Impro Fluidtek

Technical Information

Orbital Motors
Type WT

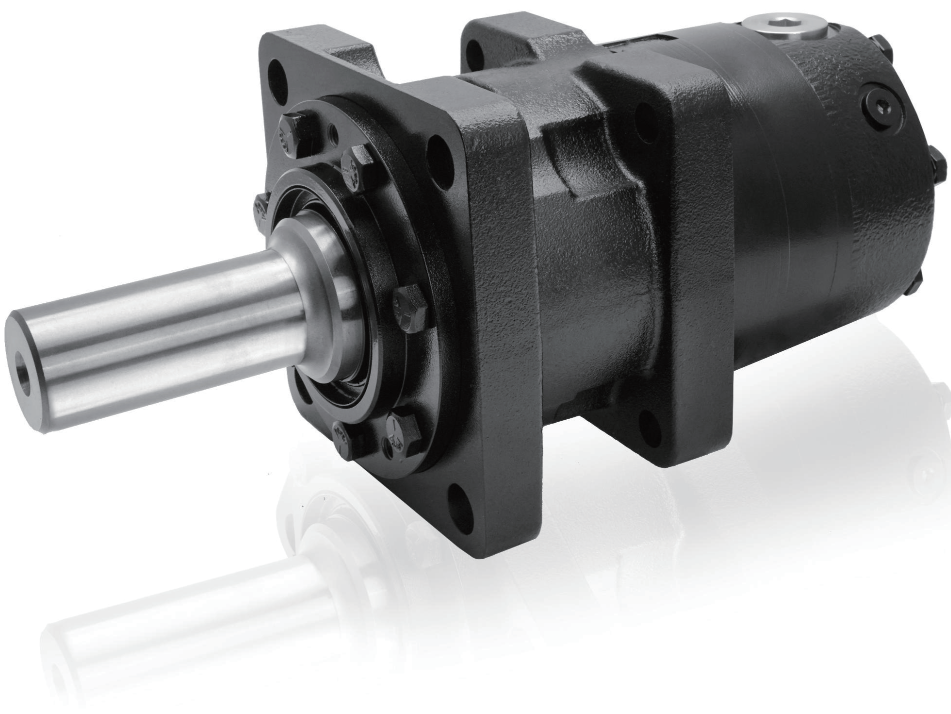

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TABLE OF CONTENTS

TECHNICAL INFORMATION

HYDRAULIC MOTOR FOR HEAVY DUTY APPLICATION

OPERATING RECOMMENDATIONS

OIL TYPE

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

FLUID VISCOSITY & FILTRATION

Fluids with a viscosity between 20 - 43 cSt [100 - 200S.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.

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

INSTALLATION & START-UP

When installing an Impro Fluidtek 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 over-pressurization. If a relief cartridge is used, it must be installed upline of the motor, if not in the motor, to relieve the pressure created by the over-running motor. To provide proper motor protection for an over-running load application, the pressure setting of the pressure relief valve must not exceed the intermittent rating of the motor.

HYDRAULIC MOTOR SAFETY PRECAUTION

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

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MOTOR/BRAKE PRECAUTION

Caution! - Impro Fluidtek motor/brakes are intended to operate as static or parking brakes. System circuitry must be designed to bring the load to a stop before applying the brake.

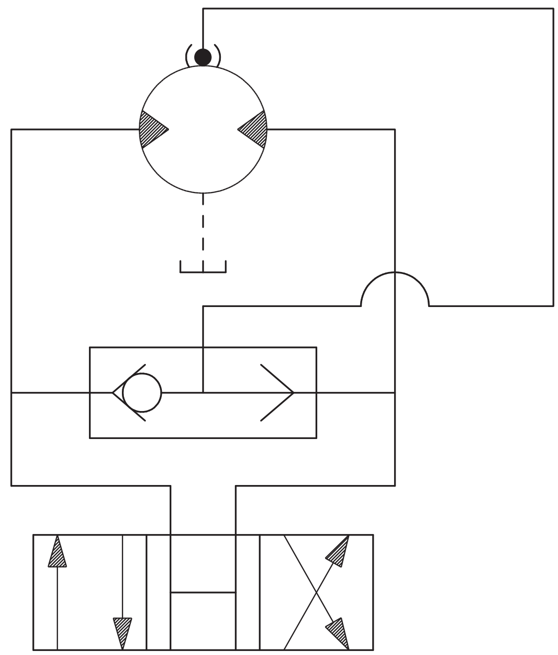
Caution! - Because it is possible for some large displacement motors to overpower the brake, it is critical that the maximum system pressure be limited for these applications. Failure to do so could cause serious injury or death. When choosing a motor/brake for an application, consult the performance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

To ensure proper operation of the brake, a separate case drain back to tank must be used. Use of the internal drain option is not recommended due to the possibility of return line pressure spikes. A simple schematic of a system utilizing a motor/brake is shown on page 6. 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 andhoses 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.

OPERATING RECOMMENDATIONS & MOTOR CONNECTIONS

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

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



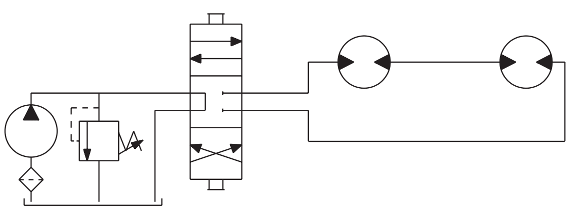
TYPICAL MOTOR/BRAKE SCHEMATIC

MOTOR CIRCUITS

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

SERIES CONNECTION

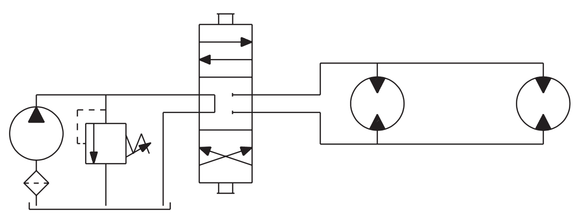
When motors are connected in series, the outlet of one motor is connected to the inlet of the next motor. This allows the full pump flow to go through each motor and provide maximum speed. Pressure and torque are distributed between the motors based on the load each motor is subjected to. The maximum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



SERIES CIRCUIT

PARALLEL CONNECTION

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



PARALLEL CIRCUIT

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

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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 an Impro Fluidtek state of the art test facility. This facility utilizes fully automated test equipment and custom designed software to provide accurate, reliable test data. Test routines are standardized, including test stand calibration and stabilization of fluid temperature and viscosity, to provide consistent data. The example below provides an explanation of the values pertaining to each heading on the performance chart.

