
38 [10]	8 [71] 626	23 [204] 618	40 [354] 608	60 [531] 596	77 [681] 582	94 [832] 567	104 [920] 558	638
45 [12]	2 [18] 752	20 [177] 744	37 [327] 735	58 [513] 727	75 [664] 716	91 [805] 696	100 [885] 680	764
53 [14]	15 [133] 880	31 [274] 870	48 [425] 862	65 [575] 847	82 [726] 810	99 [876] 860	107 [947] 840	892
61 [16]	8 [71] 970	27 [239] 958	45 [398] 944	64 [566] 932	82 [726] 924	99 [876] 902	107 [1035] 842	1020

Rotary Width

8.0 [314] mm [in]

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

Theoretical Torque - Nm [lb-in]

20 [176]	39 [343]	59 [520]	79 [695]	97 [862]	117 [1038]	131 [1155]	164 [1448]
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Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]

Technical Information Orbital Motors Type WD, WP and WR

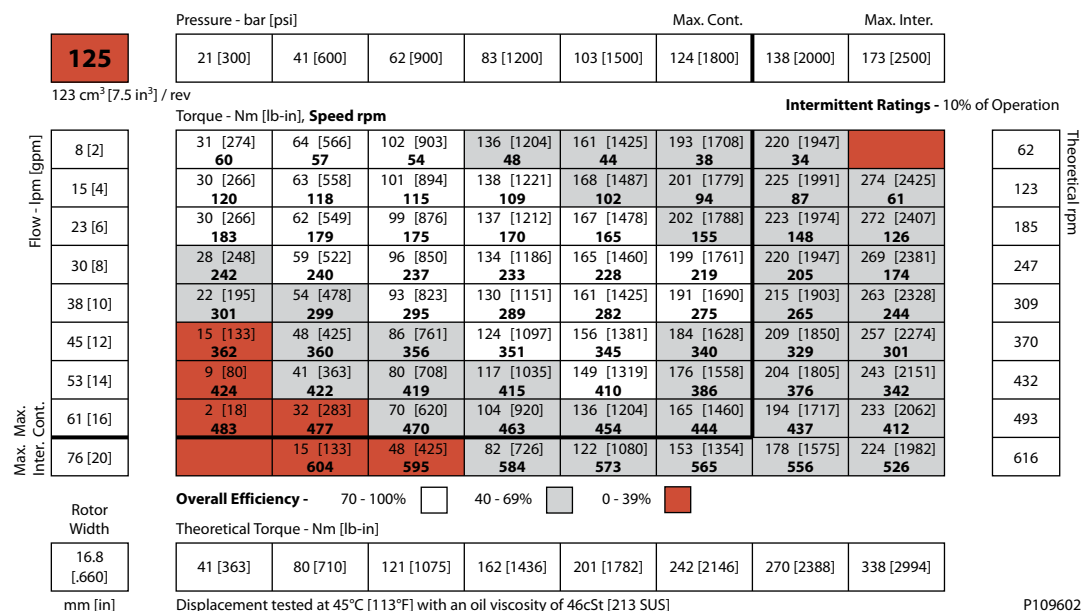
WD Product Line

080cc Displacement Performance

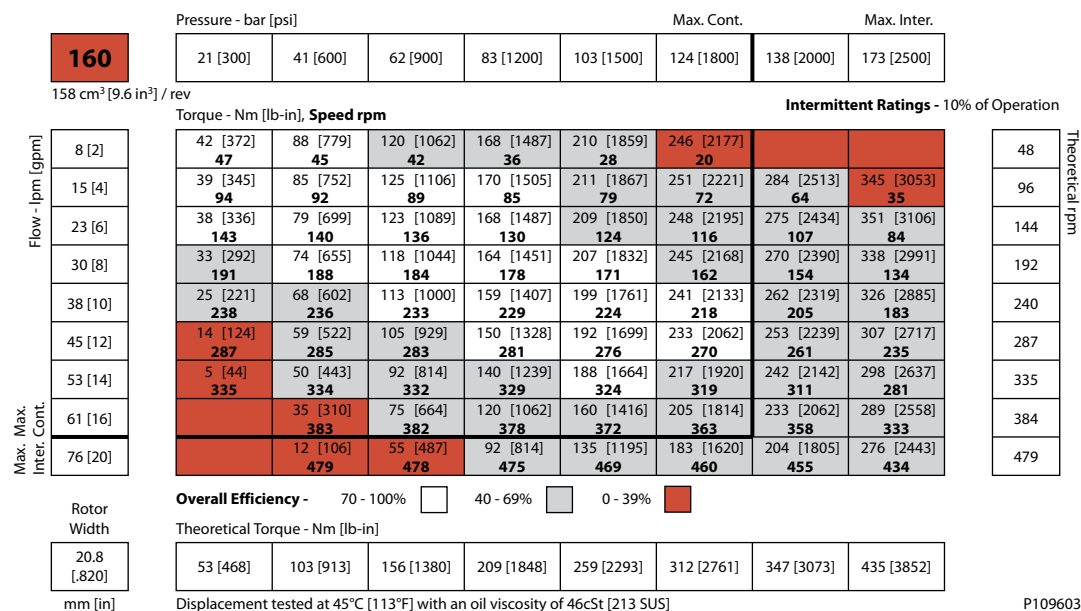
		Pressure - bar [psi]					Max. Cont.		Max. Inter.	
080		21 [300]	41 [600]	62 [900]	83 [1200]	103 [1500]	124 [1800]	138 [2000]	173 [2500]	
80 cm ³ [4.9 in ³] / rev										
		Torque - Nm [lb-in], Speed rpm					Intermittent Ratings - 10% of Operation			
Flow - lpm [gpm]	8 [2]	22 [195] 90	42 [372] 85	61 [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
	61 [16]		20 [177] 752	44 [389] 734	68 [602] 724	85 [752] 716	105 [929] 700	123 [1089] 690	154 [1363] 663	761
Max. Max. Inter. Cont.	76 [20]		11 [97] 934	32 [283] 929	54 [478] 914	74 [655] 904	94 [832] 890	108 [956] 876	148 [1310] 814	951
Rotor Width										
10.4 [410]										
mm [in]										
		Theoretical Torque - Nm [lb-in]								
		27 [236]	52 [460]	79 [697]	105 [931]	131 [1155]	157 [1391]	175 [1548]	219 [1941]	

WD Product Line

125cc Displacement Performance



160cc Displacement Performance



Technical Information Orbital Motors Type WD, WP and WR

WD Product Line

200cc Displacement Performance

		Pressure - bar [psi]				Max. Cont.		Max. Inter.	
		21 [300]	41 [600]	62 [900]	83 [1200]	103 [1500]	124 [1800]	166 [2400]	
		197 cm ³ [12.0 in ³] / rev				Intermittent Ratings - 10% of Operation			
Flow - lpm [gpm]	Max. Max. Inter. Cont.	Torque - Nm [lb-in], Speed rpm						Theoretical rpm	
		8 [2]	15 [4]	23 [6]	30 [8]	38 [10]	45 [12]	53 [14]	61 [16]
		52 [460] 38	109 [965] 35	164 [1451] 30	218 [1929] 23				
		50 [443] 76	112 [991] 74	167 [1478] 70	220 [1947] 64	270 [2390] 56	310 [2744] 48		
		48 [425] 115	110 [974] 113	165 [1460] 110	218 [1929] 105	274 [2425] 98	312 [2761] 92	411 [3637] 62	
		46 [407] 153	102 [903] 150	159 [1407] 146	216 [1912] 138	268 [2372] 132	303 [2682] 120	406 [3593] 86	
		36 [319] 192	92 [814] 190	151 [1336] 186	206 [1823] 181	258 [2283] 174	290 [2567] 163	398 [3522] 133	
		22 [195] 230	80 [708] 226	142 [1257] 223	193 [1708] 218	236 [2089] 210	282 [2496] 200	386 [3416] 167	
		5 [44] 268	70 [620] 266	130 [1151] 262	176 [1558] 258	215 [1903] 250	272 [2407] 240	374 [3310] 209	
			58 [513] 308	118 [1044] 305	156 [1381] 299	198 [1752] 292	253 [2239] 284	360 [3186] 256	
			42 [372] 384	88 [779] 381	124 [1097] 376	173 [1531] 372	220 [1947] 358	328 [2903] 330	
		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>							
		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

		Pressure - bar [psi]				Max. Cont.		Max. Inter.	
		21 [300]	41 [600]	62 [900]	83 [1200]	97 [1400]	103 [1500]	138 [2000]	155 [2250]
		241 cm ³ [14.7 in ³] / rev				Intermittent Ratings - 10% of Operation			
Flow - lpm [gpm]	Max. Max. Inter. Cont.	Torque - Nm [lb-in], Speed rpm						Theoretical rpm	
		8 [2]	15 [4]	23 [6]	30 [8]	38 [10]	45 [12]	53 [14]	61 [16]
		58 [513] 31	118 [1044] 30	193 [1708] 28	259 [2292] 23	300 [2655] 19			
		61 [540] 62	122 [1080] 61	190 [1682] 58	254 [2248] 55	302 [2673] 51	317 [2805] 47	414 [2513] 38	450 [3983] 27
		58 [513] 94	116 [1027] 93	185 [1637] 92	250 [2213] 87	295 [2611] 83	308 [2726] 81	412 [2434] 67	446 [3947] 57
		51 [451] 125	112 [991] 124	178 [1575] 121	245 [2168] 117	290 [2567] 113	304 [2690] 110	406 [2390] 97	439 [3885] 88
		40 [354] 158	98 [867] 156	169 [1496] 155	236 [2089] 151	284 [2513] 147	298 [2637] 145	390 [2319] 136	429 [3797] 121
		29 [257] 188	83 [735] 187	156 [1381] 186	230 [2036] 184	277 [2451] 180	282 [2496] 176	372 [2239] 164	414 [3664] 150
		22 [195] 220	67 [593] 219	138 [1221] 217	214 [1894] 214	262 [2319] 211	260 [2301] 209	355 [2142] 194	395 [3496] 181
			52 [460] 248	123 [1089] 244	190 [1682] 241	233 [2062] 237	244 [2159] 235	335 [2062] 223	376 [3328] 210
			24 [212] 312	84 [743] 309	165 [1460] 305	202 [1788] 302	208 [1841] 300	298 [1805] 285	335 [2965] 268
		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>							
		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

		Pressure - bar [psi]				Max. Cont.	Max. Inter.
315		21 [300]	41 [600]	62 [900]	90 [1300]	103 [1500]	138 [2000] 155 [2250]
303 cm ³ [18.5 in ³] / rev		Torque - Nm [lb-in], Speed rpm				Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	8 [2]	88 [779] 25	174 [1540] 22	255 [2257] 20			
	15 [4]	89 [788] 49	170 [1505] 47	263 [2328] 43	352 [3115] 35	396 [3505] 30	
	23 [6]	78 [690] 74	162 [1434] 72	246 [2177] 69	345 [3053] 59	392 [3469] 54	532 [4708] 33 576 [5098] 22
	30 [8]	60 [531] 101	151 [1336] 98	240 [2124] 95	339 [3000] 90	386 [3416] 84	526 [4655] 65 566 [5009] 53
	38 [10]	60 [531] 125	142 [1257] 123	230 [2036] 121	335 [2965] 115	380 [3363] 112	514 [4549] 90 558 [4938] 80
	45 [12]	37 [327] 147	128 [1133] 146	220 [1947] 143	325 [2876] 139	370 [3275] 132	500 [4425] 118 536 [4744] 105
	53 [14]	15 [133] 175	108 [956] 174	208 [1841] 171	318 [2814] 166	355 [3142] 160	486 [4301] 138 516 [4567] 127
	61 [16]		88 [779] 199	196 [1735] 197	300 [2655] 187	340 [3009] 182	465 [4115] 166 494 [4372] 152
	76 [20]		60 [531] 250	180 [1593] 246	280 [2478] 240	326 [2885] 236	442 [3912] 217 468 [4142] 206
Rotor Width		Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%					
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

		Pressure - bar [psi]				Max. Cont.	Max. Inter.
400		21 [300]	41 [600]	69 [1000]	83 [1200]	97 [1400]	121 [1750]
386 cm ³ [23.5 in ³] / rev		Torque - Nm [lb-in], Speed rpm				Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	8 [2]	105 [929] 19	218 [1929] 18	360 [3186] 14	417 [3960] 11		
	15 [4]	99 [876] 39	207 [1832] 37	344 [3044] 33	411 [3637] 28	480 [4248] 25	582 [5151] 17
	23 [6]	91 [805] 59	195 [1726] 57	336 [2974] 52	403 [3567] 43	478 [4260] 39	575 [5089] 32
	30 [8]	72 [637] 77	186 [1646] 75	325 [2876] 73	398 [3522] 67	466 [4124] 60	569 [5036] 49
	38 [10]	62 [549] 100	178 [1575] 97	314 [2779] 93	394 [3487] 89	458 [4053] 81	560 [4956] 70
	45 [12]	51 [451] 120	164 [1451] 117	310 [2744] 113	378 [3345] 109	448 [3965] 97	550 [4868] 84
	53 [14]	38 [336] 137	142 [1257] 134	284 [2513] 131	360 [3186] 129	429 [3797] 124	532 [4708] 113
	61 [16]	20 [177] 150	121 [1071] 154	260 [2301] 151	338 [2991] 148	410 [3629] 138	511 [4522] 130
	76 [20]		98 [867] 189	234 [2071] 187	308 [2726] 185	384 [3398] 182	486 [4301] 178
Rotor Width		Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%					
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

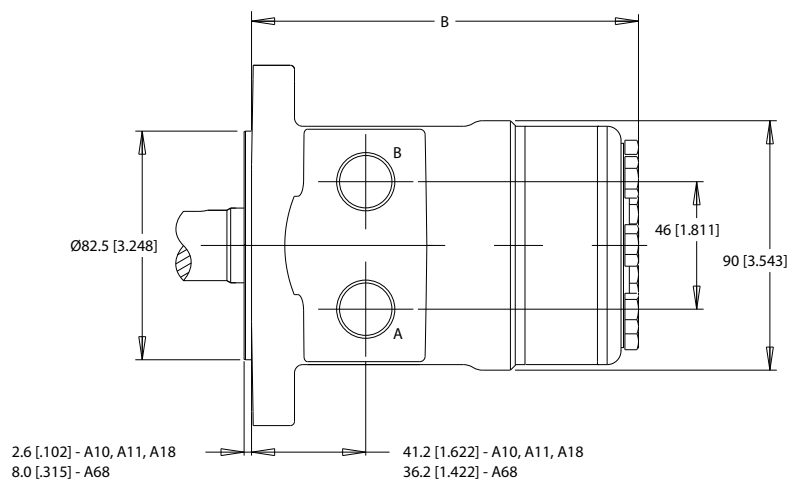
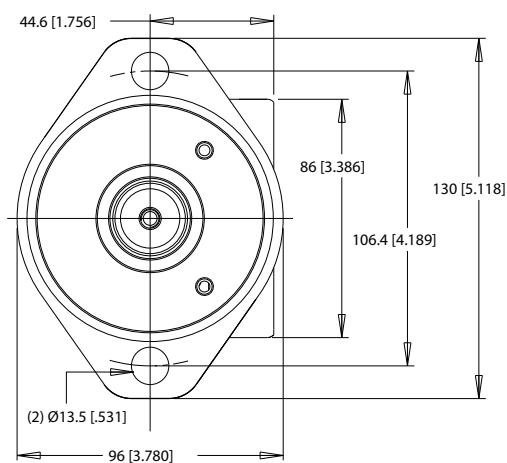
2-HOLE, SAE A MOUNT, ALIGNED PORTS

A10 1/2-14 NPT

A11 7/8-14 UNF

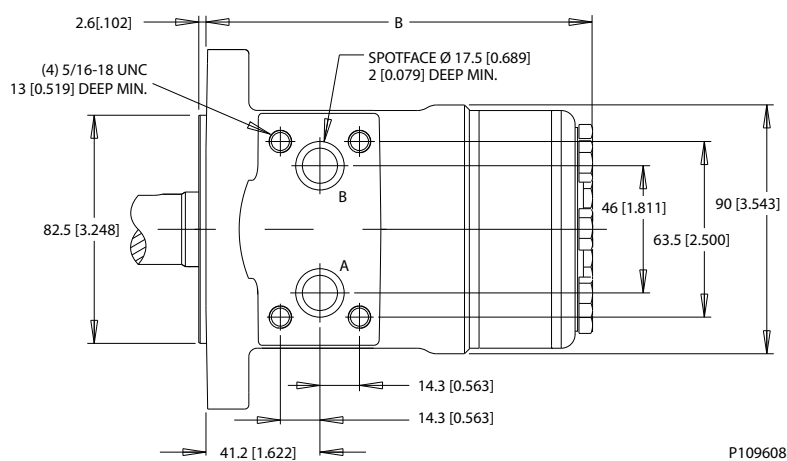
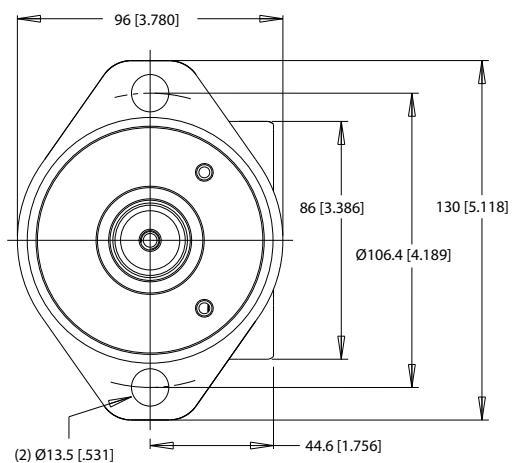
A18 G 1/2

A68 G 1/2 (TP)



2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS

A17 1/2" Drilled

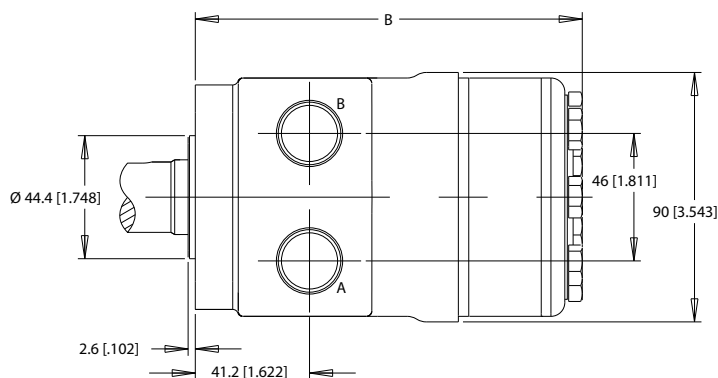
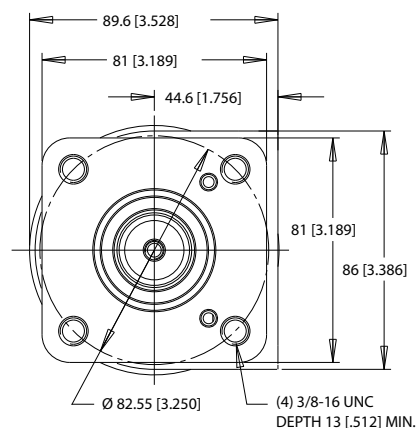


WD Product Line

4-HOLE, SQUARE MOUNT, ALIGNED PORTS

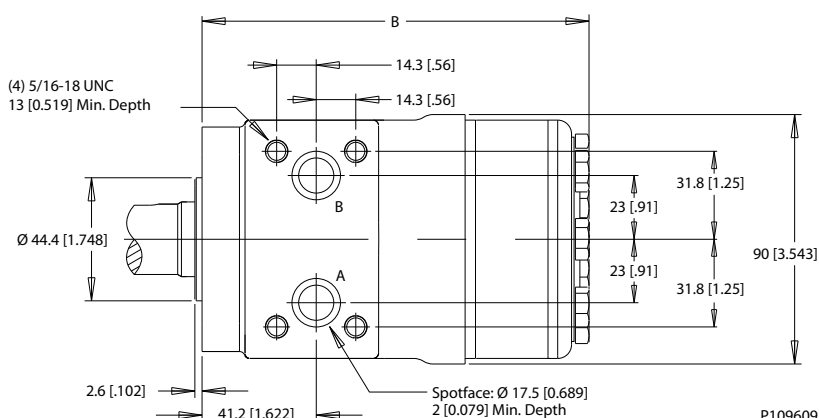
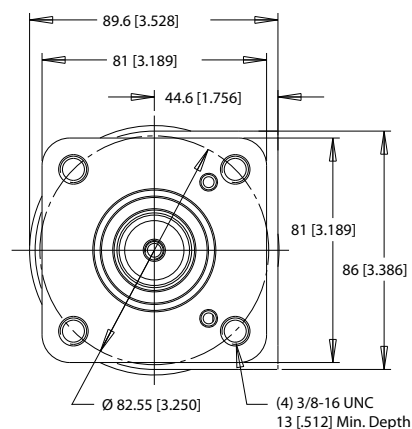
F30 1/2-14 NPT

F31 7/8-14 UNF



4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS

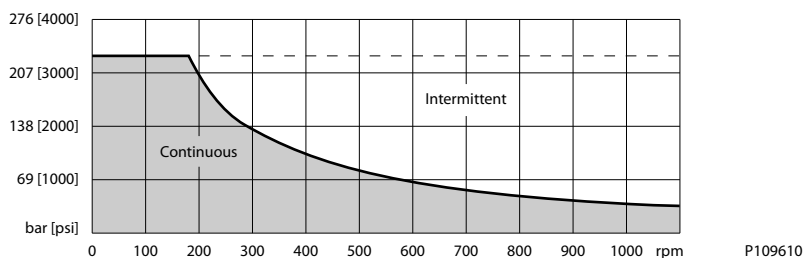
F37 1/2" Drilled



145/146 Series Technical Data

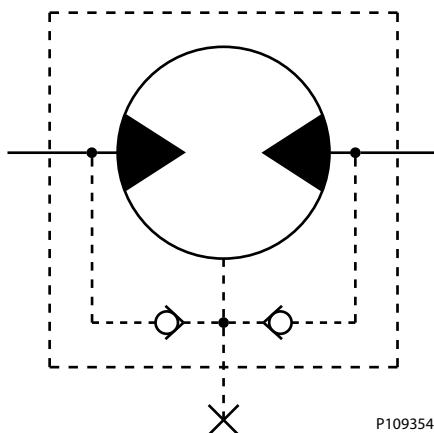
Permissible Shaft Seal Press

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.



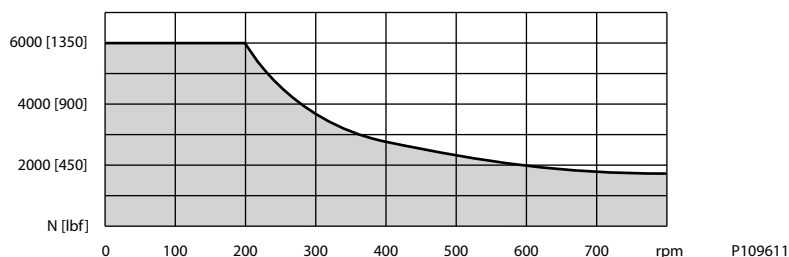
WD Product Line

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.

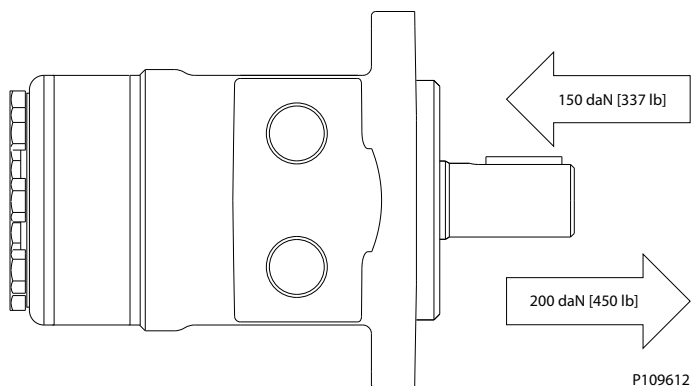


Allowable Shaft Load / Bearing Curve

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

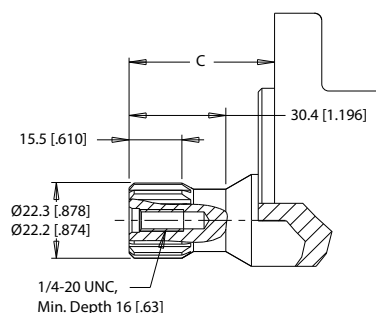
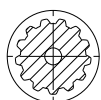
#	3mm Pilot	8mm Pilot	Weight
	mm [in]	mm [in]	kg [lb]
025	119 [4.67]	114 [4.47]	5.20 [11.5]
032	120 [4.71]	115 [4.51]	5.24 [11.6]
040	121 [4.77]	116 [4.57]	5.29 [11.7]
050	121 [4.77]	116 [4.57]	5.29 [11.7]
060	123 [4.83]	118 [4.63]	5.34 [11.8]
080	125 [4.92]	120 [4.72]	5.42 [12.0]
100	128 [5.02]	123 [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

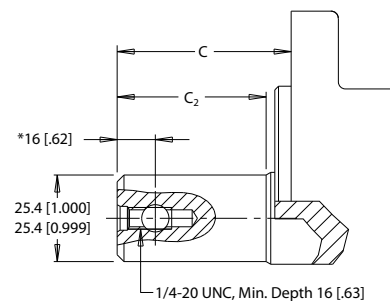
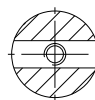
16/32 Pitch Standard
ANSI B92.1-1996 Spline



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

53 1" - 10.3 [.406] Pinhole

66 1" - 8.0 [.315] Pinhole



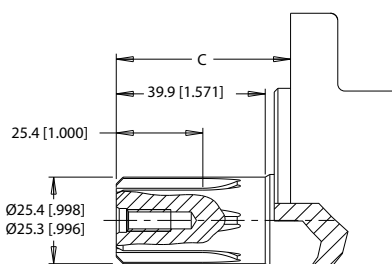
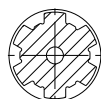
Max. Torque: 678 Nm [6000 lb-in]

* Dimension for 66 shaft is 11.2 [.44]

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

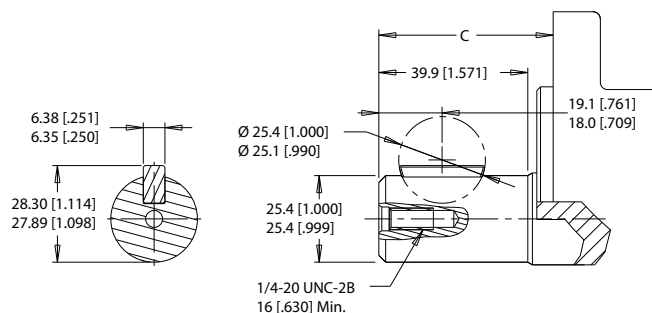
04 1" 6B Spline, M8x1.25 Tap

6B Spline
SAE J499 Standard



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

B1 1" Straight, Woodruff Key

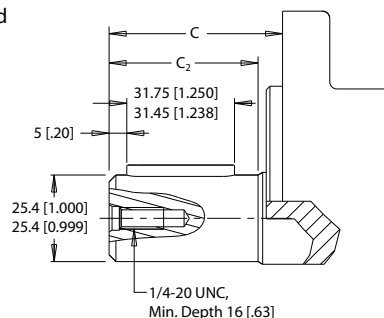
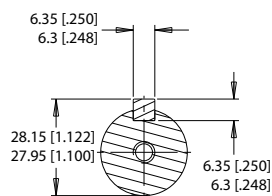


Max. Torque: 655 Nm [5800 lb-in]

10 1" Straight

15 1" Straight Extended

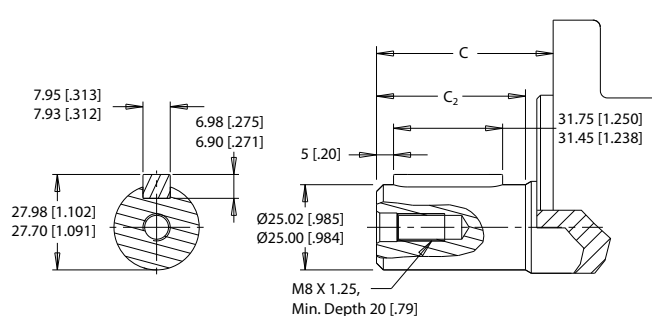
G8 1" Straight Nickel Plated



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.

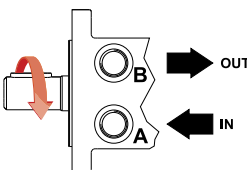
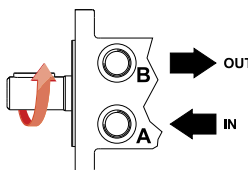
Additional shaft length information, if necessary, is noted as C₂ and does not increase or decrease the listed C dimensions in this chart. The overall shaft lengths are already factored into the overall distance from the mounting surface to the end of the shaft.

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			4. SELECT A SHAFT OPTION				
145 Standard Rotation	146 Reverse Rotation		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				
<p>► The 145 & 146 series are bi-directional.</p>			<p>► 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.</p>				
2. SELECT A DISPLACEMENT OPTION			5. SELECT A PAINT OPTION				
025 25 cm ³ /rev [1.5 in ³ /rev]	125 123 cm ³ /rev [7.5 in ³ /rev]		A Black				
032 31 cm ³ /rev [1.9 in ³ /rev]	160 158 cm ³ /rev [9.6 in ³ /rev]		B Black, Unpainted Mounting Surface				
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			6. SELECT A VALVE CAVITY / CARTRIDGE OPTION				
A10 2-Hole, SAE A Mount, Aligned Ports, 1/2-14 NPT			A None				
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							
<p>► (TP) - Tall pilot. Speed sensor option is not available on tall pilot housings.</p>			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

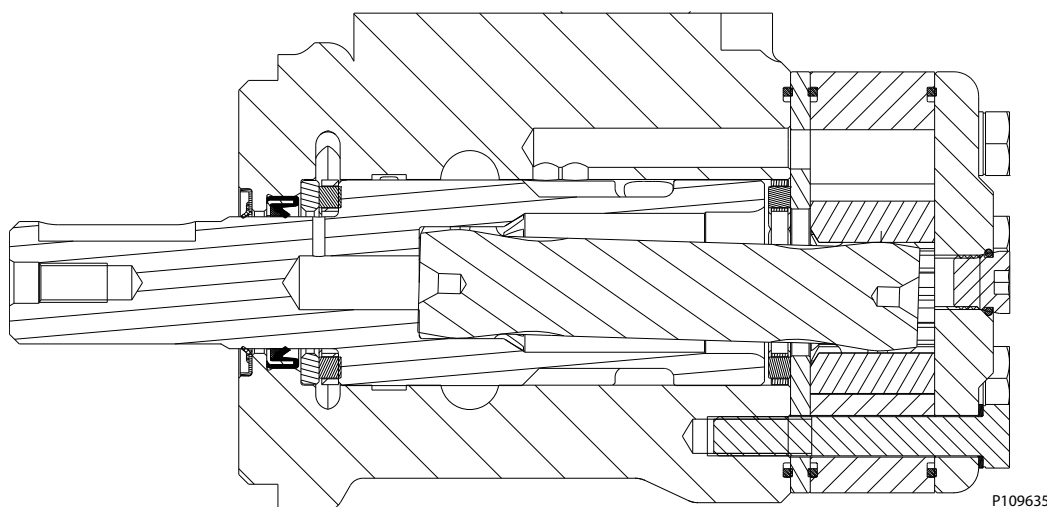
- Built-in check valves offer versatility and increased seal life.
- A variety of mounts and shafts provide flexibility in application design.
- Spool valve design gives superior performance and smooth operation over a wide speed and torque range.
- Standard high pressure shaft seals offer superior seal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

Typical Applications

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

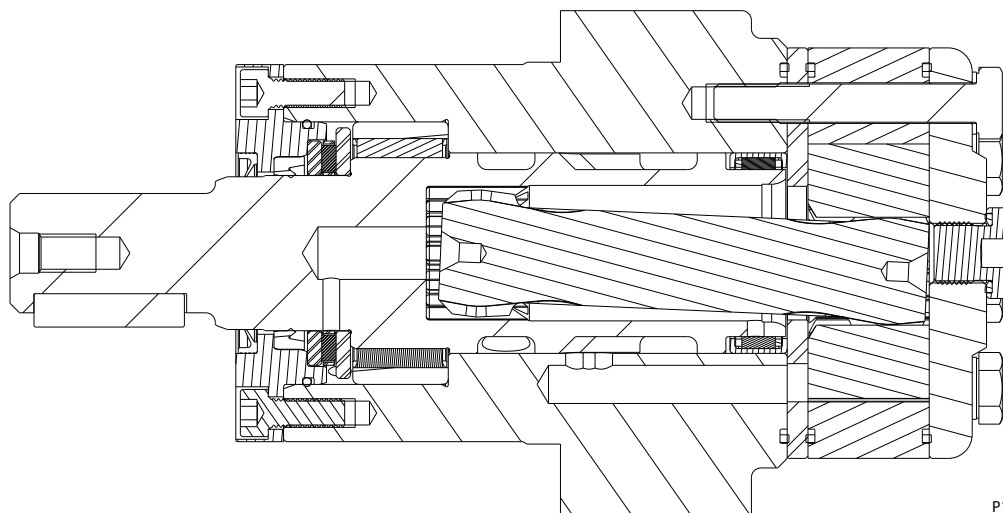
Series Descriptions

155/156 - Hydraulic Motor (standard)



WP Product Line

157/158 - Hydraulic Motor (with needle bearing)



P109636

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.

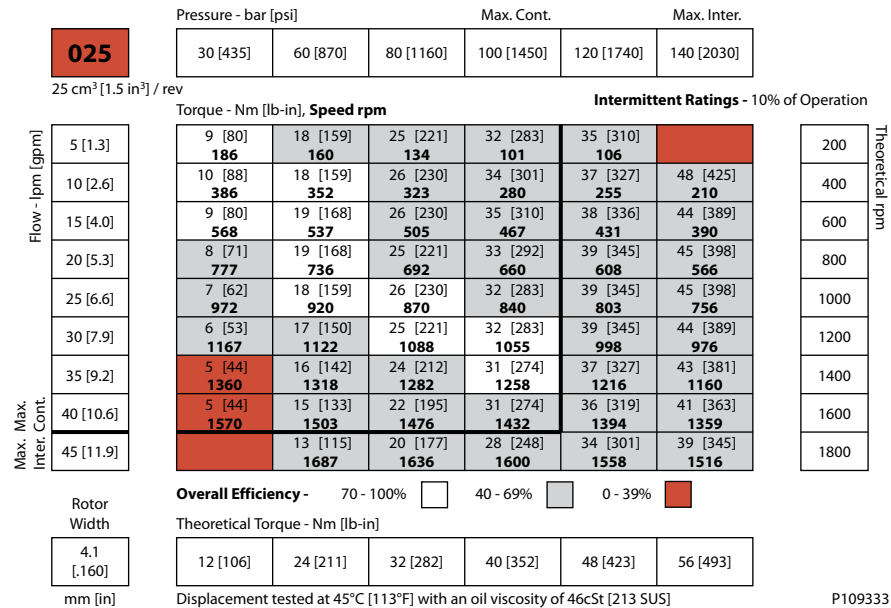
CODE	Displacement cm ³ [in ³]	Max. Speed rpm		Max. Flow lpm [gpm]		Max. Torque Nm [lb-in]		Max. Pressure bar [psi]		
		cont.	inter.	cont.	inter.	cont.	inter.	cont.	inter.	peak
025	25 [1.5]	1570	1687	40 [11]	45 [12]	35 [310]	48 [425]	100 [1450]	140 [2030]	225 [3260]
032	32 [2.0]	1550	1674	50 [13]	55 [15]	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

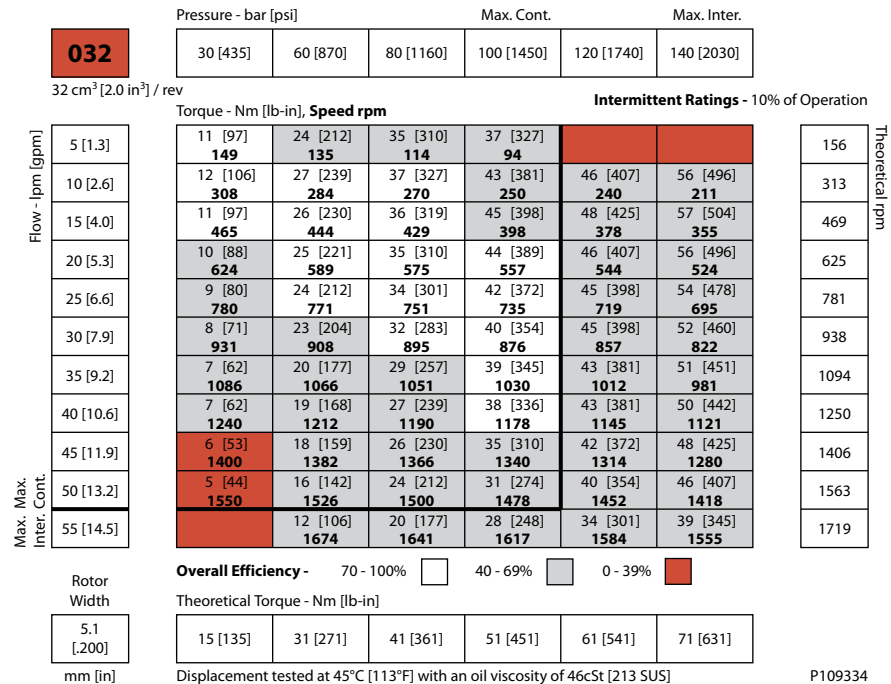
Performance data is typical. Performance of production units varies slightly from one motor to another. Operating at maximum continuous pressure and maximum continuous flow simultaneously is not recommended. For additional information on product testing please refer to [Product Testing](#) on page 7.