080 — 76 cc [4.6 in³/rev.]

Pressure - bars [psi] (2) — Max. Cont. 207 [3000]; Max. Inter. 242 [3500]

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

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

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

Theoretical Torque - Nm [lb-in]

21 [183]	41 [366]	83 [732]	124 [109 (8)	166 [1465]	207 [1831]	248 [2197]	290 [2564]

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

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

ALLOWABLE BEARING & SHAFT LOADING

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

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

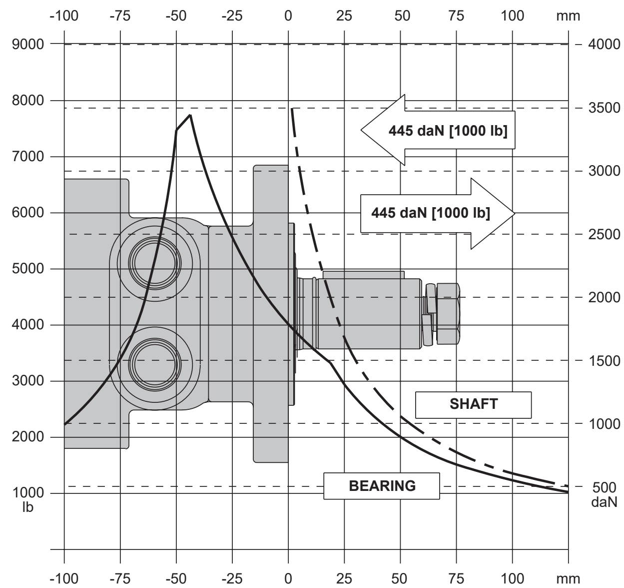
The bearing curves for each model are based on laboratory analysis and testing results constructed at Impro Fluidtek. The shaft loading is based on a 3:1 safety factor and 330 Kpsi tensile strength. The allowable load is the lower of the curves at a given point. For instance, one inch in front of the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

ISO 281 RATINGS VS. MANUFACTURERS RATINGS

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

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

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



EXAMPLE LOAD RATING FOR MECHANICALLY RETAINED NEEDLE ROLLER BEARINGS

Bearing Life L_{10} = $(C/P)^{p}$ [10^6 revolutions]
L_{10} = nominal rating life
C = dynamic load rating
P = equivalent dynamic load
Life Exponent ^{p} = 10/3 for needle bearings

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

VEHICLE DRIVE CALCULATIONS

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

Sample application (vehicle design criteria)

Vehicle description.................................... 4 wheel vehicle
GVW ....1,500 lbs.
Rolling radius of tires ....16 in.
Top speed... 5 mph
Worst working surface.................................... poor asphalt

Vehicle drive. ....2 wheel drive
Weight over each drive wheel .... 425 lbs.
Desired acceleration .... 0-5 mph in 10 sec.
Gradability... 20%

To determine maximum motor speed

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

Where:

MPH = Max. vehicle speed (miles/hr)
KPH = Max. vehicle speed (kilometers/hr)
ri = Rolling radius of tire (inches)
G = Gear reduction ratio (if none, G = 1)
rm = Rolling radius of tire (meters)

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

To determine maximum torque requirement of motor

To choose a motor(s) capable of producing enough torque to propel the vehicle, it is necessary to determine the Total Tractive Effort (TE) requirement for the vehicle.

To determine the total tractive effort, the following equation must be used:

TE = RR + GR + FA + DP (lbs or N)

Where:

TE = Total tractive effort
RR = Force necessary to overcome rolling resistance
GR = Force required to climb a grade
FA = Force required to accelerate
DP = Drawbar pull required

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

▶ Step One: Determine Rolling Resistance

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

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

Where:

GVW = Gross (loaded) vehicle weight (lb or kg)
R = Surface friction (value from Rolling Resistance)

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

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

▶ Step Two: Determine Grade Resistance

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

To convert incline degrees to % Grade:

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

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

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

▶ Step Three: Determine Acceleration Force

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

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

Where:

t = Time to maximum speed (seconds)

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

▶ Step Four: Determine Drawbar Pull

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

▶ Step Five: Determine Total Tractive Effort

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

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

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

▶ Step Six: Determine Motor Torque

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

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

Where:

M = Number of driving motors

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

▶ Step Seven: Determine Wheel Slip

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

$$TS = \frac{W \times f \times ri}{G}$$
(lb-in per motor)

$$TS = \frac{W \times f \times rm}{G}$$
(Nm per motor)

Where:

f = Coefficient of friction

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

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

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

To determine radial load capacity requirement of motor

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

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

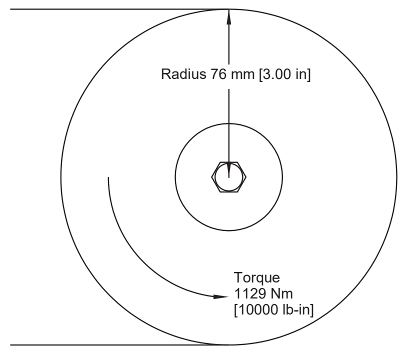
$$RL = \sqrt{W^2 + \left(\frac{T}{rm}\right)^2} \text{ kg}$$

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

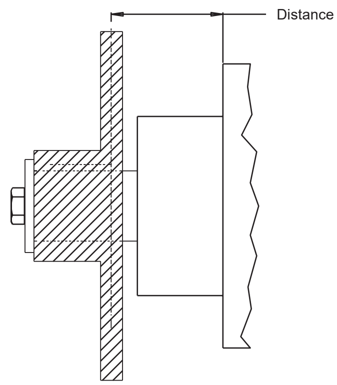
Once the maximum motor RPM, maximum torque requirement, and the maximum load each motor must support have been determined, these figures may then be compared to the motor performance charts and to the bearing load curves to choose a series and displacement to fulfill the motor requirements for the application.