WP Product Line

025 Displacement Performance

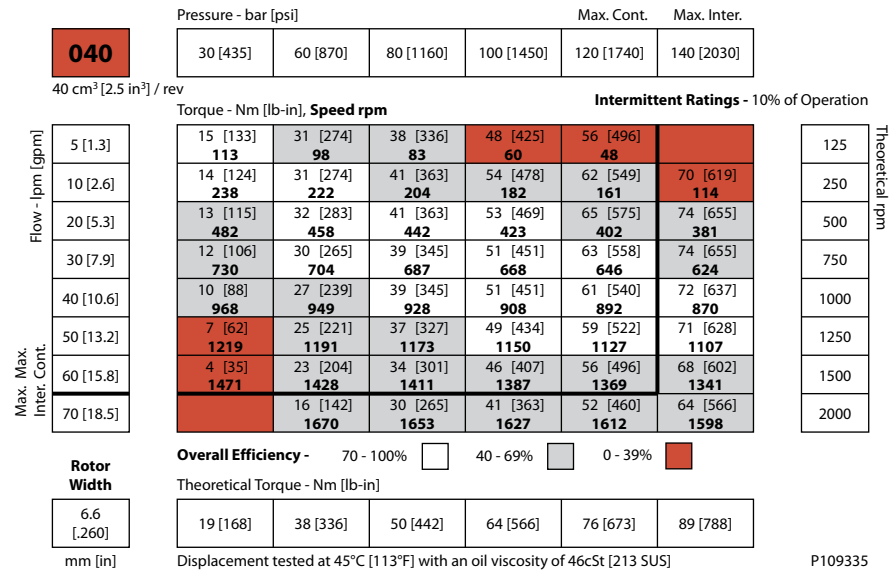


032 Displacement Performance

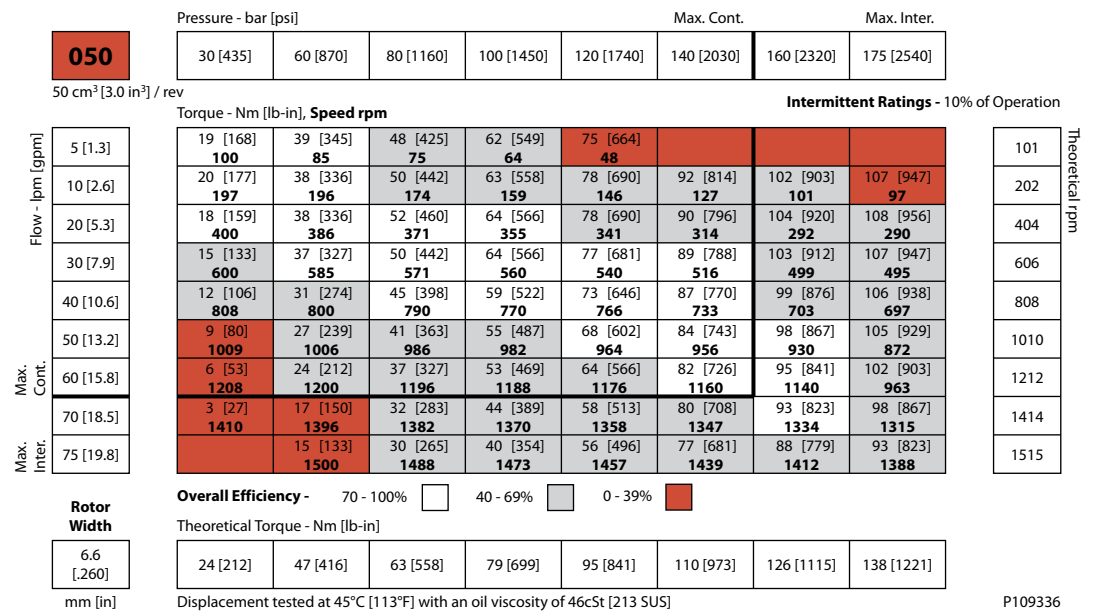


WP Product Line

040 Displacement Performance



050 Displacement Performance



WP Product Line

060 Displacement Performance

		Pressure - bar [psi]						Max. Cont.	Max. Inter.			
<div>060</div>		30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]			
59 cm³ [3.6 in³] / rev												
		Torque - Nm [lb-in], Speed rpm						Intermittent Ratings - 10% of Operation				
Max. Cont.	Flow - lpm [gpm]	5 [1.3]	10 [2.6]	20 [5.3]	30 [7.9]	40 [10.6]	50 [13.2]	60 [15.8]	70 [18.5]	75 [19.8]		
		20 [177] 83	46 [407] 79	65 [575] 72	80 [708] 64	95 [841] 51	112 [991] 38				85	
		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 [177] 338	45 [398] 332	64 [566] 320	80 [708] 309	93 [823] 290	111 [982] 276	123 [1088] 245	134 [1186] 222		339	
		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	
		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	
		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	
		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	
Max. Inter.		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	
			22 [195] 1271	43 [381] 1265	58 [513] 1256	73 [646] 1241	86 [761] 1228	100 [885] 1212	110 [973] 1196		1271	
Rotor Width		Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%										
		Theoretical Torque - Nm [lb-in]										
		28 [249]	56 [499]	75 [665]	94 [831]	113 [998]	132 [1164]	150 [1330]	164 [1455]			
mm [in]		Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]										

P109337

080 Displacement Performance

		Pressure - bar [psi]						Max. Cont.	Max. Inter.	
<div>880</div>		30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]	
78 cm ³ [4.8 in ³] / rev								Intermittent Ratings - 10% of Operation		
		Torque - Nm [lb-in], Speed rpm								
Max. Cont.	Flow - lpm [gpm]	5 [1.3]	10 [2.6]	20 [5.3]	30 [7.9]	40 [10.6]	50 [13.2]	60 [15.8]	70 [18.5]	75 [19.8]
		32 [283] 60	62 [549] 56	80 [708] 50	106 [938] 42	125 [1106] 30				
		31 [274] 125	64 [566] 118	84 [743] 112	104 [920] 104	120 [1062] 98	142 [1257] 82	162 [1434] 67	175 [1549] 50	
		26 [230] 254	60 [531] 245	84 [743] 236	102 [903] 228	125 [1106] 215	144 [1274] 204	164 [1451] 190	183 [1619] 175	
		24 [212] 384	56 [496] 374	81 [717] 366	100 [885] 358	122 [1080] 346	142 [1257] 335	160 [1416] 318	175 [1549] 305	
		19 [168] 512	53 [469] 505	75 [664] 494	96 [850] 483	118 [1044] 473	140 [1239] 462	158 [1398] 450	170 [1504] 438	
		14 [124] 638	46 [407] 630	70 [619] 625	92 [814] 615	110 [973] 606	135 [1195] 593	156 [1381] 580	168 [1487] 568	
		10 [88] 768	42 [372] 762	66 [584] 756	86 [761] 748	106 [938] 738	128 [1133] 728	150 [1327] 717	164 [1451] 694	
Max. Inter.		6 [53] 896	36 [319] 890	56 [496] 882	78 [690] 872	98 [867] 860	118 [1044] 846	140 [1239] 830	160 [1416] 816	
		3 [27] 960	27 [239] 955	50 [442] 948	74 [655] 938	92 [814] 926	113 [1000] 916	133 [1177] 896	148 [1310] 802	
Rotor Width		Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%								
		Theoretical Torque - Nm [lb-in]								
		37 [327]	75 [664]	100 [885]	125 [1106]	149 [1319]	174 [1540]	199 [1761]	218 [1929]	
mm [in]		Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]								

<

Technical Information

Orbital Motors Type WD, WP and WR

WP Product Line

100 Displacement Performance

		Pressure - bar [psi]						Max. Cont.	Max. Inter.
<div>100</div>		30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]
		96 cm ³ [5.9 in ³] / rev							
		Torque - Nm [lb-in], Speed rpm						Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	5 [1.3]	43 [381] 51	82 [726] 42	109 [965] 35	131 [1159] 25				52
	10 [2.6]	43 [381] 99	84 [743] 93	108 [956] 84	133 [1177] 72	152 [1345] 62	180 [1593] 48	197 [1743] 24	104
	20 [5.3]	41 [363] 205	79 [699] 202	107 [947] 197	127 [1124] 192	154 [1363] 182	178 [1575] 172	200 [1770] 140	208
	30 [7.9]	39 [345] 311	74 [655] 307	101 [894] 301	126 [1115] 294	152 [1345] 283	176 [1558] 271	198 [1752] 258	313
	40 [10.6]	29 [257] 413	63 [558] 410	93 [823] 406	121 [1071] 399	150 [1327] 388	172 [1522] 379	195 [1726] 368	417
	50 [13.2]	20 [177] 519	52 [460] 515	85 [752] 510	115 [1018] 503	148 [1310] 492	169 [1496] 480	193 [1708] 464	521
	60 [15.8]	17 [150] 624	53 [469] 620	83 [735] 615	111 [982] 608	138 [1221] 600	165 [1460] 582	183 [1619] 565	625
	70 [18.5]	11 [97] 728	42 [372] 726	73 [646] 723	93 [823] 714	126 [1115] 706	159 [1407] 684	172 [1522] 668	729
	75 [19.8]	6 [53] 780	35 [310] 771	61 [540] 764	89 [788] 755	118 [1044] 736	145 [1283] 724	156 [1381] 712	781
Rotor Width									
<div>13.0 [510]</div>									
mm [in]									
		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>							
		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

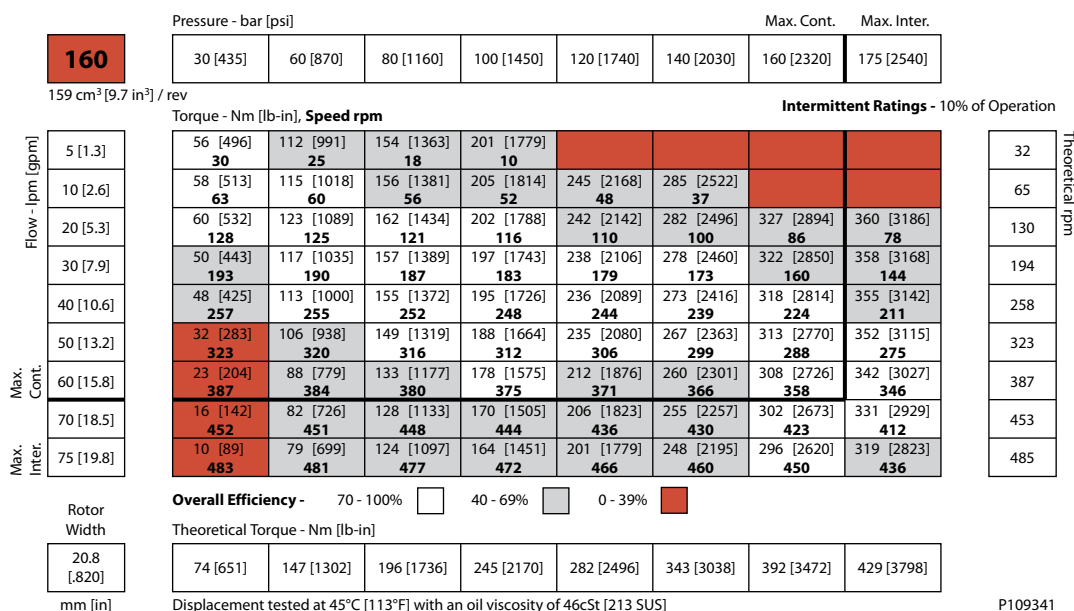
125 Displacement Performance

		Pressure - bar [psi]						Max. Cont.	Max. Inter.
<div>125</div>		30 [435]	60 [870]	80 [1160]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	175 [2540]
125 cm ³ [7.6 in ³] / rev									
		Torque - Nm [lb-in], Speed rpm						Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	5 [1.3]	52 [460] 38	95 [841] 35	135 [1195] 32	168 [1487] 27				40
	10 [2.6]	50 [442] 78	98 [867] 74	138 [1221] 69	172 [1522] 62	190 [1681] 54	234 [2071] 45	258 [2283] 35	80
	20 [5.3]	50 [442] 158	96 [850] 152	132 [1168] 144	168 [1487] 135	202 [1788] 124	236 [2088] 110	256 [2265] 94	160
	30 [7.9]	44 [389] 238	92 [814] 232	126 [1115] 225	164 [1451] 215	198 [1752] 210	232 [2053] 198	262 [2319] 168	240
	40 [10.6]	35 [310] 319	82 [726] 316	118 [1044] 312	160 [1416] 308	193 [1708] 300	226 [2000] 288	252 [2230] 262	320
	50 [13.2]	31 [274] 399	77 [681] 396	108 [956] 392	155 [1372] 383	182 [1611] 368	220 [1947] 354	238 [2106] 338	400
	60 [15.8]	15 [133] 479	64 [566] 478	97 [858] 475	146 [1292] 470	166 [1469] 463	210 [1858] 454	224 [1982] 443	480
	70 [18.5]	8 [71] 559	50 [442] 555	90 [796] 548	140 [1239] 538	162 [1434] 524	204 [1805] 516	209 [1850] 500	560
	75 [19.8]		40 [354] 599	71 [628] 594	128 [1133] 588	158 [1398] 576	192 [1699] 565	199 [1761] 536	600
	Rotor Width								
16.8 [660]									
mm [in]									
		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>							
		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]							

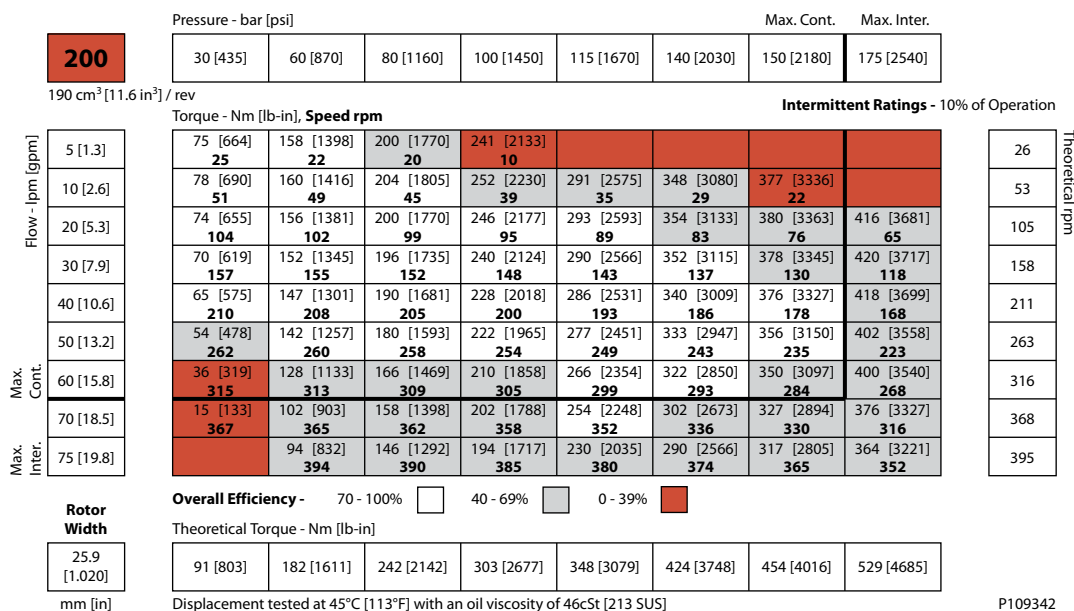
P109340

WP Product Line

160 Displacement Performance



200 Displacement Performance



WP Product Line

250 Displacement Performance

		Pressure - bar [psi]					Max. Cont.		Max. Inter.		
250		30 [435]	60 [870]	85 [1230]	100 [1450]	125 [1810]	140 [2030]	160 [2320]	175 [2540]		
240 cm³ [14.6 in³] / rev											
		Torque - Nm [lb-in], Speed rpm					Intermittent Ratings - 10% of Operation				
Flow - lpm [gpm]	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	
	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	
	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	
Max. Cont.											
	Max. Inter.										
Rotor Width											
32.5 [1.280]											
mm [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

		Pressure - bar [psi]					Max. Cont.		Max. Inter.	
315		30 [435]	50 [725]	70 [1015]	85 [1230]	100 [1450]	120 [1740]	140 [2030]	160 [2320]	
303 cm³ [18.5 in³] / rev										
		Torque - Nm [lb-in], Speed rpm					Intermittent Ratings - 10% of Operation			
Flow - lpm [gpm]	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
	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. Cont.	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
Rotor Width	40.9 [1.610]									
	mm [in]									
		Overall Efficiency - 60 - 100% 40 - 59% 0 - 39%								
		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

		Pressure - bar [psi]				Max. Cont.		Max. Inter.		
400		30 [435]	45 [650]	55 [800]	65 [940]	80 [1160]	95 [1380]	110 [1595]	125 [1810]	
388 cm ³ [23.7 in ³] / rev										
Torque - Nm [lb-in], Speed rpm						Intermittent Ratings - 10% of Operation				
Flow - lpm [gpm]	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
	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
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>								
		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]	
Displacement tested at 45°C [113°F] with an oil viscosity of 46cSt [213 SUS]										
P109345										

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.

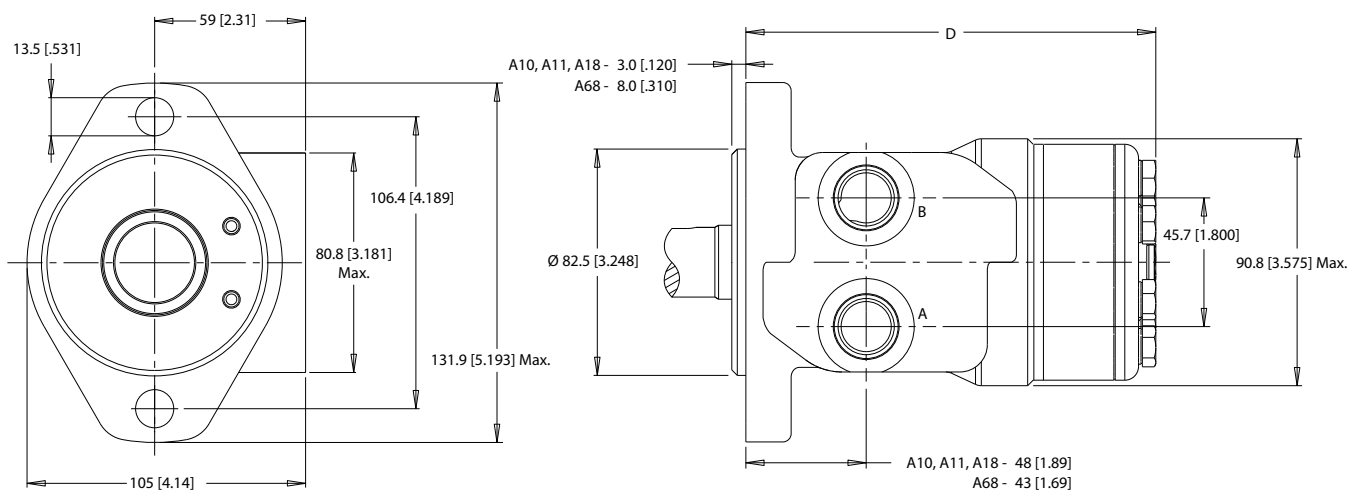
2-HOLE, SAE A MOUNT, ALIGNED PORTS

A10 1/2-14 NPT

A11 7/8-14 UNF

A18 G 1/2

A68 G 1/2 (TP)

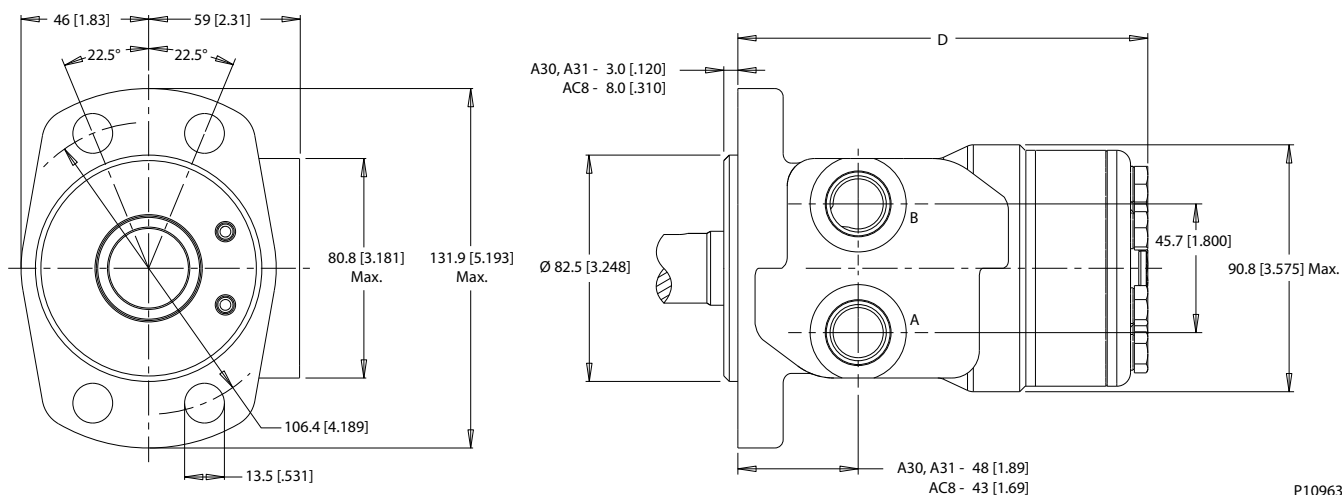


4-HOLE, MAGNETO MOUNT, ALIGNED PORTS

A30 1/2-14 NPT

A31 7/8-14 UNF

AC8 G 1/2 (TP)



P109637

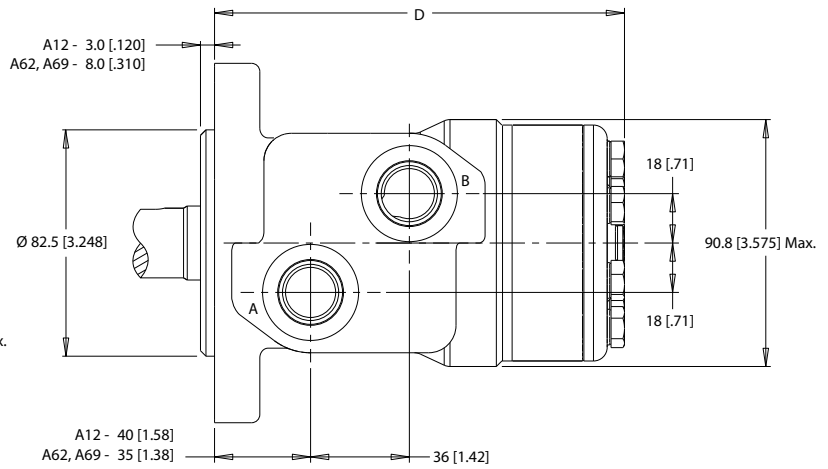
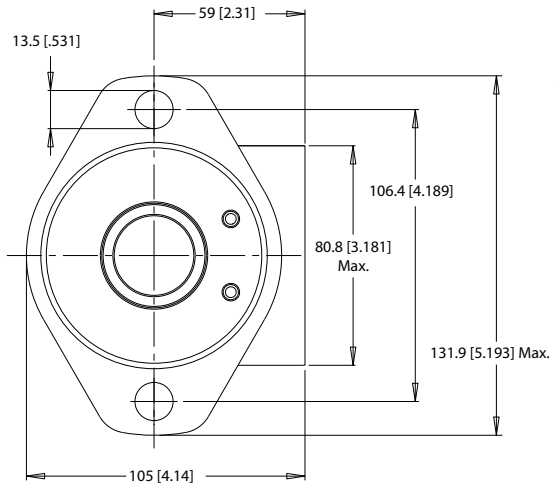
WP Product Line

2-HOLE, SAE A MOUNT, OFFSET PORTS

A12 G 1/2

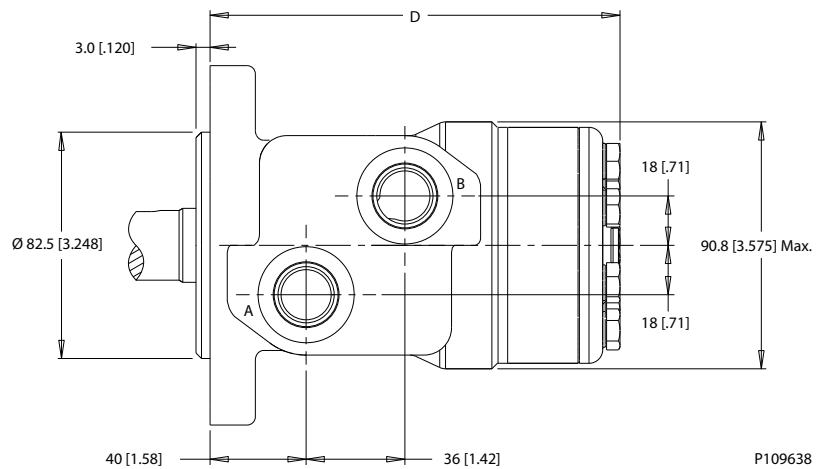
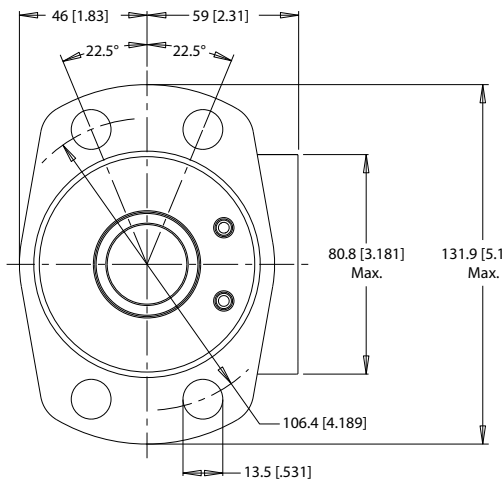
A62 G 1/2 (TP)

A69 7/8-14 UNF (TP)



4-HOLE, MAGNETO MOUNT, OFFSET PORTS

A32 G 1/2

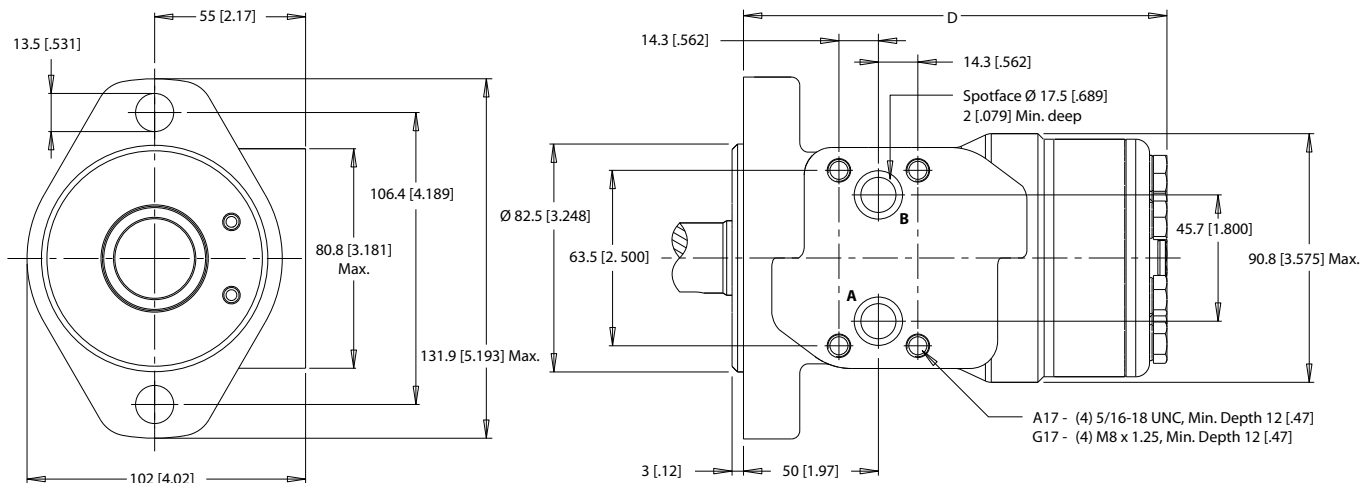


P109638

WP Product Line

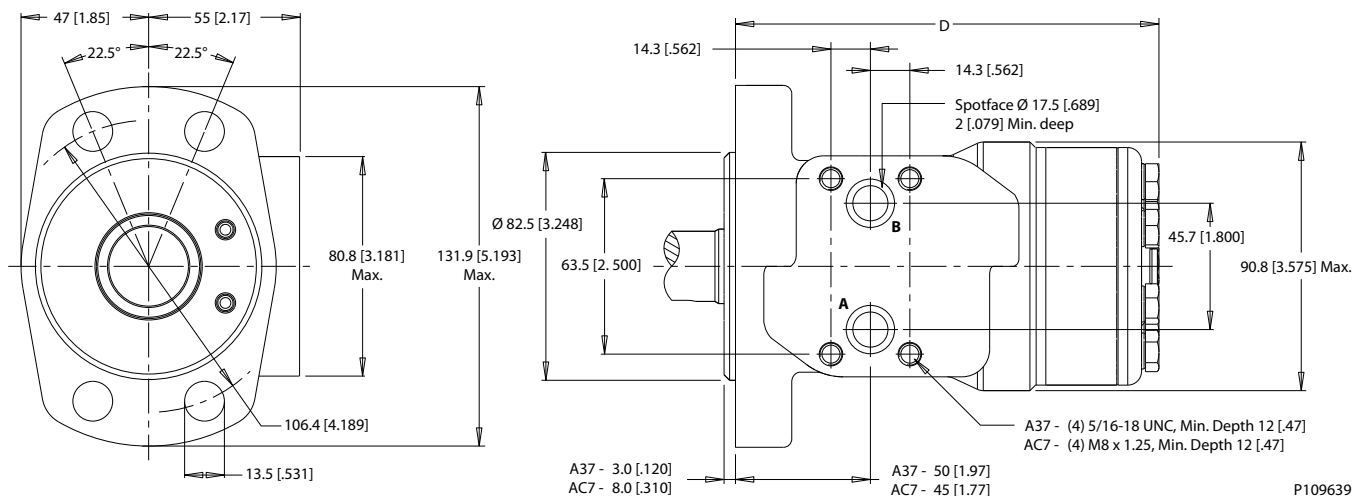
2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS

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



4-HOLE, MAGNETO MOUNT, ALIGNED MANIFOLD PORTS

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



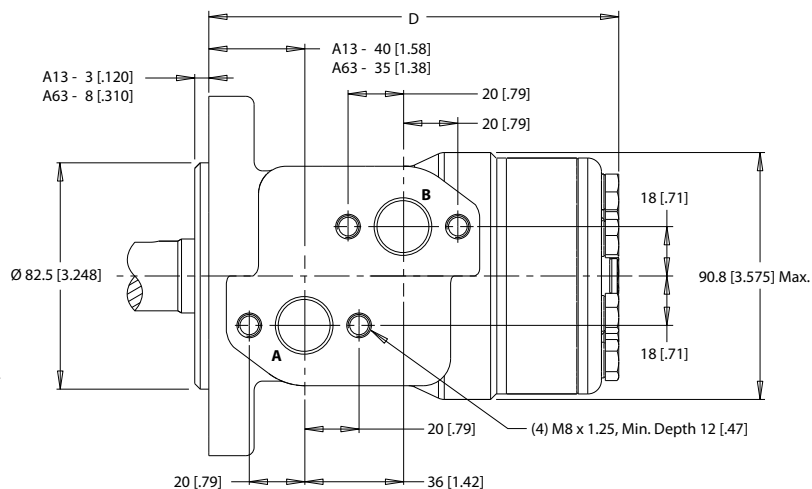
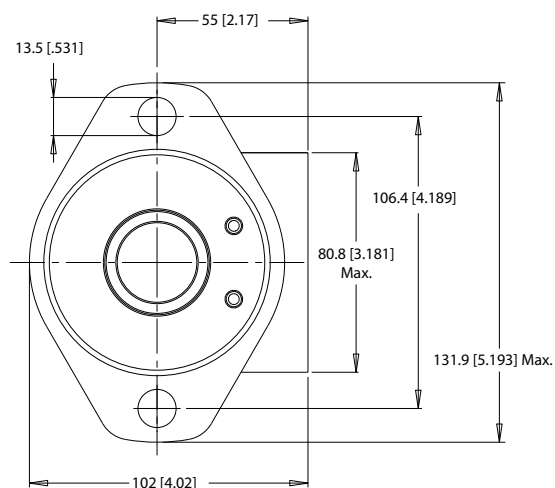
P109639

WP Product Line

2-HOLE, SAE A MOUNT, OFFSET MANIFOLD PORTS

A13 G 1/2

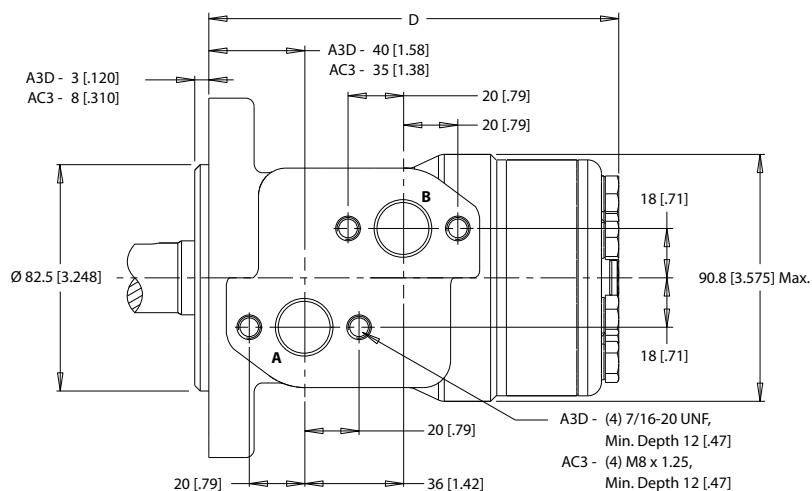
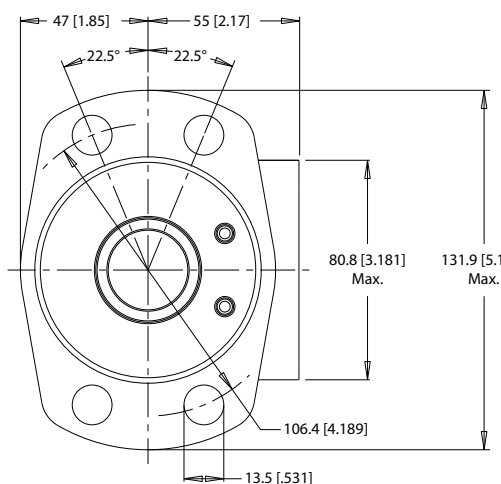
A63 G 1/2 (TP)



4-HOLE, MAGNETO, OFFSET MANIFOLD PORTS

A3D 7/8-14 UNF

AC3 G 1/2 (TP)



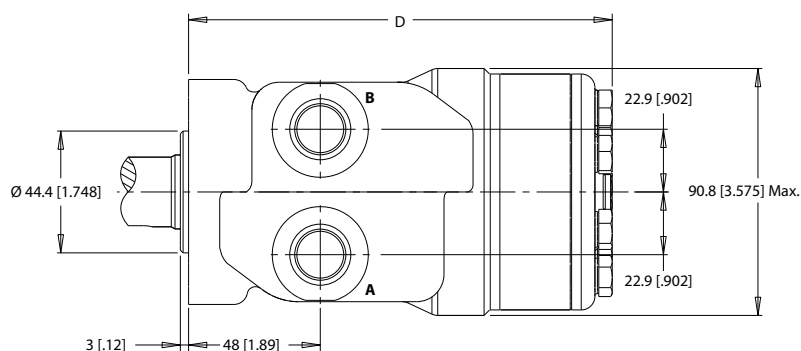
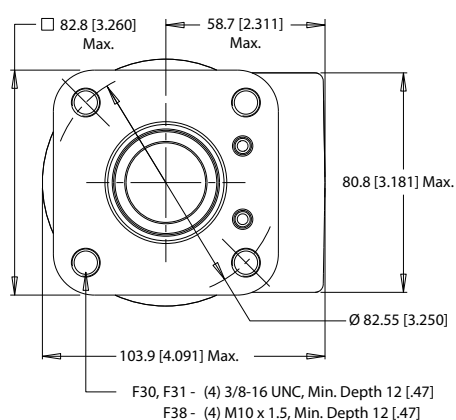
P109640

Technical Information Orbital Motors Type WD, WP and WR

WP Product Line

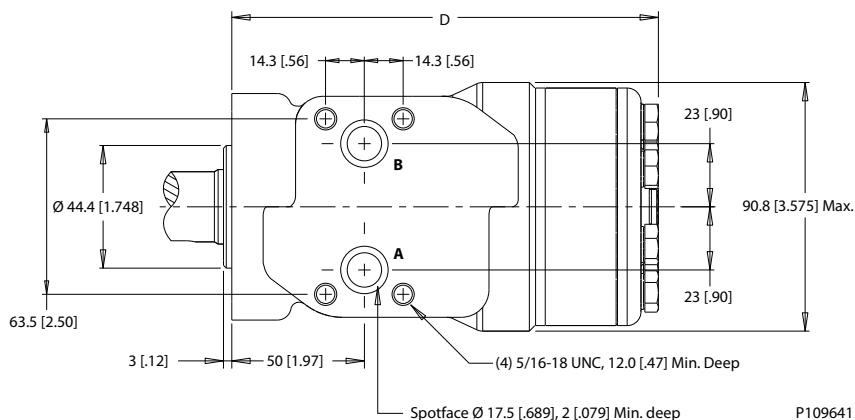
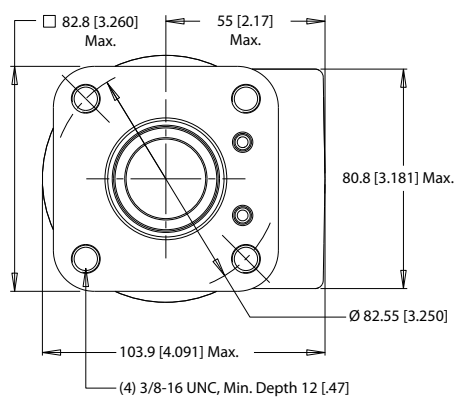
4-HOLE, SQUARE MOUNT, ALIGNED PORTS

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



4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS

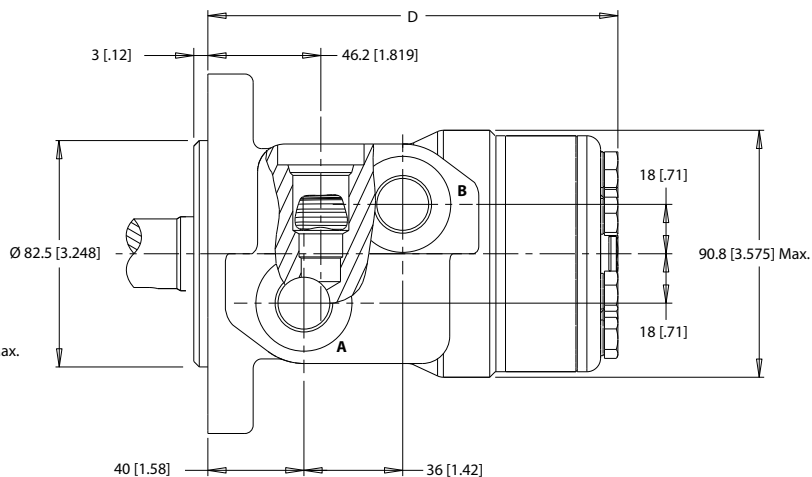
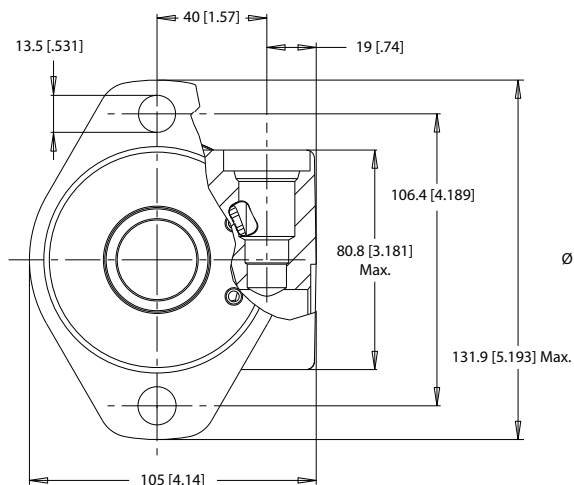
F37 1/2" Drilled



WP Product Line

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

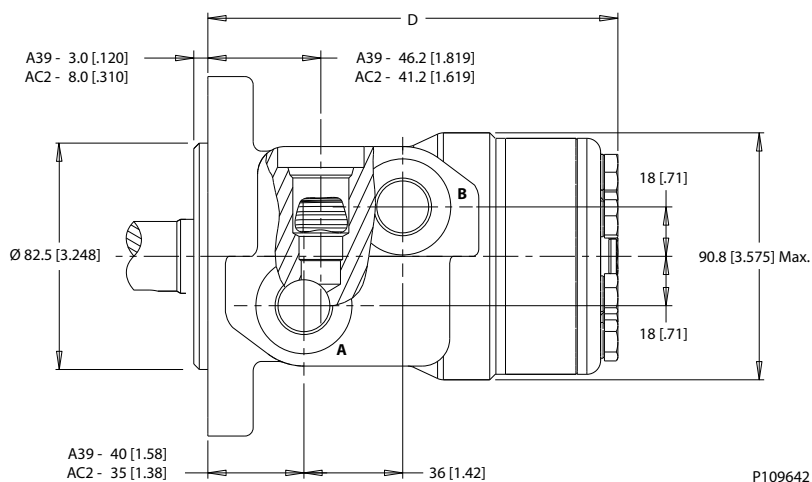
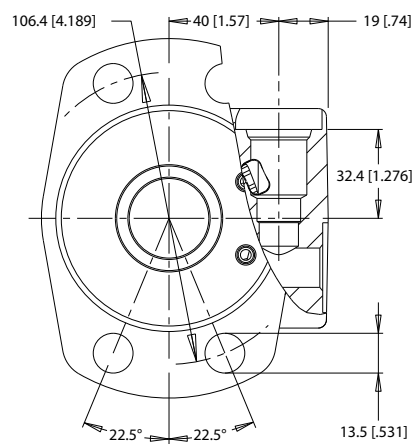
A19 7/8-14 UNF



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

A39 7/8-14 UNF

AC2 G 1/2 (TP)