INDUCED SIDE LOAD

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



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



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

Side Load = 14855 Nm [3333 lbs]

HYDRAULIC EQUATIONS

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

$$\text{Theo. Speed (RPM)} = \frac{1000 \times \text{LPM}}{\text{Displacement (cm}^3\text{/rev)}} \text{ or } \frac{231 \times \text{GPM}}{\text{Displacement (in}^3\text{/rev)}}$$

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

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

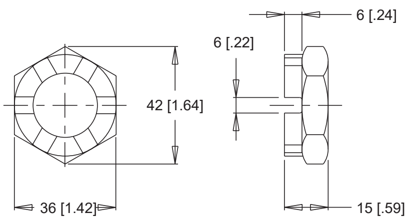
$$\text{Power Out (HP)} = \frac{\text{Torque (Nm)} \times \text{RPM}}{9543} \text{ or } \frac{\text{Torque (lb-in)} \times \text{RPM}}{63024}$$

SHAFT NUT INFORMATION

35MM TAPERED SHAFTS

M24 x 1.5 Thread

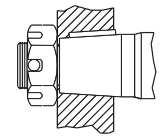
A Slotted Nut



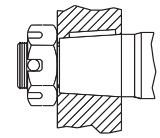
Torque Specifications: 32.5 daNm [240 ft.lb.]

PRECAUTION

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



incorrect

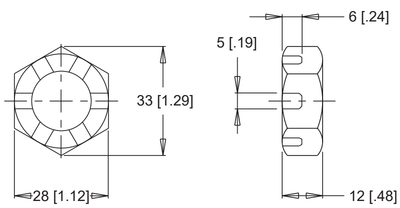


correct

1” TAPERED SHAFTS

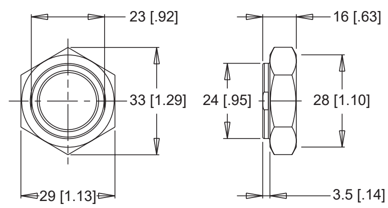
3/4-28 Thread

A Slotted Nut



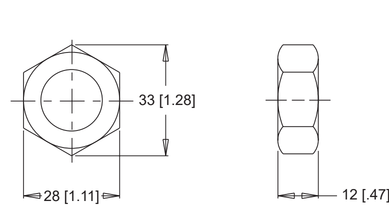
Torque Specifications: 20 - 23 daNm [150 - 170 ft.lb.]

B Lock Nut



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

C Solid Nut

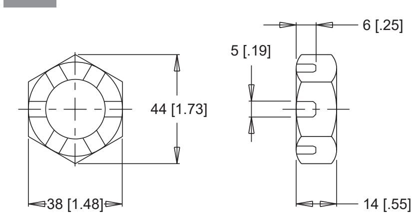


Torque Specifications: 20 - 23 daNm [150 - 170 ft.lb.]

1-1/4” TAPERED SHAFTS

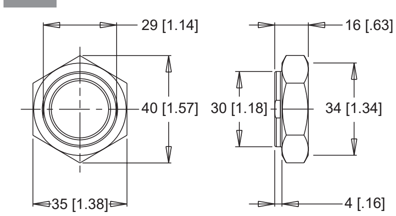
1-20 Thread

A Slotted Nut



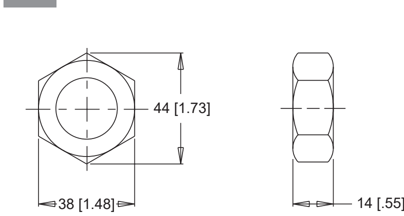
Torque Specifications: 38 daNm [280 ft.lb.] Max.

B Lock Nut



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

C Solid Nut

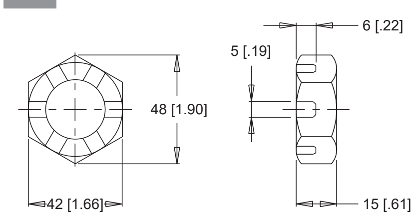


Torque Specifications: 38 daNm [280 ft.lb.] Max.

1-3/8” & 1-1/2” TAPERED SHAFTS

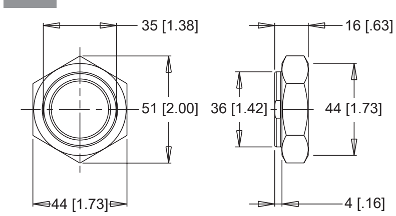
1 1/8-18 Thread

A Slotted Nut



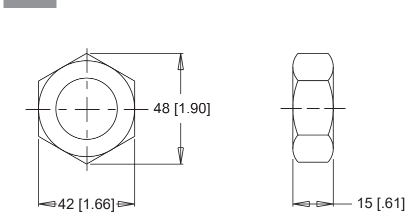
Torque Specifications: 41 - 54 daNm [300 - 400 ft.lb.]

B Lock Nut



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

C Solid Nut



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

WT (All Series)

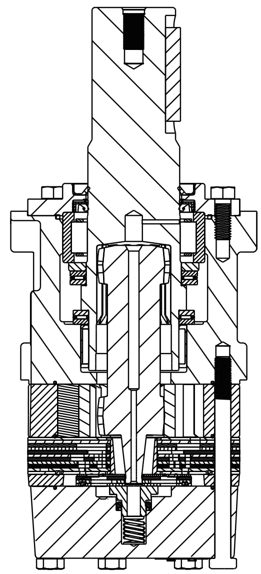
Heavy Duty Hydraulic Motor

OVERVIEW

One of the most impressive features of the WT series is its remarkable torque potential despite its compact size. The WT series motor can generate a torque output comparable to that of competing designs, but in a smaller and lighter package. This space and weight efficiency does not compromise durability, as the motor utilizes substantial shafts, bearings, and links to efficiently transmit the powerful torque it produces. Additionally, the use of a drain reduces pressure on the shaft seal while ensuring optimal motor life through proper driveline lubrication. Furthermore, the WT series offers standard mounting and shaft options that are interchangeable with competing designs, and an internal drain option is also available.

SERIES DESCRIPTIONS

700 - Hydraulic Motor
Standard



FEATURES / BENEFITS

- Heavy-duty roller bearings for extra side load capacity.
- Best in class power to weight ratio due to compact design.
- A variety of mounts and shafts provide flexibility in application design.
- Heavy-Duty Drive Link receives full flow lubrication to provide long service life.
- Optimized rotor geometry provides highly efficient smooth running performance.
- Three-zone Commutator Valve results in exceptional volumetric efficiency.
- Standard case and internal drain for extended shaft seal life.

TYPICAL APPLICATIONS

Heavy-duty wheel drives, grain augers, sweepers, construction equipment, feed rollers, mixers, pumping units, conveyors, boring machines, rotators, mining equipment, forestry equipment and more.

SPECIFICATIONS

CODE	Displacement cm^3 [in^3/rev]	Max. Speed rpm		Max. Flow lpm [gpm]		Max.Torque Nm [lb-in]		Max. Pressure bar [psi]		
		cont.	inter.	cont.	inter.	cont.	inter.	cont.	inter.	peak
300	300 [18.3]	320	380	95 [25]	114 [30]	819 [7250]	955 [8450]	207 [3000]	241 [3500]	259 [3750]
375	374 [22.8]	250	300	95 [25]	114 [30]	1045 [9250]	1127 [9975]	207 [3000]	224 [3250]	241 [3500]
470	464 [28.3]	200	240	95 [25]	114 [30]	1071 [9475]	1390 [12300]	172 [2500]	224 [3250]	241 [3500]
540	536 [32.7]	180	210	95 [25]	114 [30]	1277 [11300]	1525 [13500]	172 [2500]	207 [3000]	241 [3500]
750	747 [45.6]	130	155	95 [25]	114 [30]	1835 [16240]	2138 [18923]	172 [2500]	207 [3000]	241 [3500]
930	929 [56.7]	100	120	95 [25]	114 [30]	1780 [15750]	2141 [18950]	138 [2000]	172 [2500]	207 [3000]
1K1	1047 [63.9]	93	112	95 [25]	114 [30]	2041 [18064]	2308 [20428]	138 [2000]	172 [2500]	207 [3000]
1K5	1495 [91.2]	60	70	95 [25]	114 [30]	2090 [18500]	2316 [20500]	103 [1500]	121 [1750]	138 [2000]
2K1	2093 [127.7]	40	50	95 [25]	114 [30]	2661 [23550]	3342 [29580]	103 [1500]	121 [1750]	138 [2000]

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.
Running at intermittent ratings should not exceed 10% of every minute of operation.

DISPLACEMENT PERFORMANCE

300

300 cm³ [18.3 in³/rev.]

Pressure - bars [psi] — Max. Cont.: 207 [3000]; Max. Inter.: 241 [3500]

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

Flow - lpm [gpm]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000] (Max. Cont.)	241 [3500] (Max. Inter.)	Theoretical rpm
2 [0.5]	54 [476] **4**	115 [1014] **3**	237 [2100] **2**						7
4 [1]	47 [415] **11**	108 [952] **9**	255 [2256] **7**	380 [3363] **5**	486 [4304] **3**				13
8 [2]	49 [435] **24**	119 [1057] **23**	257 [2278] **21**	410 [3628] **19**	543 [4801] **15**	671 [5942] **12**	789 [6983] **9**	899 [7959] **7**	26
15 [4]	49 [430] **50**	120 [1064] **49**	264 [2336] **46**	409 [3616] **43**	554 [4904] **37**	701 [6202] **32**	839 [7424] **28**	971 [8595] **26**	51
23 [6]		116 [1025] **75**	278 [2462] **69**	420 [3719] **65**	567 [5019] **58**	712 [6297] **54**	854 [7554] **51**	983 [8701] **48**	76
30 [8]		105 [929] **100**	251 [2222] **97**	396 [3506] **93**	542 [4793] **86**	692 [6122] **78**	831 [7353] **70**	974 [8621] **69**	101
38 [10]		99 [877] **126**	237 [2099] **122**	388 [3438] **115**	549 [4857] **113**	687 [6081] **107**	833 [7369] **96**	970 [8588] **90**	127
45 [12]		88 [762] **151**	237 [2094] **150**	378 [3342] **140**	527 [4666] **135**	666 [5893] **129**	823 [7281] **119**	963 [8523] **113**	152
53 [14]		77 [679] **176**	211 [1864] **175**	361 [3191] **172**	506 [4478] **164**	656 [5802] **156**	805 [7121] **151**	951 [8420] **140**	177
61 [16]		60 [528] **201**	208 [1845] **200**	359 [3179] **189**	495 [4378] **185**	648 [5731] **178**	791 [6999] **172**	928 [8213] **165**	202
68 [18]			191 [1694] **225**	335 [2961] **222**	497 [4402] **211**	632 [5592] **156**	776 [6871] **196**	914 [8093] **189**	228
76 [20]			168 [1489] **251**	320 [2835] **247**	461 [4083] **240**	610 [5401] **233**	764 [6762] **228**	897 [7934] **216**	253
83 [22]			147 [1298] **276**	302 [2675] **272**	444 [3926] **269**	588 [5205] **258**	742 [6570] **249**	883 [7810] **234**	278
91 [24]			123 [1086] **300**	272 [2409] **298**	414 [3666] **296**	558 [4934] **290**	708 [6264] **281**	851 [7535] **272**	303
95 [25] (Max. Cont.)			108 [958] **315**	257 [2278] **313**	393 [3482] **308**	549 [4857] **300**	694 [6139] **289**	839 [7421] **280**	316
114 [30] (Max. Inter.)				186 [1642] **376**	333 [2945] **372**	473 [4189] **369**			379