P109642

WP Product Line

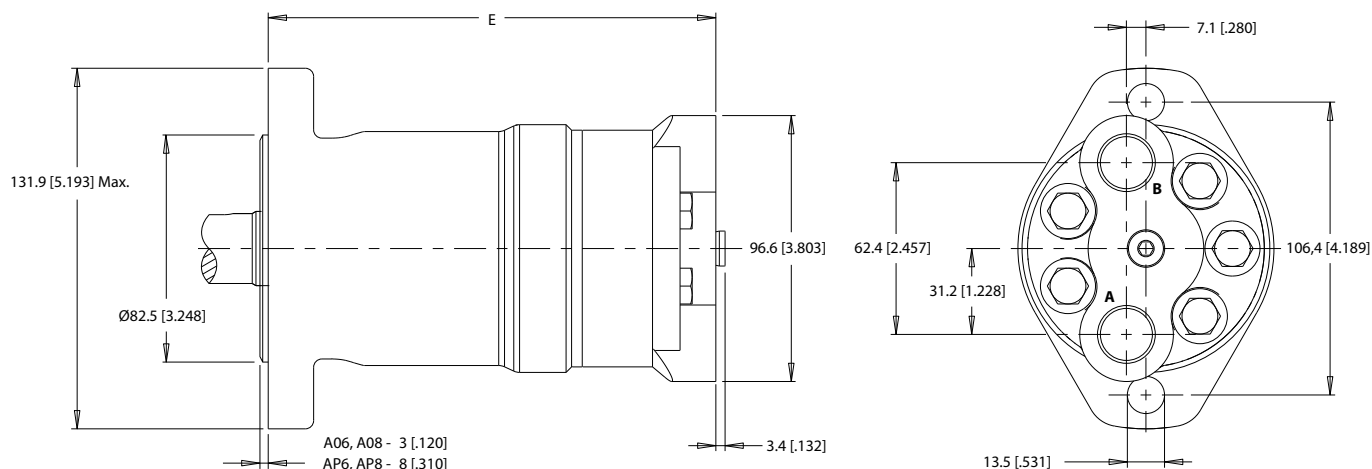
2-HOLE, SAE A MOUNT, ALIGNED END PORTS

A06 3/4-16 UNF

A08 G 1/2

AP6 3/4-16 UNF (TP)

AP8 G 1/2 (TP)



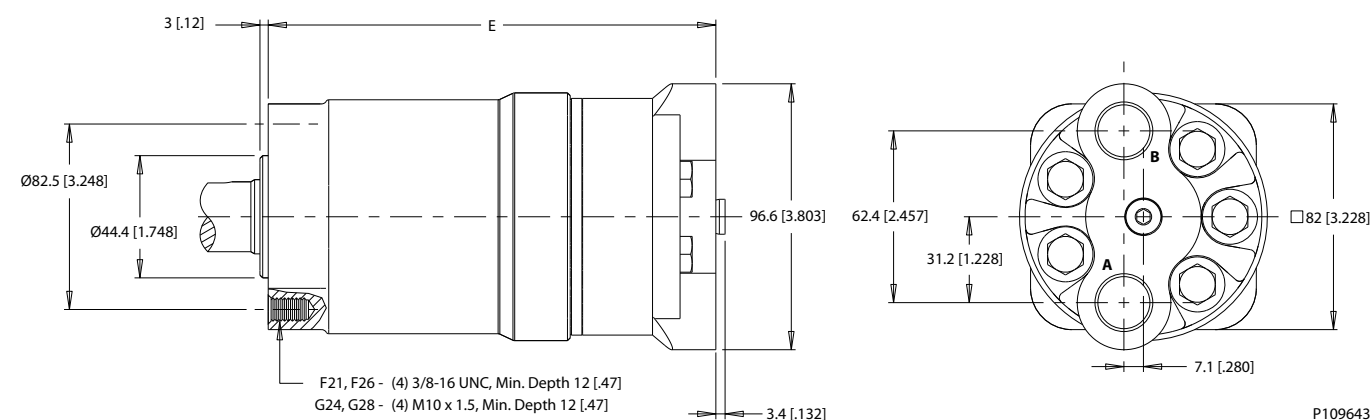
4-HOLE, SQUARE MOUNT, ALIGNED END PORTS

F21 7/8-14 UNF

F26 3/4-16 UNF

G24 M22 x 1.5

G28 G 1/2



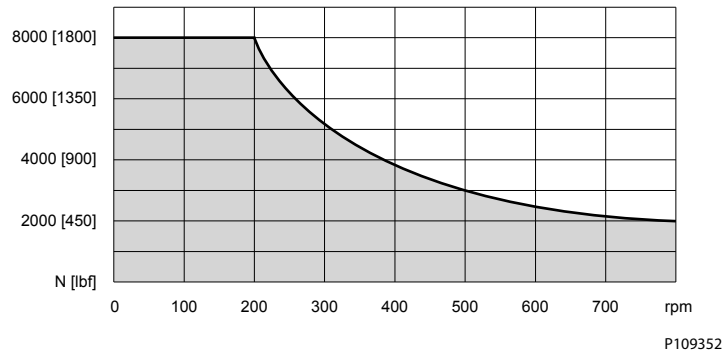
P109643

155/156 Series Technical Data

Allowable Shaft Load / Bearing Curve

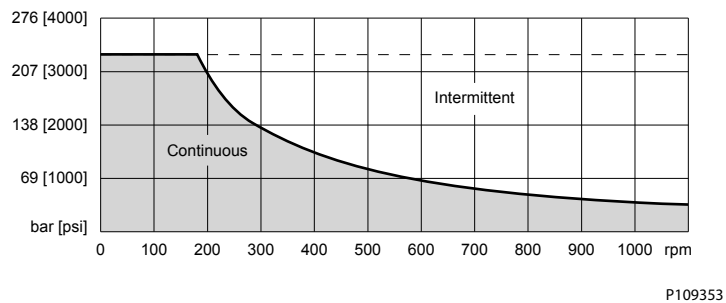
The bearing curve below represents the side load capacity of the motor at the centerline of the key for various motor speeds. Operating conditions within the shaded area will maintain acceptable oil film lubrication with recommended fluids. Operating conditions outside the shaded area are susceptible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

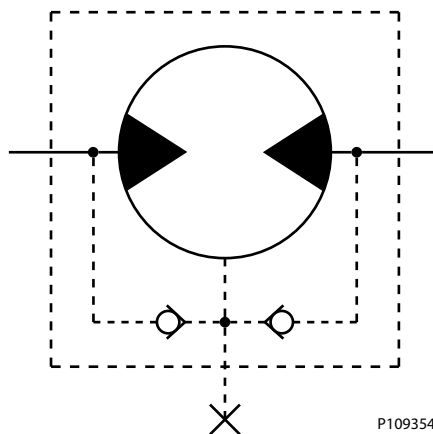


Permissible Shaft Seal Pressure

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.

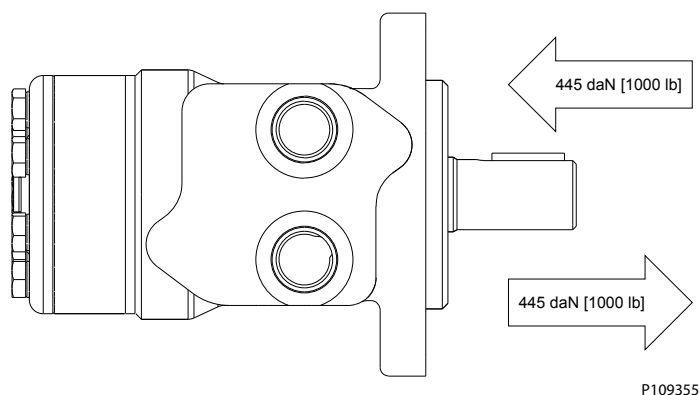


With check valves and drain connection, the shaft seal pressure equals pressure in the drain line. With check valves and no drain connection, shaft seal pressure is identical to output pressure. No check valves and no drain connection, the shaft seal pressure is identical to the average value of input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

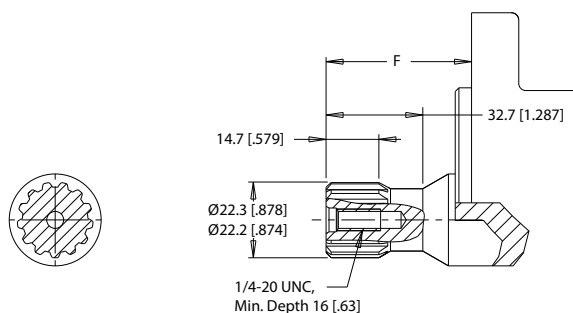
WP Product Line
Dimension E (continued)

#	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

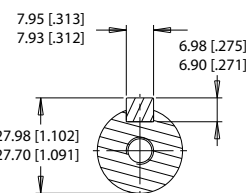
155/156 Series Shafts

01 7/8" 13 Tooth Spline



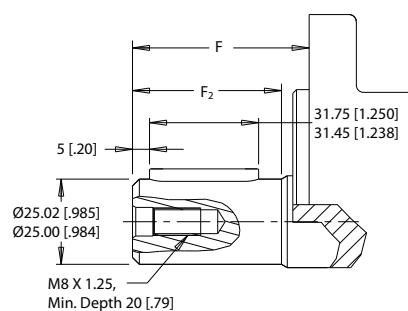
Max. Torque: 170 Nm [1500 lb-in]

12 25mm Straight



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

16 25mm Straight Extended

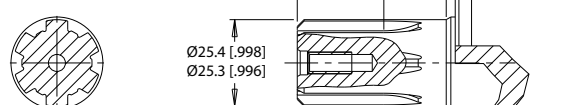


02 1" 6B Spline, 1/4-20 Tap

04 1" 6B Spline, M8x1.25 Tap

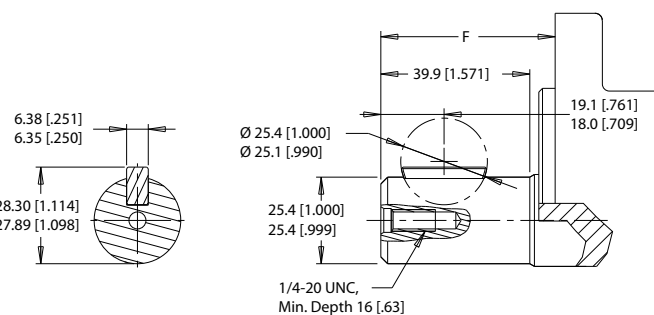
F3 1" 6B Spline, M8x1.25 Tap

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

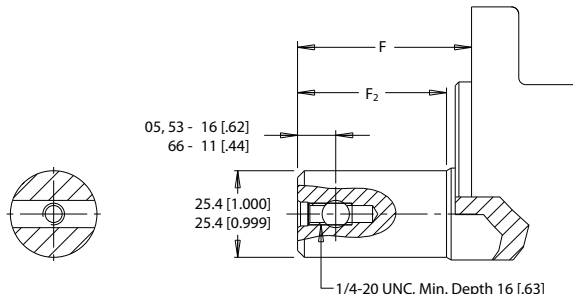


Max. Torque: 655 Nm [5800 lb-in]

05 1" - 9.5 [.375] Pinhole

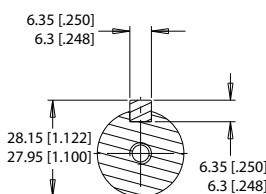
53 1" - 10.3 [.406] Pinhole

66 1" - 8.0 [.315] Pinhole



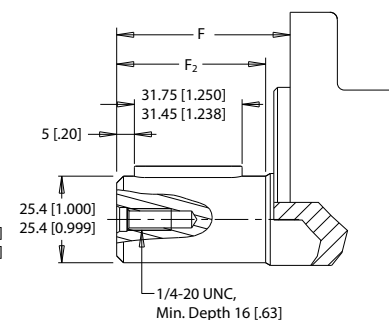
Max. Torque: 678 Nm [6000 lb-in]

10 1" Straight



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

15 1" Straight Extended



P109364

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.

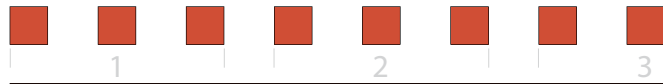
WP Product Line
Dimension F

#	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

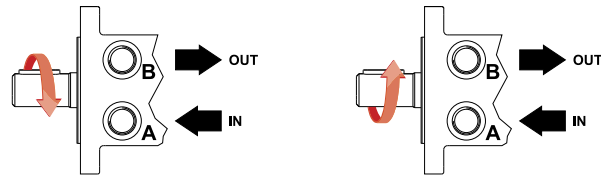
155/156 Order Codes

WP Product Line



1. 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		

WP Product Line

WP Product Line

WP 157 and 158 Series

WP 157 and 158 Series Housings

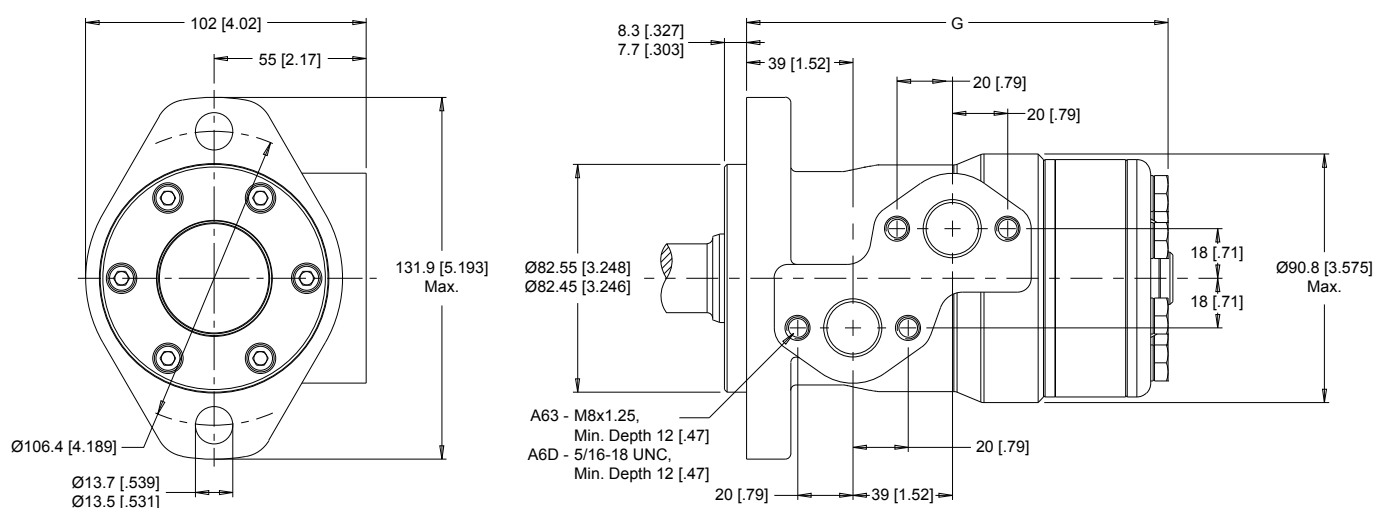
Dimensions shown are without paint. Paint thickness can be up to 0.13 [0.005].

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

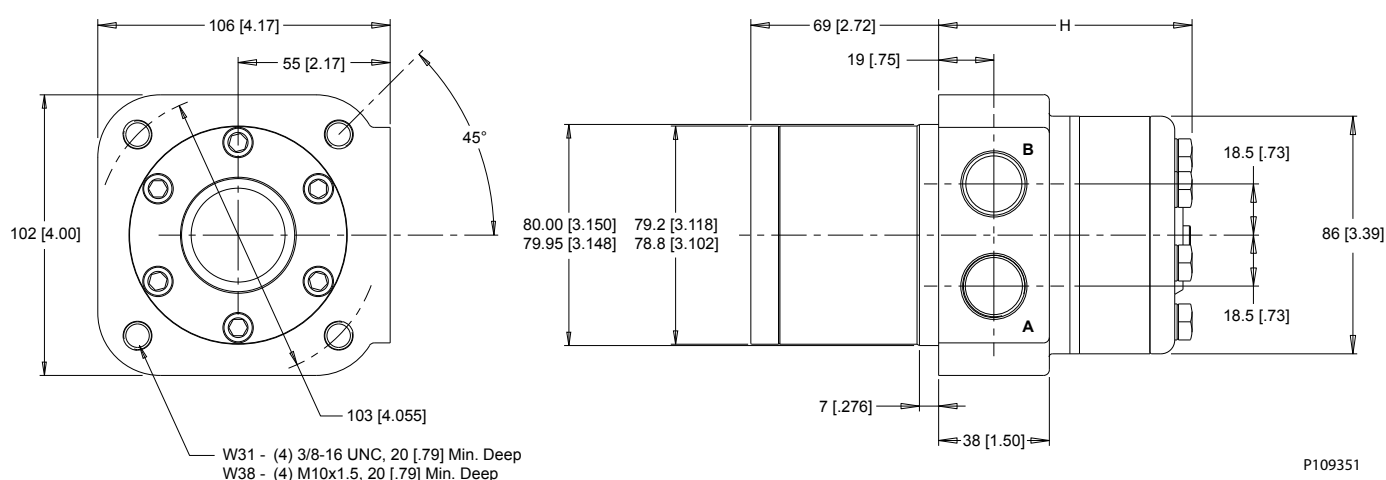
A6D 7/8-14 UNF



4-HOLE, WHEEL MOUNT, ALIGNED PORTS

W31 7/8-14 UNF

W38 G 1/2



P109351

WP 157 and 158 Series Technical Information

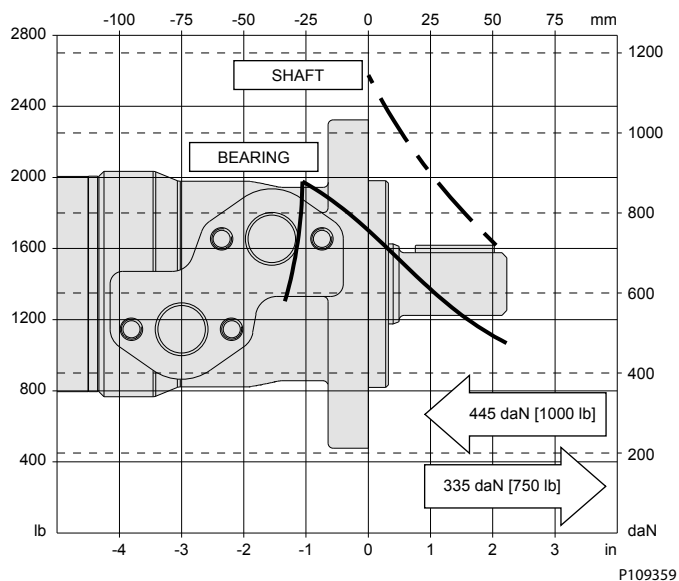
Allowable Shaft Load / Bearing Curve

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

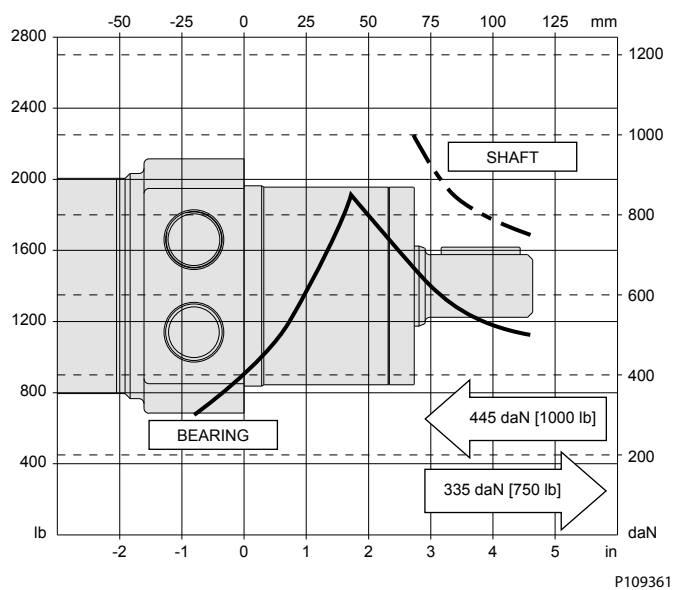
SAE A Mount

SAE A MOUNT



Wheel 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

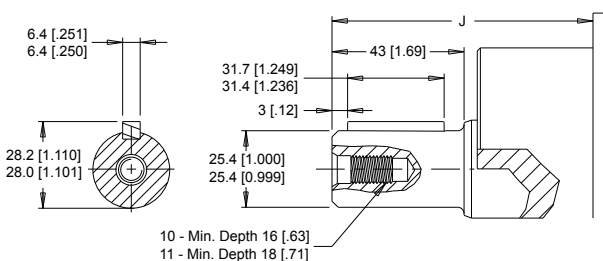
#	SAE and A Mounts	Wheel Mounts
	mm [in]	mm [in]
10	55 [2.18]	116 [4.57]
11	55 [2.18]	116 [4.57]

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]

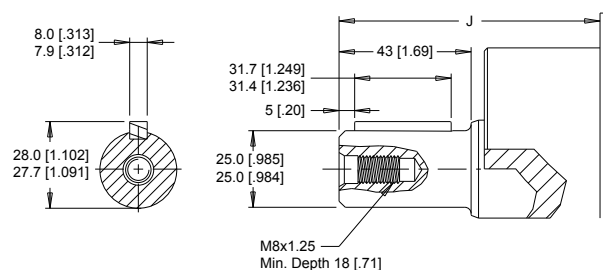
10 1" Straight, 1/4-20 Tap



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

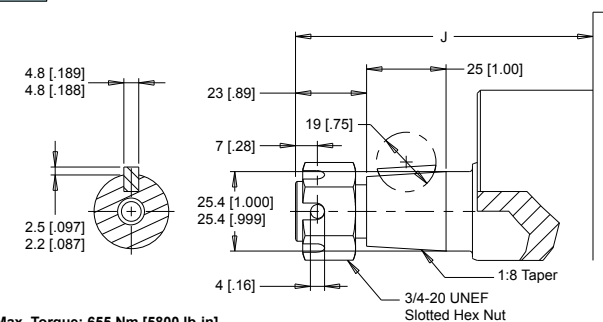
11 1" Straight, M8x1.25 Tap

12 25mm Straight



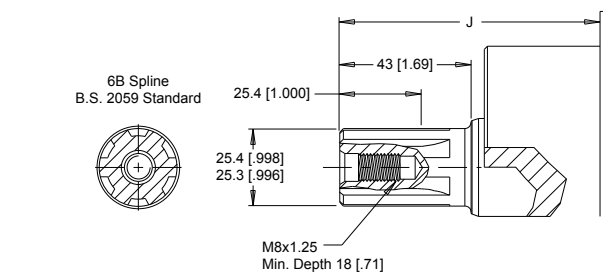
Max. Torque: 655 Nm [5800 lb-in]

13 1" Tapered



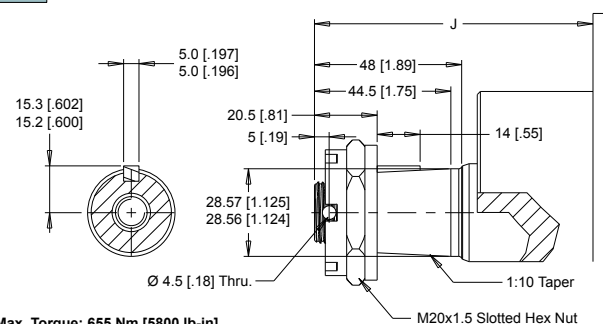
Max. Torque: 655 Nm [5800 lb-in]

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

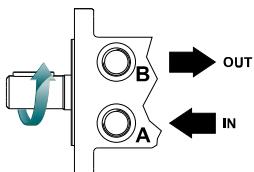
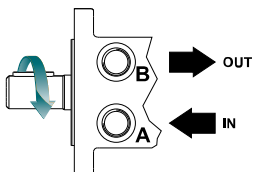
WP 157 and 158 Series Ordering Information

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.