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

Theoretical Torque - Nm [lb-in]

Rotor Width	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000]	241 [3500]
25.4 [1.000]	82 [729]	165 [1457]	329 [2914]	494 [4371]	659 [5828]	823 [7285]	988 [8742]	1152 [10199]

mm [in]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

Impro Fluidtek

DISPLACEMENT PERFORMANCE

375

375 cm³ [22.8 in³/rev.]

Pressure - bars [psi] — Max. Cont. 207 [3000], Max. Inter. 224 [3250]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000]	224 [3250]	Theoretical rpm
2 [0.5]	65 [574] **4**	144 [1272] **3**	302 [2670] **2**	449 [3970] **1**					6
4 [1]	66 [583] **9**	152 [1345] **8**	312 [2757] **7**	475 [4208] **5**	625 [5535] **4**				11
8 [2]	67 [596] **19**	154 [1365] **18**	329 [2907] **17**	496 [4388] **14**	644 [5695] **12**	805 [7122] **10**	963 [8524] **8**	1050[9288] **7**	21
15 [4]	71 [627] **40**	158 [1400] **39**	337 [2982] **37**	513 [4536] **34**	680 [6020] **30**	858 [7596] **27**	1013 [8962] **25**	1099[9723] **23**	41
23 [6]	64 [570] **60**	151 [1334] **60**	336 [2969] **58**	520 [4598] **54**	694 [6141] **49**	871 [7704] **45**	1048 [9275] **41**	1115[9867] **41**	61
30 [8]	53 [467] **81**	151 [1337] **80**	325 [2876] **78**	512 [4532] **73**	691 [6113] **69**	873 [7724] **63**	1051 [9304] **60**	1126[9964] **59**	82
38 [10]		131 [1161] **101**	313 [2768] **99**	502 [4439] **95**	686 [6075] **89**	884 [7824] **82**	1049 [9281] **79**	1131[10011] **77**	102
45 [12]		112 [995] **121**	308 [2725] **120**	494 [4375] **116**	685 [6059] **109**	862 [7626] **103**	1053 [9321] **98**	1137[10066] **97**	122
53 [14]		99 [878] **141**	283 [2508] **140**	469 [4149] **136**	645 [5705] **131**	844 [7467] **125**	1013 [8965] **117**	1116[9877] **115**	142
61 [16]		75 [662] **162**	262 [2319] **161**	443 [3923] **160**	631 [5587] **155**	823 [7283] **148**	1009 [8930] **143**	1114[9859] **136**	163
68 [18]			248 [2198] **181**	427 [3779] **178**	612 [5416] **175**	804 [7119] **167**	1005 [8895] **160**	1091[9653] **156**	183
76 [20]			218 [1925] **202**	403 [3568] **200**	583 [5161] **195**	778 [6886] **189**	966 [8549] **178**	1071[9474] **173**	203
83 [22]			189 [1676] **222**	375 [3318] **221**	561 [4967] **217**	754 [6669] **211**	942 [8335] **201**	1036[9171] **96**	223
91 [24]			155 [1374] **242**	344 [3041] **240**	535 [4732] **237**	724 [6410] **229**			244
Max. Cont. 95 [25]				321 [2839] **252**	519 [4596] **249**	710 [6283] **241**			254
Max. Inter. 114 [30]				238 [2110] **303**	432 [3820] **301**	622 [5503] **296**			304

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

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000]	224 [3250]
31.8 [1.252]	103 [908]	205 [1815]	410 [3631]	615 [5446]	821 [7261]	1026 [9076]	1231 [10892]	1333 [11799]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

DISPLACEMENT PERFORMANCE

470

465 cm³ [28.3 in³/rev.]

Pressure - bars [psi]; Torque - Nm [lb-in], **Speed rpm**

Intermittent Ratings - 10% of Operation (Max. Cont.: 207 [3000]; Max. Inter.: 224 [3250]; Flow Max. Cont.: 95 [25]; Flow Max. Inter.: 114 [30])

Flow - lpm [gpm]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000]	224 [3250]	Theoretical rpm
2 [0.5]	86 [762] **3**	201 [1780] **2**	401 [3553] **2**						5
4 [1]	92 [817] **7**	195 [1728] **7**	406 [3597] **6**	610 [5395] **5**	806 [7137] **4**				9
8 [2]	94 [835] **15**	199 [1761] **15**	418 [3702] **14**	631 [5580] **13**	832 [7365] **11**	1042 [9226] **9**	1239 [10961] **8**		17
15 [4]	92 [815] **32**	202 [1784] **32**	426 [3769] **60**	646 [5717] **28**	849 [7513] **24**	1066 [9430] **23**	1272 [11256] **21**	1381 [12217] **19**	33
23 [6]	82 [729] **48**	203 [1799] **47**	423 [3744] **46**	647 [5725] **43**	855 [7565] **39**	1070 [9473] **36**	1275 [11287] **34**	1365 [12083] **32**	49
30 [8]	67 [595] **65**	185 [1641] **64**	414 [3663] **63**	642 [5683] **60**	867 [7671] **54**	1078 [9538] **47**	1300 [11508] **46**	1398 [12367] **44**	66
38 [10]	52 [459] **81**	170 [1503] **80**	399 [3532] **79**	630 [5573] **78**	857 [7584] **69**	1077 [9531] **63**	1283 [11352] **61**	1393 [12323] **58**	82
45 [12]		153 [1354] **97**	380 [3366] **96**	613 [5422] **93**	842 [7454] **88**	1072 [9488] **77**	1302 [11523] **74**	1394 [12334] **68**	98
53 [14]		127 [1121] **114**	359 [3173] **113**	591 [5229] **110**	823 [7282] **104**	1057 [9350] **97**	1270 [11242] **89**	1392 [12318] **85**	114
61 [16]		100 [888] **160**	335 [2964] **129**	564 [4993] **127**	798 [7061] **119**	1030 [9118] **114**	1254 [11101] **108**	1369 [12118] **102**	131
68 [18]		67 [595] **146**	304 [2689] **145**	535 [4734] **143**	765 [6772] **137**	1003 [8875] **132**	1229 [10877] **120**	1348 [11926] **114**	147
76 [20]			274 [2428] **162**	504 [4458] **160**	733 [6485] **155**	965 [8536] **148**	1197 [10592] **139**	1318 [11668] **136**	164
83 [22]			226 [2003] **178**	458 [4050] **175**	691 [6118] **172**	928 [8215] **165**	1150 [10181] **156**	1266 [11200] **154**	180
91 [24]			176 [1554] **194**	415 [3670] **192**	669 [5917] **190**	885 [7833] **183**			196
95 [25]				389 [3442] **203**	632 [5589] **198**	867 [7676] **190**			205
114 [30]				277 [2451] **243**	514 [4549] **240**	755 [6684] **235**			245

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

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000]	224 [3250]
39.4 [1.553]	127 [1127]	255 [2253]	509 [4506]	764 [6760]	1018 [9013]	1273 [1126]	1528 [13519]	1655 [14646]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

DISPLACEMENT PERFORMANCE

540

536 cm³ [32.7 in³/rev.]

Pressure - bars [psi]; Max. Cont. 173 [2500]; Max. Inter. 207 [3000]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500] (Max. Cont.)	207 [3000] (Max. Inter.)	Theoretical rpm
2 [0.5]	103 [908] **2**	215 [1607] **2**	421 [3722] **1**					4
4 [1]	104 [917] **6**	228 [2016] **5**	454 [4015] **4**	666 [5897] **3**	874 [7730] **1**			8
8 [2]	108 [954] **13**	231 [2043] **12**	474 [4191] **11**	704 [6231] **9**	925 [8190] **5**	1153 [10201] **4**		15
15 [4]	102 [906] **27**	232 [2052] **26**	503 [4448] **24**	756 [6692] **21**	994 [8799] **18**	1221 [10806] **15**	1461 [12930] **13**	29
23 [6]	98 [866] **42**	230 [2038] **41**	498 [4404] **39**	766 [6774] **36**	1023 [9049] **30**	1268 [11225] **27**	1494 [13219] **24**	43
30 [8]	84 [744] **56**	213 [1883] **55**	484 [4280] **53**	754 [6669] **49**	1032 [9130] **42**	1273 [11262] **38**	1524 [13486] **34**	57
38 [10]	63 [561] **70**	195 [1727] **69**	466 [4122] **68**	737 [6519] **64**	1006 [8903] **57**	1285 [11374] **49**	1532 [13556] **46**	71
45 [12]	42 [373] **84**	179 [1586] **83**	444 [3928] **82**	717 [6349] **76**	984 [8710] **72**	1274 [11277] **65**	1518 [13436] **57**	85
53 [14]		146 [1295] **97**	421 [3722] **95**	694 [6139] **93**	964 [8529] **87**	1253 [11091] **80**	1512 [13381] **70**	99
61 [16]		116 [1025] **113**	391 [3460] **111**	663 [5865] **108**	930 [8230] **103**	1206 [10675] **97**	1479 [13086] **84**	114
68 [18]		90 [798] **127**	356 [3153] **125**	629 [5563] **123**	900 [7969] **116**	1192 [10550] **107**	1451 [12841] **100**	128
76 [20]		56 [498] **141**	330 [2923] **139**	595 [5265] **137**	887 [7850] **133**	1158 [10250] **123**	1421 [12578] **114**	142
83 [22]			278 [2464] **155**	549 [4859] **153**	822 [7271] **148**	1121 [9919] **136**	1388 [12283] **133**	156
91 [24]			243 [2154] **169**	508 [4494] **166**	794 [7024] **164**	1054 [9325] **156**		170
Max. Cont. 95 [25]			220 [1948] **176**	486 [4299] **174**	762 [6741] **169**	1025 [9075] **163**		177
Max. Inter. 114 [30]			90 [800] **211**	366 [3237] **210**	638 [5649] **207**	920 [8144] **203**		212

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

Rotor Width

45.5 [1.791]

mm [in]

Theoretical Torque - Nm [lb-in]

17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000]
147 [1302]	294 [2604]	588 [5207]	883 [7811]	1177[10414]	1471 [13018]	1765 [15621]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

DISPLACEMENT PERFORMANCE

750

748cm³ [45.6 in³/rev.]