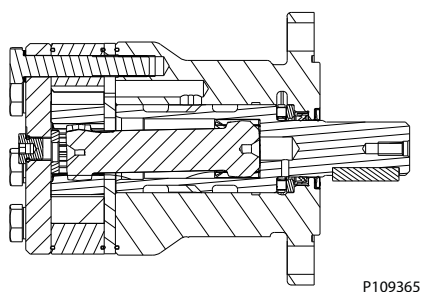
Typical Applications

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

Series Descriptions

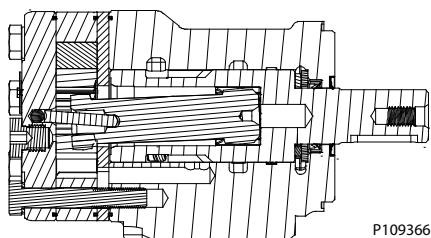
251/252 - Hydraulic Motor

Standard



255/256 - 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.

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]

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.

P109367

Technical Information Orbital Motors Type WD, WP and WR

WR Product Line

		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]
		50 cm ³ [3.1 in ³] / rev										
		Torque - Nm [lb-in], Speed rpm										Intermittent Ratings - 10% of Operation
Flow - lpm [gpm]	4 [1]	11 [97] 77	24 [212] 75	37 [327] 74	49 [434] 69	61 [540] 63	74 [655] 52	82 [726] 41	91 [805] 36			80
	8 [2]	11 [97] 155	24 [212] 152	36 [319] 150	49 [434] 142	62 [548] 132	75 [664] 124	88 [779] 107	99 [876] 91	107 [947] 82		160
	15 [4]	9 [80] 295	23 [204] 291	36 [319] 283	49 [434] 272	62 [548] 267	75 [664] 248	88 [779] 231	99 [876] 215	110 [973] 199	123 [1088] 182	147 [1301] 164
	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
	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
	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
	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
	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
	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
	Max. Cont.											
	Inter.											
		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>										
		Theoretical Torque - Nm [lb-in]										
		14 [122]	27 [195]	41 [301]	55 [398]	69 [496]	82 [593]	96 [690]	110 [796]	124 [894]	137 [1215]	165 [1458]
		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]										
		Rotor Width										
		9.9 [389]										
		mm [in]										

P109368

		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]
		59 cm ³ [3.6 in ³] / rev										
		Torque - Nm [lb-in], Speed rpm										Intermittent Ratings - 10% of Operation
Flow - lpm [gpm]	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
	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
	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
	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
	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
	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
	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
	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
	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
		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>										
		Theoretical Torque - Nm [lb-in]										
		16 [142]	33 [292]	49 [434]	65 [575]	81 [717]	98 [867]	114 [1009]	131 [1150]	147 [1292]	164 [1442]	179 [1584]
		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]										
		Rotor Width										
		11.8 [463]										
		mm [in]										

P109369

WR Product Line

<div>070</div>		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]	
71 cm³ [4.3 in³] / rev													
Torque - Nm [lb-in], Speed rpm													
Intermittent Ratings - 10% of Operation													
Flow - lpm [gpm]	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
	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
Max. Inter.	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
	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
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>											
Theoretical Torque - Nm [lb-in]													
13.8 [.542]		19 [169]	39 [348]	77 [685]	97 [854]	117 [1033]	136 [1202]	155 [1371]	174 [1540]	194 [1719]	213 [1888]	232 [2056]	
mm [in]													
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]													

080		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]		
79 cm³ [4.9 in³] / rev														
Torque - Nm [lb-in], Speed rpm														
Intermittent Ratings - 10% of Operation														
Flow - lpm [gpm]	4 [1]	18 [159] 49	38 [336] 46	77 [681] 41	94 [832] 40								50	
	8 [2]	18 [159] 99	39 [345] 98	76 [673] 89	98 [867] 83	120 [1062] 74	141 [1248] 68	159 [1407] 59	174 [1540] 50				100	
	15 [4]	17 [150] 189	38 [336] 187	76 [673] 177	98 [867] 170	120 [1062] 161	141 [1248] 151	160 [1416] 144	180 [1593] 131	199 [1761] 122	220 [1947] 112	240 [2124] 100	190	
	23 [6]	17 [150] 290	37 [327] 286	79 [690] 274	97 [858] 268	119 [1053] 259	140 [1239] 250	160 [1416] 240	182 [1611] 227	202 [1788] 214	222 [1965] 200	243 [2150] 185	291	
	30 [8]	14 [124] 374	35 [310] 368	75 [664] 357	96 [850] 349	117 [1035] 339	138 [1221] 330	159 [1407] 321	181 [1602] 307	200 [1770] 296	220 [1947] 284	241 [2133] 268	380	
	38 [10]	11 [97] 480	34 [301] 475	73 [646] 464	94 [832] 453	116 [1027] 442	138 [1221] 433	158 [1398] 423	177 [1566] 412	199 [1761] 398	218 [1929] 383	238 [2106] 370	481	
	45 [12]	8 [71] 568	31 [274] 562	72 [637] 548	93 [823] 543	114 [1009] 532	135 [1195] 525	155 [1372] 515	176 [1558] 501	196 [1735] 486	215 [1903] 472	235 [2080] 458	570	
	53 [14]	5 [44] 668	28 [248] 663	69 [611] 649	90 [796] 642	111 [982] 632	133 [1177] 624	152 [1345] 620	172 [1522] 600	193 [1708] 585	212 [1876] 570	232 [2053] 554	671	
	61 [16]		24 [212] 759	65 [575] 752	85 [752] 747	109 [965] 739	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 [921] 828	125 [1106] 818	143 [1265] 807	164 [1451] 800	182 [1611] 789	204 [1805] 776	223 [1973] 760	861	
76 [20]		18 [159] 957	56 [496] 952	76 [673] 944	100 [885] 932	120 [1062] 923	138 [1221] 912	159 [1407] 900	178 [1575] 886	199 [1761] 872	218 [1929] 858	962		
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>												
Theoretical Torque - Nm [lb-in]														
15.7 [617]		22 [192]	43 [384]	87 [768]	108 [960]	130 [1152]	152 [1344]	174 [1536]	195 [1728]	217 [1920]	239 [2112]	260 [2304]		
mm [in]		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]												

P109371

Technical Information Orbital Motors Type WD, WP and WR

WR Product Line

Pressure - bar [psi]											Max. Cont.	Max. Inter.
090											172 [2500]	207 [3000]
88 cm ³ [5.4 in ³] / rev												
Torque - Nm [lb-in], Speed rpm											Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	2 [0.5]	18 [159] 23	40 [354] 22	75 [664] 17								23
	4 [1]	20 [177] 45	44 [389] 42	88 [779] 35	112 [991] 31	118 [1044] 27	128 [1133] 21					45
	8 [2]	22 [195] 91	44 [389] 88	87 [770] 81	114 [1009] 77	134 [1186] 72	158 [1398] 68	175 [1549] 60	198 [1752] 52	216 [1912] 42		91
	15 [4]	20 [177] 169	44 [389] 166	88 [779] 160	112 [991] 156	134 [1186] 152	154 [1363] 146	182 [1611] 140	204 [1805] 130	222 [1965] 122	242 [2142] 110	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	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	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	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	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	601
	61 [16]		20 [177] 691	66 [584] 688	90 [797] 684	109 [965] 678	134 [1186] 670	156 [1381] 664	173 [1531] 654	200 [1770] 642	220 [1947] 630	692
Max. Inter.	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	772
	76 [20]		10 [88] 864	58 [513] 863	79 [699] 858	100 [885] 848	121 [1071] 844	148 [1310] 835	163 [1442] 825	186 [1646] 812	205 [1814] 800	864
Rotor Width 17.3 [682] mm [in]											Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>	
Theoretical Torque - Nm [lb-in] 24 [215] 49 [429] 97 [859] 121 [1073] 146 [1288] 170 [1502] 194 [1717] 218 [1932] 243 [2146] 267 [2361] 291 [2576]												
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]												

P109372

Pressure - bar [psi]											Max. Cont.	Max. Inter.
100											172 [2500]	207 [3000]
100 cm ³ [6.1 in ³] / rev												
Torque - Nm [lb-in], Speed rpm											Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	2 [0.5]	18 [159] 17	37 [327] 13	77 [681] 11	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	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	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	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	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	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	530
	61 [16]	10 [88] 610	28 [248] 608	79 [699] 600	103 [912] 596	129 [1142] 590	152 [1345] 582	172 [1522] 576	198 [1752] 568	223 [1973] 556	254 [2248] 542	610
Max. Inter.	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] 610	215 [1903] 610	251 [2221] 594	680
	76 [20]		15 [133] 760	63 [558] 754	85 [752] 750	112 [991] 742	133 [1177] 730	160 [1416] 715	185 [1637] 702	202 [1788] 688	248 [2195] 666	760
Rotor Width 19.7 [777] mm [in]											Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>	
Theoretical Torque - Nm [lb-in] 27 [239] 56 [496] 110 [974] 137 [1212] 166 [1469] 193 [1708] 220 [1947] 247 [2186] 275 [2434] 303 [2682] 330 [2921]												
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]												

P109373

WR Product Line

		Pressure - bar [psi]								Max. Cont.	Max. Inter.	
100		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]
100 cm³ [6.1 in³] / rev										Intermittent Ratings - 10% of Operation		
Torque - Nm [lb-in], Speed rpm												
Flow - lpm [gpm]	2 [0.5]	18 [159] 17	37 [327] 13	77 [681] 12	91 [805] 11							20
	4 [1]	26 [230] 38	49 [434] 37	84 [743] 33	106 [938] 31	120 [1062] 29	140 [1239] 15	160 [1416] 7				40
	8 [2]	25 [221] 80	50 [442] 78	98 [867] 75	125 [1106] 70	150 [1327] 68	175 [1549] 65	199 [1761] 61	189 [1673] 20			80
	15 [4]	26 [230] 150	46 [407] 148	97 [858] 142	124 [1097] 139	148 [1310] 136	175 [1549] 131	198 [1752] 128	224 [1982] 122	245 [2168] 118	267 [2363] 111	289 [2558] 85
	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
	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
	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
	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
	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
	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
Max. Cont.	68 [18]	6 [53] 680	21 [186] 677	71 [628] 666	94 [832] 660	121 [1071] 653	146 [1292] 645	169 [1496] 635	192 [1699] 624	215 [1903] 610	251 [2221] 594	272 [2407] 574
	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
Max. Inter.		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input checked="" type="checkbox"/>										
		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

		Pressure - bar [psi]								Max. Cont.		Max. Inter.	
130		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
129 cm³ [7.9 in³] / rev										Intermittent Ratings - 10% of Operation			
Flow - lpm [gpm]	2 [0.5]	34 [301] 15	60 [531] 6									15	
	4 [1]	32 [283] 30	64 [566] 29	124 [1097] 18	140 [1239] 10	185 [1637] 6						30	
	8 [2]	31 [274] 59	65 [575] 58	126 [1115] 51	144 [1274] 46	198 [1752] 38	223 [1974] 32	248 [2195] 25				59	
	15 [4]	31 [274] 115	66 [584] 112	130 [1151] 106	164 [1451] 102	195 [1726] 97	221 [1956] 92	255 [2257] 86	285 [2522] 80	312 [2761] 74	345 [3053] 66	118	
	23 [6]	30 [266] 177	65 [575] 175	130 [1151] 167	162 [1434] 163	196 [1735] 157	230 [2036] 152	265 [2345] 142	289 [2558] 138	316 [2797] 132	352 [3115] 121	375 [3319] 114	
	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	
	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	
	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	
	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	
	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	
Max. Inter.	68 [18]		36 [319] 529	102 [903] 522	132 [1168] 517	166 [1469] 507	198 [1752] 500	224 [1982] 489	262 [2319] 482	292 [2584] 468	323 [2859] 445	351 [3106] 430	
	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	
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>											
Theoretical Torque - Nm [lb-in]		35 [310]	71 [628]	142 [1257]	177 [1566]	212 [1876]	248 [2195]	283 [2504]	318 [2814]	354 [3133]	389 [3442]	425 [3761]	
25.4 [1.002] mm [in]		Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]											

P109375

Technical Information Orbital Motors Type WD, WP and WR

WR Product Line

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

		Pressure - bar [psi]										Max. Cont.		Max. Inter.	
200		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]			
198 cm³ [12.1 in³] / rev															
Torque - Nm [lb-in], Speed rpm															
Intermittent Ratings - 10% of Operation															
Flow - lpm [gpm]	2 [0.5]	38 [336] 10	87 [770] 8	172 [1522] 6	201 [1779] 5								10	Theoretical rpm	
	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		
	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		
Max. Inter.	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	Theoretical rpm	
	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		
Rotor Width		Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%													
39.4 [1.553]		Theoretical Torque - Nm [lb-in]													
mm [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]															

WR Product Line

		Pressure - bar [psi]								Max. Cont.	Max. Inter.		
240		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
236 cm³ [14.4 in³] / rev													
Torque - Nm [lb-in], Speed rpm												Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	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
	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
Max. Inter.	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
	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
Rotor Width													
47.4 [1.865]													
mm [in]													
Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>													
Theoretical Torque - Nm [lb-in]													
		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

		Pressure - bar [psi]								Max. Cont.		Max. Inter.	
250		17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	
250 cm³ [15.3 in³] / rev													
		Torque - Nm [lb-in], Speed rpm										Intermittent Ratings - 10% of Operation	
Flow - lpm [gpm]	8 [2]	49 [434] 31	112 [991] 31									32	
	15 [4]	49 [434] 59	115 [1018] 60	237 [2097] 56	295 [2611] 53	356 [3150] 48						60	
	23 [6]	45 [398] 91	112 [991] 90	233 [2062] 88	301 [2664] 85	360 [3186] 81	418 [3699] 74	471 [4168] 69	521 [4611] 64	561 [4965] 61		92	
	30 [8]	41 [363] 119	107 [947] 118	235 [2080] 116	285 [2522] 113	352 [3115] 107	399 [3531] 103	441 [3903] 99	511 [4522] 92	559 [4947] 87	598 [5292] 84	624 [5522] 82	120
	38 [10]	33 [292] 151	97 [858] 150	219 [1938] 148	273 [2416] 144	330 [2920] 139	390 [3451] 134	434 [3841] 132	484 [4283] 129	529 [4681] 124	578 [5115] 119	618 [5469] 116	152
	45 [12]	22 [195] 179	81 [717] 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
	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 [5133] 220	304
Rotor Width													
49.2 [1.938]													
mm [in]													
		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>											
		Theoretical Torque - Nm [lb-in]											
		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

Technical Information Orbital Motors Type WD, WP and WR

WR Product Line

		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]
		291 cm ³ [17.8 in ³] / rev										
		Torque - Nm [lb-in], Speed rpm										
		Intermittent Ratings - 10% of Operation										
Flow - lpm [gpm]	2 [0.5]	60 [531] 7	115 [1018] 6	185 [1637] 5	260 [2301] 4	292 [2584] 3						
	4 [1]	62 [549] 13	122 [1080] 12	187 [1655] 10	265 [2345] 8	304 [2690] 6	365 [2330] 4					
	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		
	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
	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
	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
	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
	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
	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
	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
Max. Inter.	68 [18]		66 [581] 230	140 [1239] 226	218 [1929] 218	280 [2478] 210	365 [3230] 202	435 [3850] 192	479 [4239] 182	526 [4655] 174	588 [5204] 164	604 [5345] 158
	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
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>										
Theoretical Torque - Nm [lb-in]												
57.2 [2.252] mm [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

		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]	
		322 cm ³ [19.6 in ³] / rev										
		Torque - Nm [lb-in], Speed rpm										
		Intermittent Ratings - 10% of Operation										
Flow - lpm [gpm]	2 [0.5]	60 [531] 6	134 [1186] 5	189 [1673] 5	238 [2106] 4							
	4 [1]	70 [619] 12	140 [1239] 11	239 [2115] 10	276 [2442] 9	324 [2867] 6	393 [3478] 4	403 [3566] 2				
	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	
	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	
	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	
	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	
	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	
	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	
	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	
	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	
Max. Inter.	68 [18]		88 [779] 210	144 [1274] 208	220 [1947] 204	285 [2522] 197	356 [3150] 190	424 [3752] 181	487 [4310] 173	549 [4858] 165	602 [5327] 156	
	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	
Rotor Width		Overall Efficiency - 70 - 100% <input type="checkbox"/> 40 - 69% <input type="checkbox"/> 0 - 39% <input type="checkbox"/>										
Theoretical Torque - Nm [lb-in]												
63.5 [2.502] mm [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

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

P109382

WR Product Line

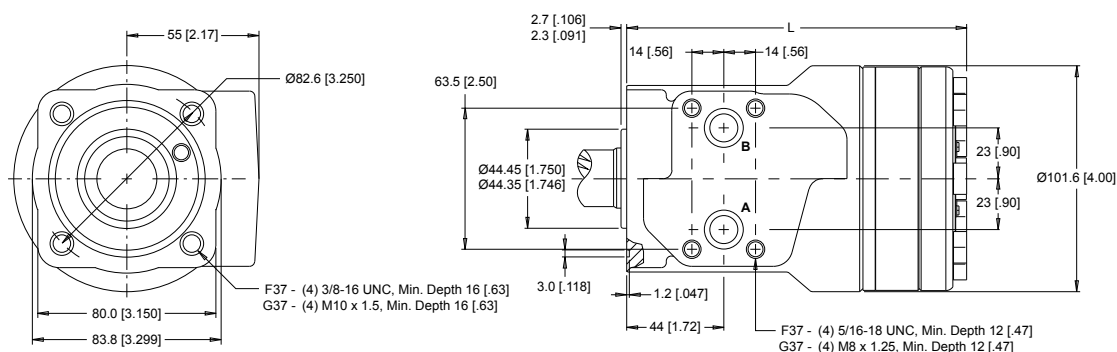
WR 251 and 252 Series

WR 251 and 252 Series Housings

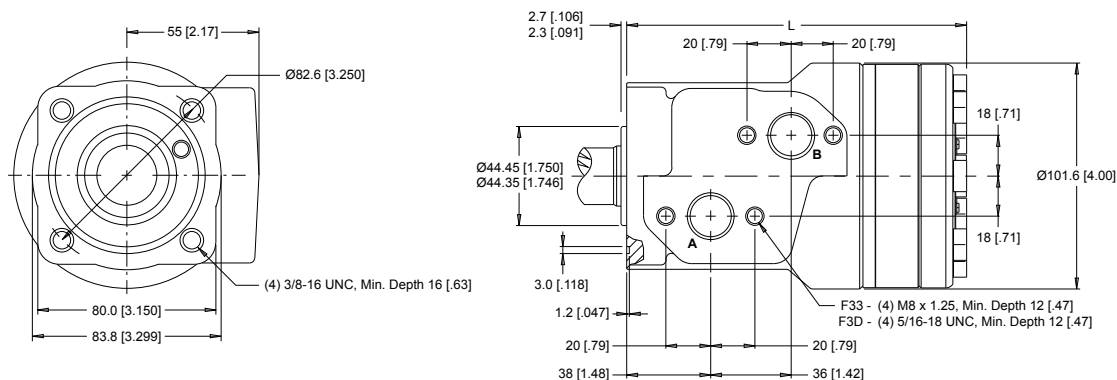
Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