Pressure - bars [psi]; Max. Cont. 173 [2500]; Max. Inter. 207 [3000]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500] (Max. Cont.)	207 [3000] (Max. Inter.)	Theoretical rpm
2 [0.5]	155 [1368] **3**	322 [2850] **2**						3
4 [1]	166 [1467] **5**	345 [3050] **5**	663 [5866] **5**					6
8 [2]	179 [1585] **11**	373 [3304] **11**	736 [6515] **10**	1105 [9779] **9**				11
15 [4]	169 [1492] **20**	369 [3264] **20**	732 [6480] **19**	1102 [9749] **18**	1439 [12738] **15**	1731 [15321] **12**		21
23 [6]	163 [1446] **31**	362 [3202] **31**	729 [6456] **30**	1124 [9949] **29**	1482 [13113] **25**	1779 [15754] **19**	2101 [18595] **13**	31
30 [8]	155 [1371] **41**	348 [3084] **41**	714 [6318] **40**	1087 [9617] **39**	1473 [13034] **35**	1835 [16245] **26**	2138 [18924] **19**	41
38 [10]	144 [1273] **52**	334 [2952] **52**	702 [6216] **51**	1075 [9517] **50**	1454 [12876] **46**	1826 [16161] **36**	2130 [18855] **27**	51
45 [12]	136 [1199] **61**	331 [2926] **61**	697 [6167] **60**	1078 [9539] **58**	1428 [12636] **54**	1806 [15985] **44**	2113 [18702] **35**	61
53 [14]	120 [1064] **73**	309 [2738] **72**	676 [5981] **71**	1056 [9343] **70**	1426 [12618] **65**	1789 [15835] **55**	2118 [18748] **44**	71
61 [16]	100 [883] **84**	299 [2649] **83**	660 [5841] **82**	1069 [9458] **80**	1421 [12579] **73**	1793 [15868] **64**	2096 [18550] **54**	82
68 [18]	87 [766] **93**	283 [2506] **92**	652 [5770] **91**	1031 [9122] **88**	1417 [12539] **85**	1750 [15489] **77**	2084 [18445] **65**	92
76 [20]	66 [581] **104**	252 [2228] **104**	620 [5491] **103**	1000 [8850] **101**	1375 [12167] **97**	1743 [15425] **88**	2068 [18299] **77**	102
83 [22]		241 [2134] **113**	610 [5396] **112**	999 [8840] **110**	1362 [12056] **105**	1700 [15047] **96**	2044 [18087] **84**	112
91 [24]		213 [1889] **124**	569 [5034] **123**	970 [8581] **121**	1331 [11778] **116**	1684 [14901] **108**	2030 [17970] **95**	122
Max. Cont. 95 [25]		184 [1632] **130**	548 [4849] **129**	933 [8257] **128**	1288 [11397] **124**	1648 [14585] **113**	1994 [17645] **100**	127
Max. Inter. 114 [30]			481 [4260] **155**	854 [7556] **153**	1218 [10783] **149**	1578 [13963] **141**	1927 [17056] **129**	152

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

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	173 [2500]	207 [3000]
63.5 [2.501]	205 [1815]	410 [3631]	821 [7261]	1231 [10892]	1641 [14522]	2051 [18153]	2462 [21783]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

DISPLACEMENT PERFORMANCE

930

929cm³ [56.7 in³/rev.]

Pressure - bars [psi] — Max. Cont. 138 [2000]; Max. Inter. 173 [2500]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	173 [2500]	Theoretical rpm
2 [0.5]	180 [1590] **1**	387 [3423] **1**	607 [5368] **1**	801 [7089] **1**							3
4 [1]	196 [1734] **4**	418 [3696] **3**	653 [5780] **3**	864 [7649] **3**	1067 [9447] **3**	1294 [11451] **3**					5
8 [2]	205 [1816] **8**	442 [3907] **7**	680 [6015] **7**	877 [7764] **7**	1117 [9886] **7**	1300 [11501] **6**	1510 [13365] **5**				9
15 [4]	198 [1753] **16**	432 [3825] **16**	664 [5878] **15**	906 [8021] **15**	1121 [9924] **15**	1338 [11840] **14**	1556 [13769] **13**	1730 [15306] **11**			17
23 [6]	185 [1633] **24**	420 [3719] **24**	651 [5765] **24**	908 [8034] **24**	1123 [9935] **23**	1355 [11991] **22**	1543 [13651] **20**	1794 [15873] **18**	1981 [17532] **16**		25
30 [8]	162 [1438] **32**	404 [3576] **31**	636 [5624] **30**	893 [7900] **30**	1107 [9800] **29**	1340 [11854] **28**	1581 [13988] **27**	1776 [15716] **24**	1985 [17570] **22**	2105 [18632] **17**	33
38 [10]	125 [1109] **40**	368 [3253] **40**	626 [5536] **39**	845 [7476] **38**	1087 [9620] **38**	1314 [11625] **36**	1497 [13251] **34**	1736 [15364] **31**	1956 [17306] **28**	2153 [19054] **24**	41
45 [12]	91 [807] **48**	341 [3018] **47**	578 [5111] **46**	815 [7213] **45**	1072 [9487] **44**	1314 [11630] **42**	1525 [13492] **41**	1713 [15159] **36**	1946 [17222] **33**	2133 [18873] **32**	49
53 [14]	35 [310] **57**	290 [2565] **56**	533 [4715] **55**	765 [6772] **54**	1024 [9059] **52**	1240 [10974] **50**	1487 [13155] **49**	1727 [15287] **45**	1945 [17216] **43**	2168 [19188] **36**	58
61 [16]		239 [2118] **64**	484 [4281] **63**	726 [6429] **62**	959 [8488] **61**	1210 [10708] **59**	1450 [12830] **57**	1696 [15008] **54**	1925 [17039] **50**	2140 [18934] **46**	66
68 [18]		205 [1811] **72**	440 [3891] **72**	701 [6202] **70**	920 [8143] **69**	1177 [10418] **67**	1422 [12580] **65**	1643 [14538] **64**	1893 [16741] **58**	2105 [18625] **55**	74
76 [20]		150 [1325] **81**	409 [3616] **80**	632 [5590] **79**	801 [7091] **78**	1100 [9733] **76**	1505 [12135] **75**	1599 [14148] **72**	1859 [16454] **67**	2060 [18230] **63**	82
83 [22]		99 [875] **89**	336 [2977] **88**	581 [5139] **87**	837 [7403] **86**	1056 [9342] **83**	1305 [11553] **83**	1561 [13816] **80**	1799 [15918] **77**	2025 [17925] **71**	90
91 [24]			282 [2497] **97**	501 [4438] **96**	766 [6778] **94**	1021 [9038] **93**	1266 [11201] **92**	1489 [13179] **89**	1752 [15505] **86**	1969 [17427] **82**	98
Max. Cont. 95 [25]			241 [2137] **101**	496 [4389] **100**	722 [6390] **100**	974 [8621] **97**	1214 [10743] **96**	1454 [12863] **93**	1727 [15286] **89**	1956 [17309] **84**	102
Max. Inter. 114 [30]			66 [582] **122**	300 [2652] **121**	532 [4711] **120**	781 [6914] **118**	1044 [9235] **118**	1271 [11248] **116**			123

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

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	173 [2500]
78.9 [3.106]	255 [2257]	510 [4514]	765 [6771]	1020 [9029]	1275 [11286]	1530 [13543]	1785 [15800]	2040 [18057]	2296 [20314]	2551 [22572]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

DISPLACEMENT PERFORMANCE

1K1

1047cm³ [63.9 in³/rev.]