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

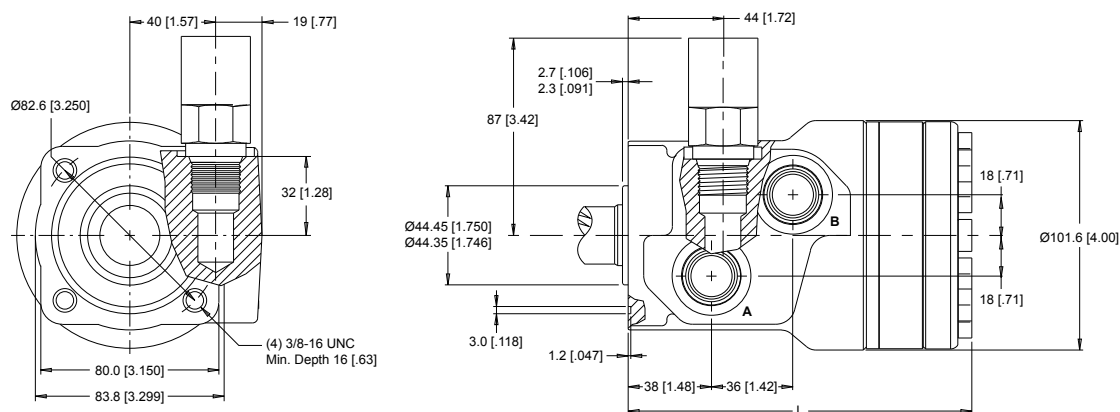
4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS **F37** 1/2" Drilled **G37** 1/2" Drilled



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

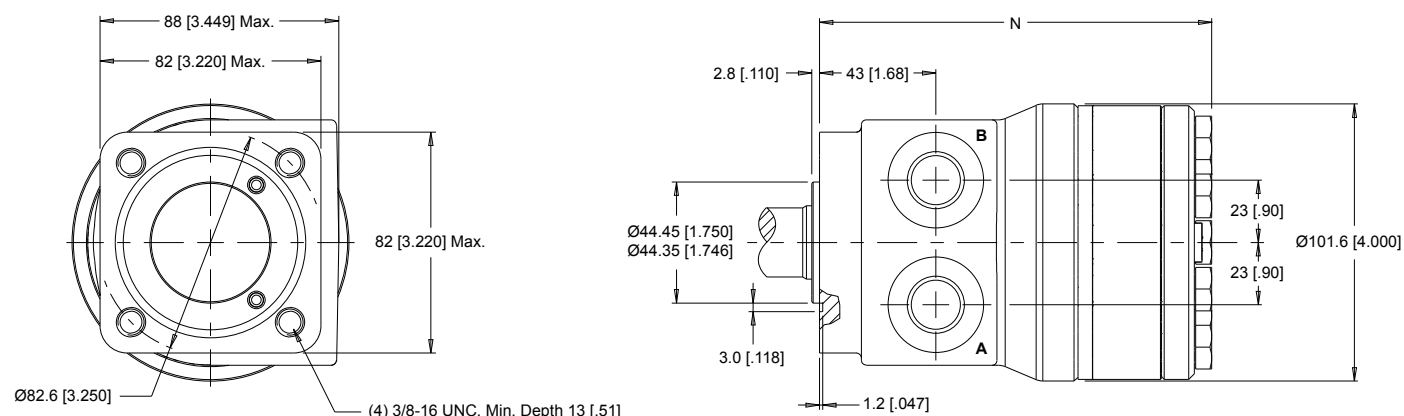


P109383

WR Product Line

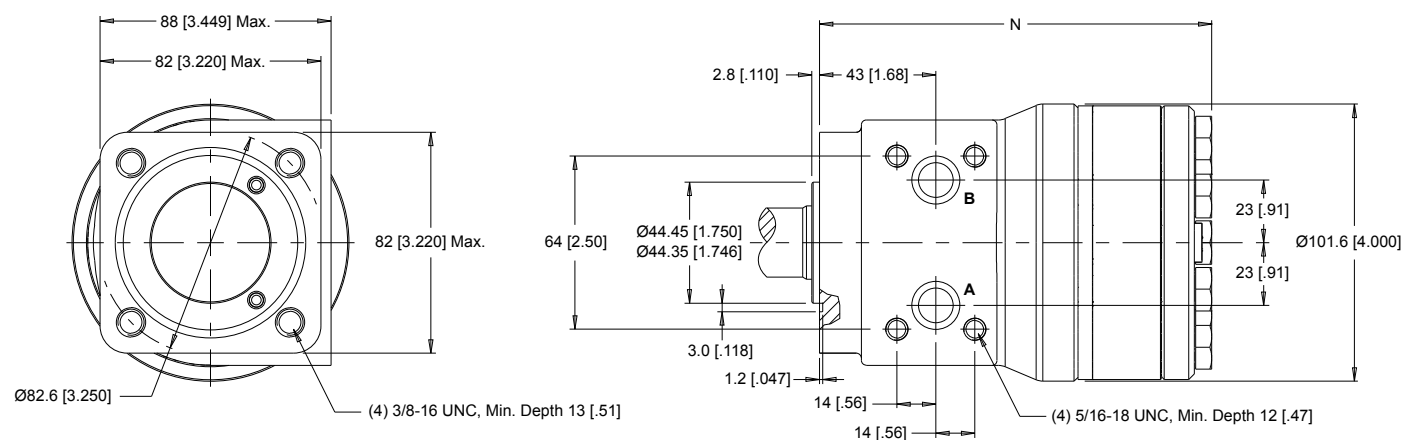
4-HOLE, SQUARE MOUNT, ALIGNED PORTS

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



4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS

F37 1/2" Drilled



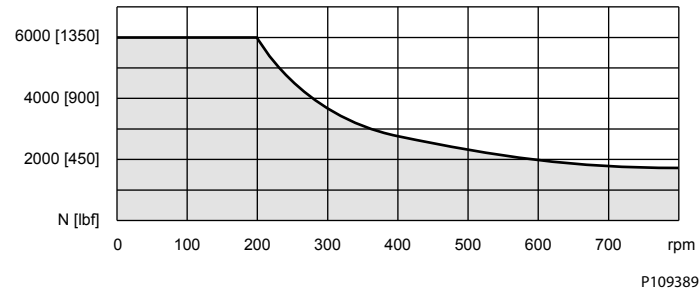
P109385

WR 251 and 252 Series Technical Information

Allowable Shaft Load / Bearing Curve

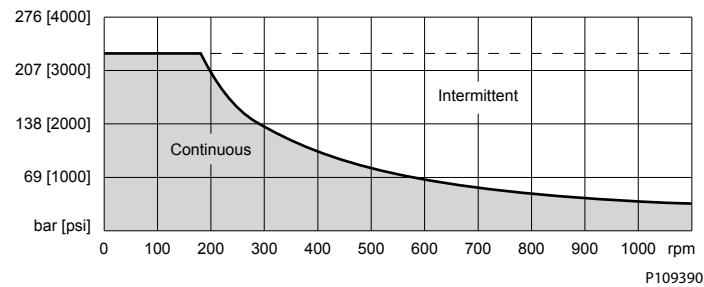
The bearing curve below represents the side load capacity of the motor at the centerline of the key for various motor speeds. Operating conditions within the shaded area will maintain acceptable oil film lubrication with recommended fluids. Operating conditions outside the shaded area are susceptible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

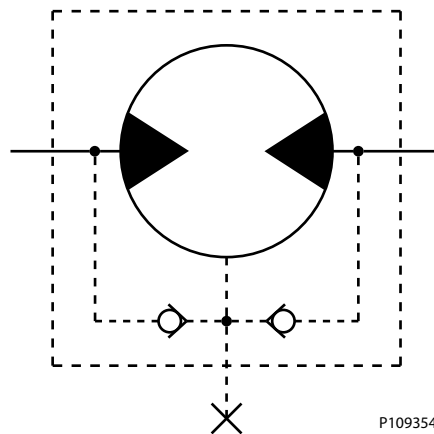


Permissible Shaft Seal Pressure

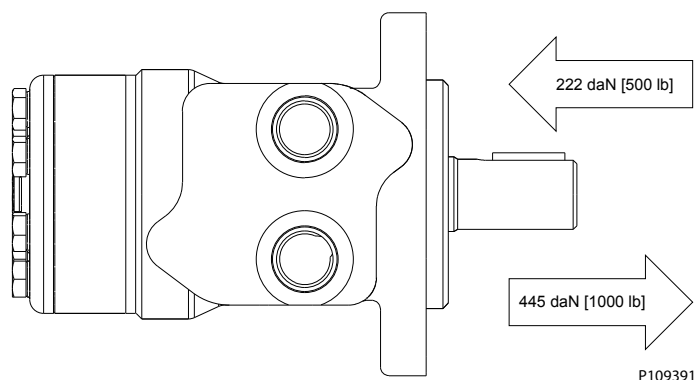
The curve below represents allowable seal pressure at various speeds. Operation in the gray area results in maintaining the rated life of the shaft seal. Actual shaft seal pressure depends on motor configuration.



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.

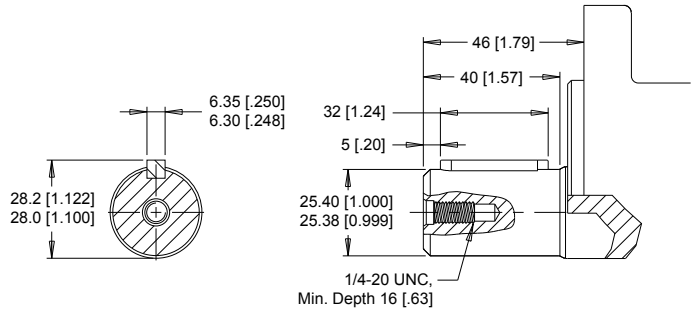
Dimension N

#	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

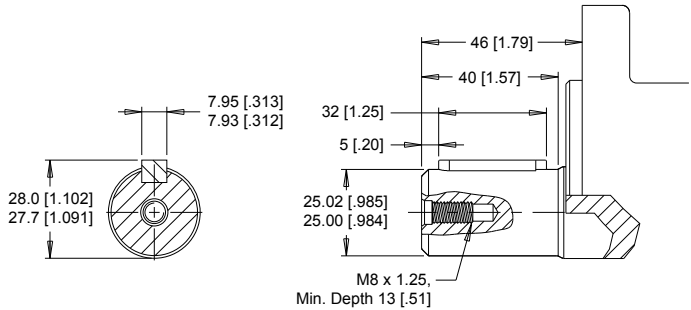
WR 251 and 252 Series Shafts

10 1" Straight



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

12 25mm Straight



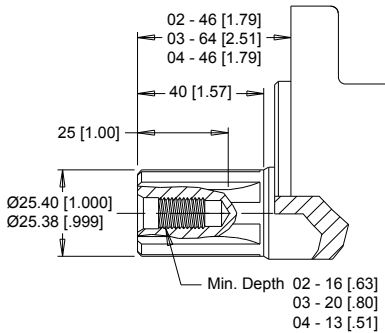
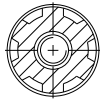
Max. Torque: 678 Nm [6000 lb-in]

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

04 1" 6B Spline, M8x1.25 Tap

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

6B Spline
SAE J499 Standard



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

P109392

WR Product Line

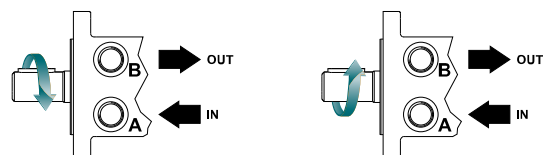
WR 251 and 252 Series Ordering Information

12345678

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	10	1" Straight
03	6B Spline, 5/16 Tap (Ext)	12	25mm Straight
04	6B Spline, M8 Tap		

► 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

P109396

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].

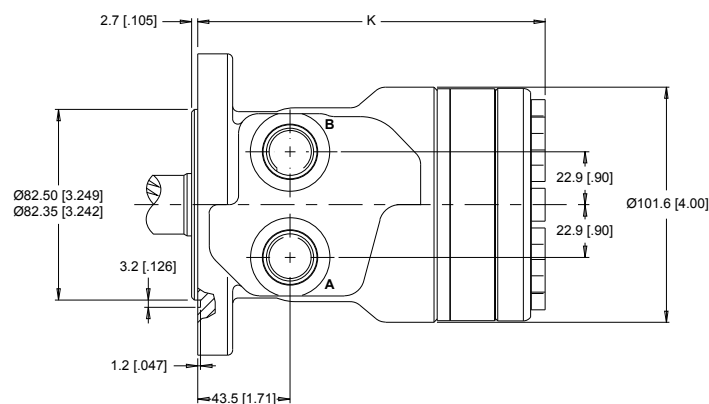
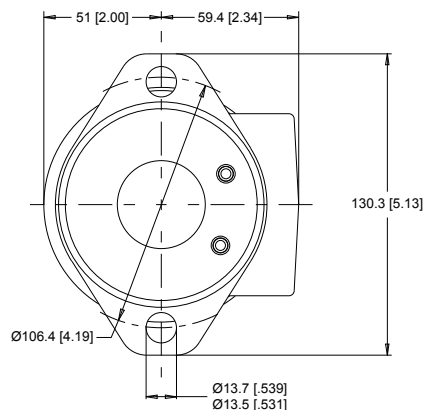
Dimensions are charted in *WR 255 and 256 Series Technical Information* on page 85.

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

WR Product Line

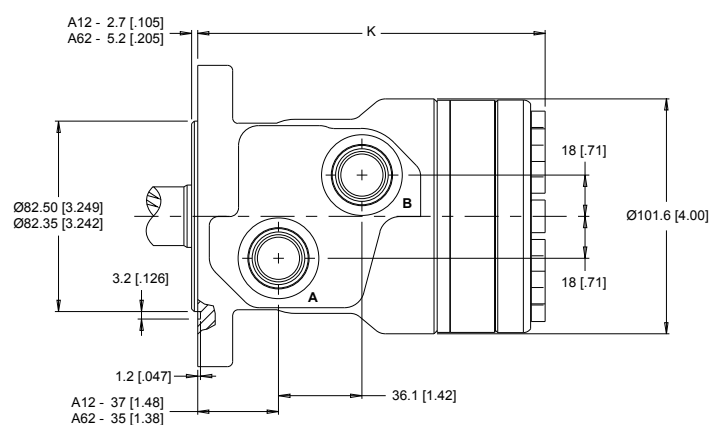
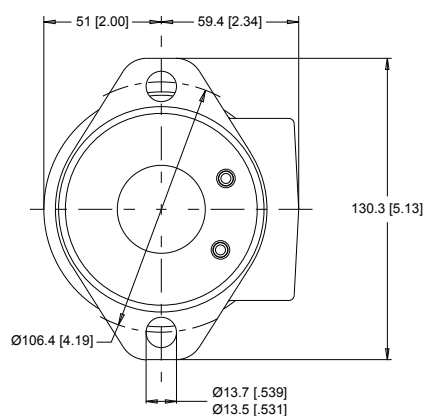
2-HOLE, SAE A MOUNT, ALIGNED PORTS

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



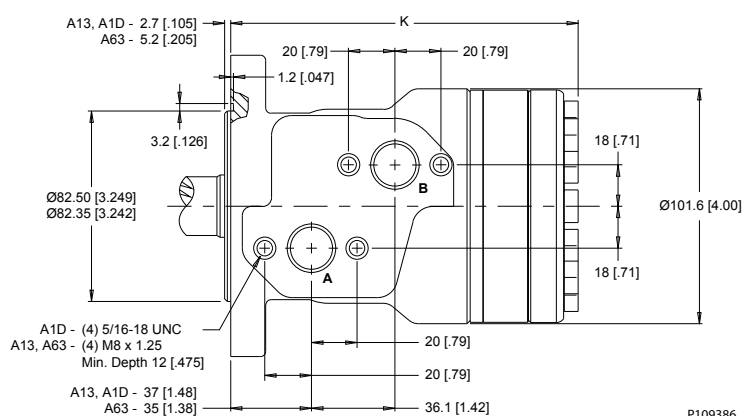
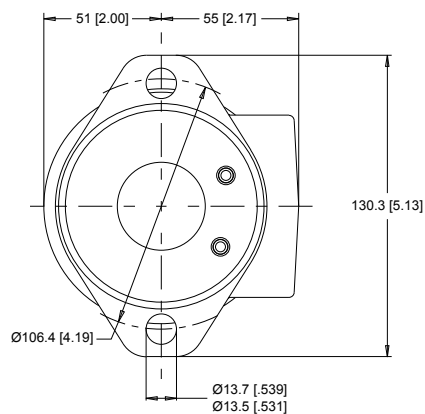
2-HOLE, SAE A MOUNT, OFFSET PORTS

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



2-HOLE, SAE A MOUNT, OFFSET MANIFOLD PORTS

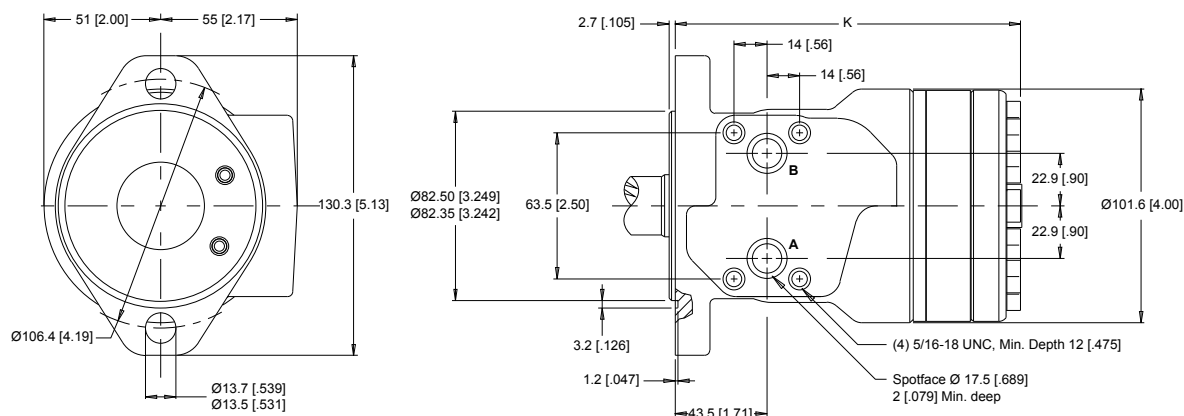
A13 G 1/2 **A1D** 7/8-14 UNF **A63** G 1/2 (TP)



WR Product Line

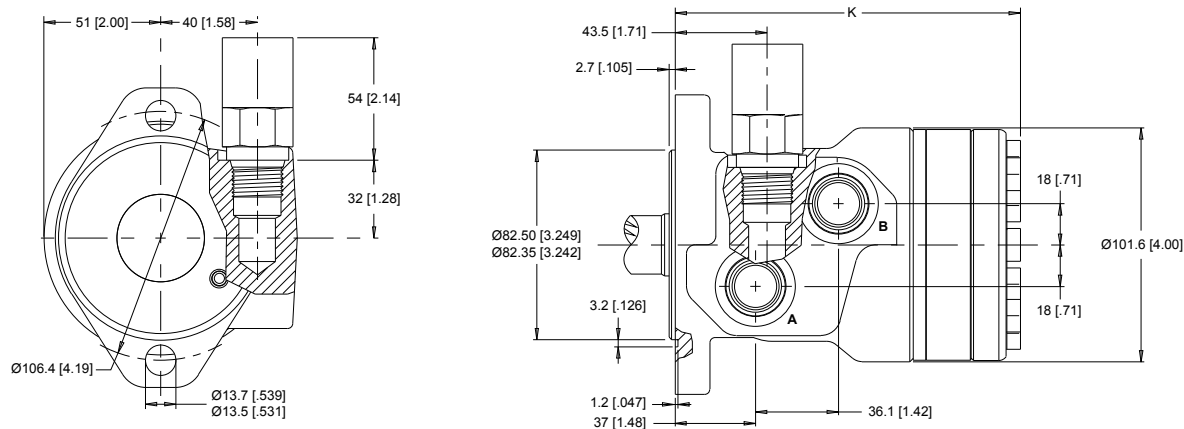
2-HOLE, SAE A MOUNT, ALIGNED MANIFOLD PORTS

A17 1/2" Drilled



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

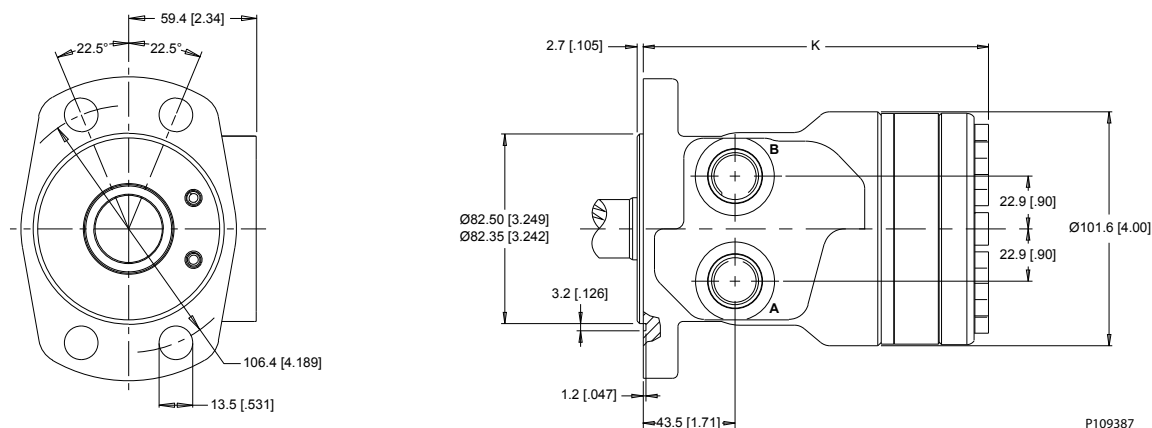
A19 7/8-14 UNF



4-HOLE, MAGNETO MOUNT, ALIGNED PORTS

A30 1/2-14 NPT

A31 7/8-14 UNF

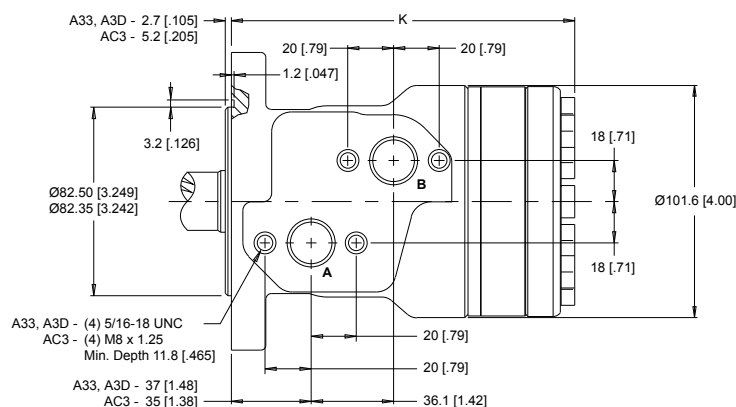
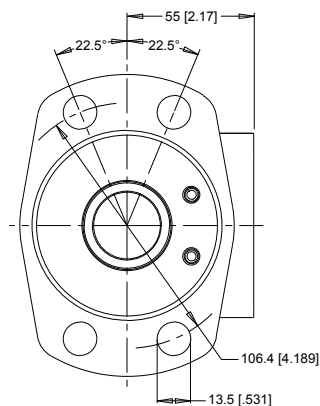


P109387

WR Product Line

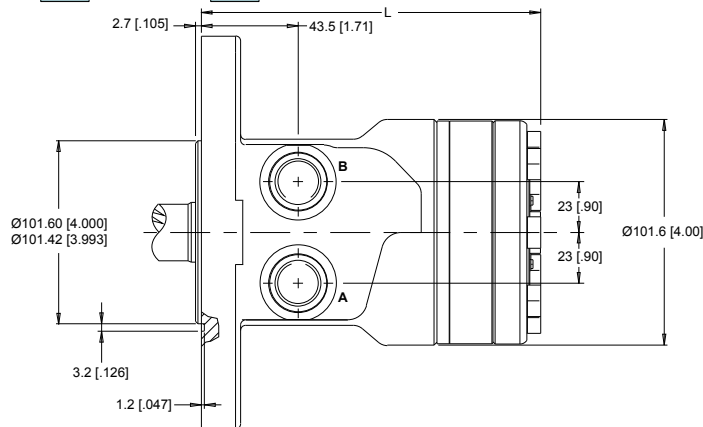
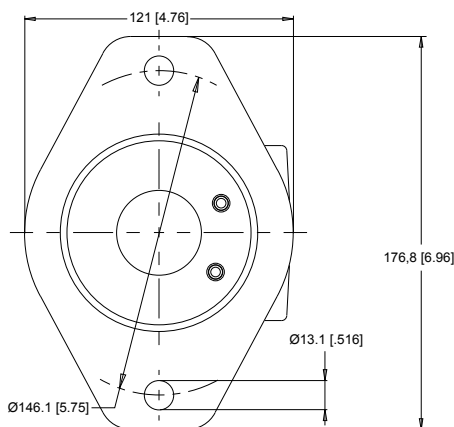
4-HOLE, MAGNETO MOUNT, OFFSET MANIFOLD

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



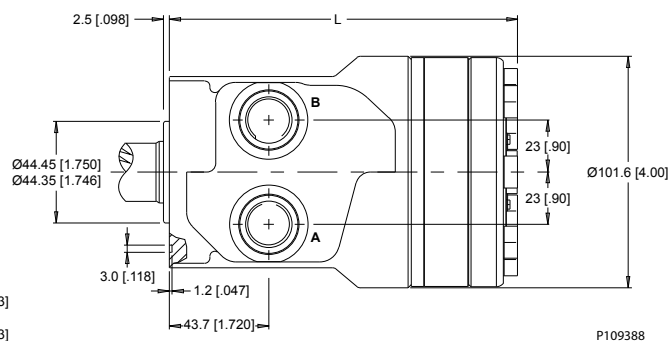
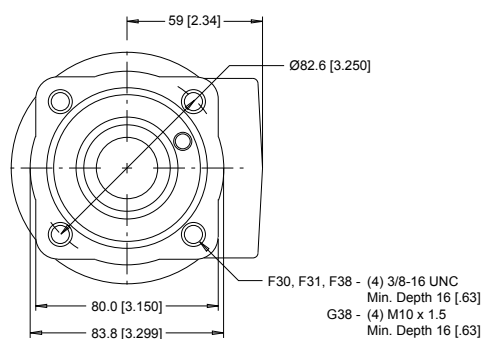
2-HOLE, SAE B MOUNT, ALIGNED PORTS

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

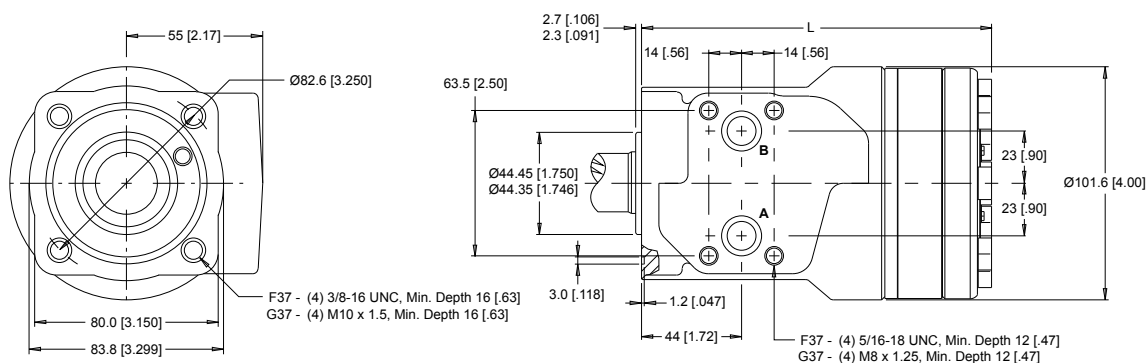


P109388

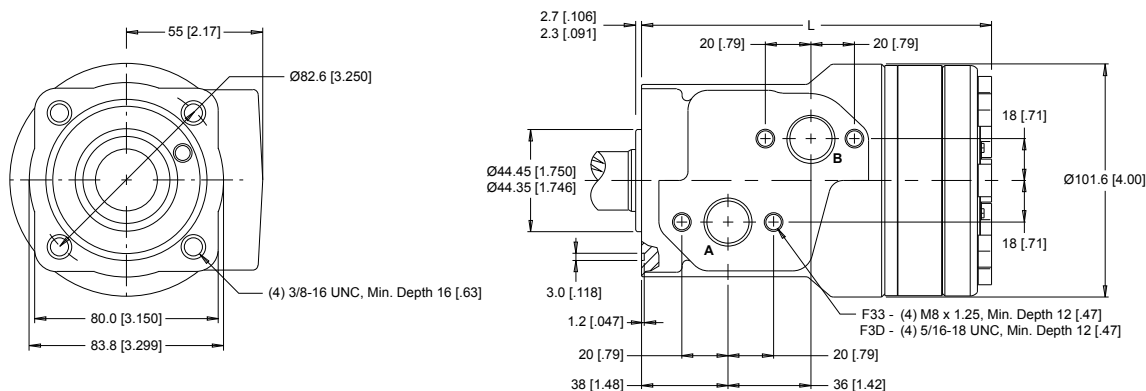
Technical Information Orbital Motors Type WD, WP and WR

WR Product Line

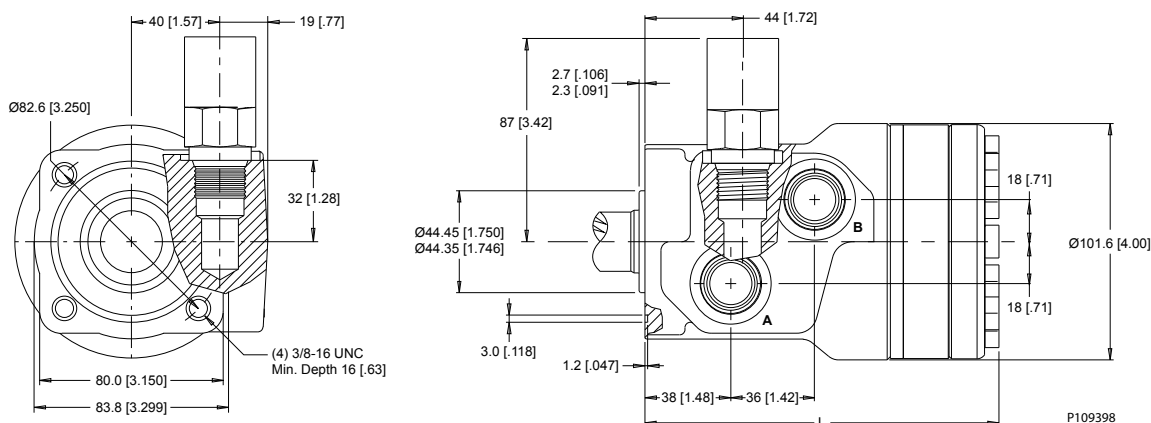
4-HOLE, SQUARE MOUNT, ALIGNED MANIFOLD PORTS **F37** 1/2" Drilled **G37** 1/2" Drilled



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



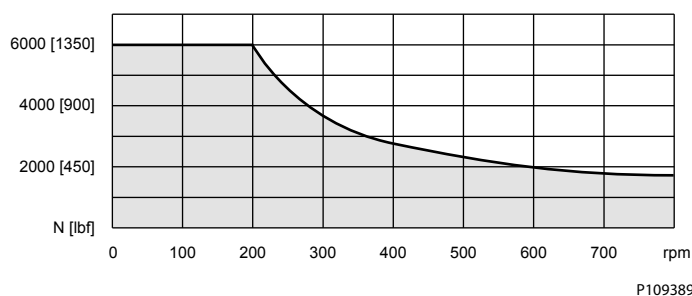
WR 255 and 256 Series Technical Information

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

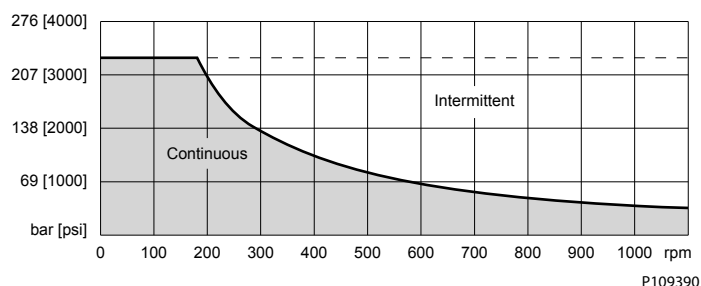
WR Product Line

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.

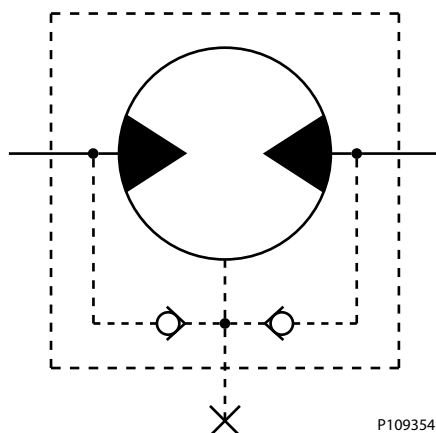


Permissible Shaft Seal Pressure

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.

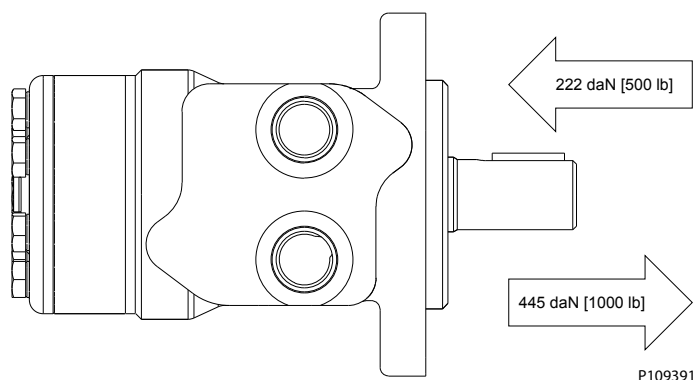


With check valves and drain connection, the shaft seal pressure equals pressure in the drain line. With check valves and no drain connection, shaft seal pressure is identical to output pressure. No check valves and no drain connection, the shaft seal pressure is identical to the average value of input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

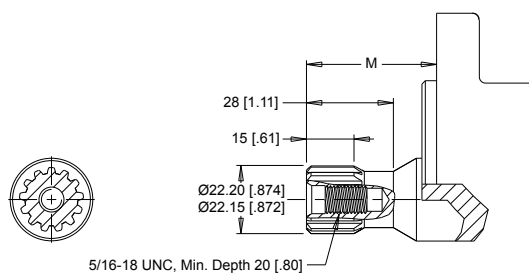
#	Square and B Mounts	B Mount Weight	Sq. Mount Weight
	mm [in]	kg [lb]	kg [lb]
040	142 [5.60]	7.8 [17.2]	5.3 [11.8]
050	144 [5.67]	7.8 [17.2]	5.3 [11.9]
060	146 [5.74]	7.9 [17.4]	5.4 [11.9]
070	147 [5.80]	7.9 [17.4]	5.4 [11.9]
080	150 [5.91]	8.0 [17.6]	5.5 [12.1]
090	151 [5.96]	8.0 [17.6]	5.5 [12.1]
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

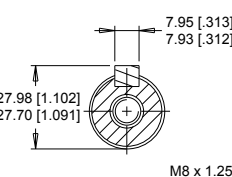
Mounting / Shaft Length Chart

01 7/8" 13 Tooth Spline



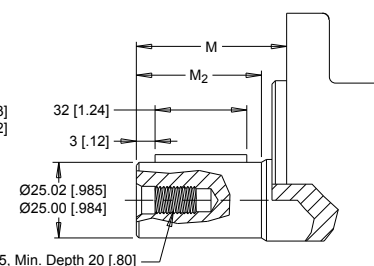
Max. Torque: 170 Nm [1500 lb-in]

12 25mm Straight



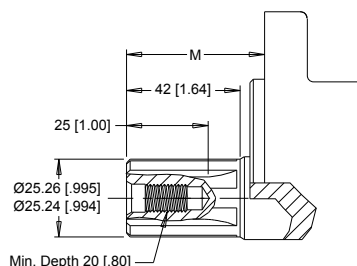
Max. Torque: 678 Nm [6000 lb-in]

16 25mm Straight Extended



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

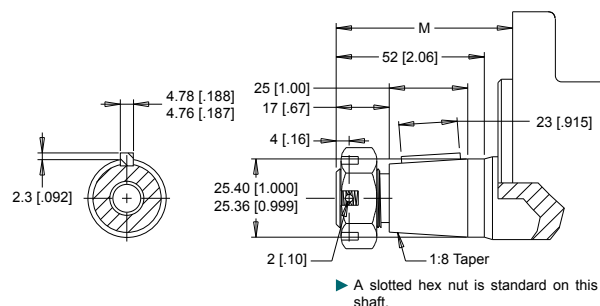
6B Spline
SAE J499 Standard



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

04 1" 6B Spline, M8x1.25 Tap

13 1" Tapered

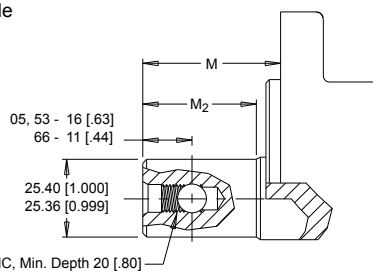


Max. Torque: 655 Nm [5800 lb-in]

05 1" - 9.5 [.375] Pinhole

53 1" - 10.3 [.406] Pinhole

66 1" - 8.0 [.315] Pinhole

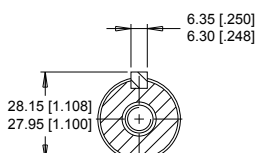


Max. Torque: 678 Nm [6000 lb-in]

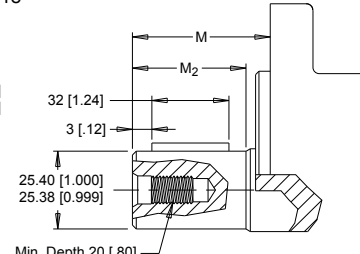
10 1" Straight, 5/16-18 Tap

11 1" Straight, M8x1.25 Tap

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



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



P109393

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.

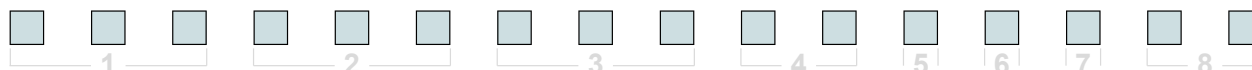
#	3 mm Pilot	5 mm Pilot	M_2
	mm [in]	mm [in]	mm [in]
01	40 [1.59]	43 [1.69]	N/A
02	48 [1.88]	51 [1.98]	N/A
04	48 [1.88]	51 [1.98]	N/A
05	48 [1.88]	51 [1.98]	42 [1.64]

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]

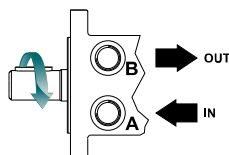
WR Product Line

WR 255 and 256 Series Ordering Information

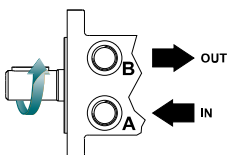


1. CHOOSE SERIES DESIGNATION

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

P109394

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