Pressure - bars [psi]; Max. Cont. = 138 [2000]; Max. Inter. = 173 [2500]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	173 [2500]	Theoretical rpm
2 [0.5]	231 [2047] **2**										2
4 [1]	236 [2091] **4**	489 [4328] **4**	735 [6507] **3**	961 [8506] **3**							4
8 [2]	239 [2114] **8**	509 [4502] **8**	763 [6752] **7**	1013 [8700] **7**	1249 [11053] **7**	1492 [13202] **6**					8
15 [4]	233 [2062] **14**	507 [4489] **14**	770 [6819] **14**	1022 [8946] **14**	1272 [11258] **13**	1531 [13546] **12**	1761 [15590] **11**	1994 [17647] **9**			15
23 [6]	224 [1979] **22**	493 [4363] **22**	767 [6790] **22**	1028 [9023] **22**	1285 [11377] **21**	1543 [13658] **21**	1793 [15872] **19**	2041 [18066] **16**	2295 [20315] **11**	2560 [22654] **8**	22
30 [8]	213 [1886] **29**	496 [4391] **28**	751 [6647] **29**	1012 [8580] **29**	1264 [11188] **28**	1537 [13601] **27**	1787 [15813] **25**	2028 [17949] **21**	2302 [20373] **15**	2548 [22549] **12**	29
38 [10]	207 [1831] **37**	483 [4278] **37**	746 [6598] **36**	1004 [8356] **36**	1264 [11186] **35**	1529 [13534] **34**	1774 [15699] **32**	2027 [17940] **28**	2309 [20432] **22**	2528 [22373] **18**	37
45 [12]	186 [1646] **44**	461 [4082] **44**	720 [6371] **44**	973 [7915] **43**	1249 [11055] **43**	1511 [13377] **42**	1761 [15582] **41**	2022 [17896] **38**	2247 [19887] **33**	2500 [22129] **27**	44
53 [14]	161 [1424] **52**	435 [3846] **52**	694 [6140] **51**	951 [7535] **51**	1223[10821] **50**	1490 [13188] **49**	1746 [15450] **45**	1988 [17597] **41**	2219 [19641] **35**	2462 [21793] **30**	51
61 [16]	139 [1831] **60**	410 [3624] **59**	671 [5940] **59**	931 [6871] **59**	1193 [10558] **58**	1471 [13018] **57**	1717 [15192] **54**	1974 [17467] **50**	2199 [19464] **44**	2438 [21574] **37**	58
68 [18]		392 [3469] **66**	654 [5790] **66**	911 [6252] **66**	1172 [10373] **65**	1441 [12757] **64**	1692 [14974] **62**	1946 [17223] **57**	2171 [19215] **52**	2434 [21263] **44**	66
76 [20]		366 [3239] **74**	624 [5518] **74**	883 [5774] **73**	1141 [10095] **73**	1415 [12527] **72**	1672 [14795] **70**	1926 [17050] **66**	2150 [19085] **59**	2402 [21544] **52**	73
83 [22]		333 [2945] **81**	587 [5197] **81**	852 [5034] **80**	1125 [9960] **80**	1396[12352] **78**	1642 [14535] **76**	1894 [16767] **71**	2120 [18762] **65**	2389 [21263] **57**	80
91 [24]		301 [2665] **89**	551 [4878] **89**	810 [4346] **88**	1076 [9527] **87**	1347 [11920] **87**	1597 [14130] **85**	1857 [16438] **81**	2096 [18553] **76**	2353 [20827] **68**	87
Max. Cont. 95 [25]		270 [2392] **93**	528 [4671] **92**	792 [4096] **92**	1060[9382] **92**	1330 [11772] **90**	1581 [13990] **88**	1845 [16330] **83**	2086 [18458] **77**	2325 [20573] **69**	91
Max. Inter. 114 [30]		180 [1597] **112**	437 [3867] **111**	695 [1789] **111**	967 [8557] **110**	1237 [10948] **109**	1485 [13144] **106**	1749 [15477] **101**	2979 [17516] **94**	2231 [19744] **86**	109

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

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	173 [2500]
88.9 [3.502]	287 [2544]	575 [5088]	862 [7631]	1150 [10175]	1437 [12719]	1725 [15263]	2012 [17807]	2300 [20350]	2587 [22894]	2874 [25438]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

DISPLACEMENT PERFORMANCE

1K5

1495cm³ [91.2in³/rev.]

Pressure - bars [psi] (Max. Cont. = 104 [1500]; Max. Inter. = 121 [1750])

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500] (Max. Cont.)	121 [1750] (Max. Inter.)	Theoretical rpm
2 [0.5]	305 [2703] **0.9**	648 [5736] **0.6**						2
4 [1]	336 [2978] **2**	693 [6128] **1**	1011 [8942] **1**					3
8 [2]	351 [3106] **4**	729 [6454] **4**	1085 [9597] **3**	1364 [12072] **3**				6
15 [4]	331 [2925] **9**	712 [6304] **9**	1116 [9879] **8**	1491 [13191] **7**	1771 [15668] **7**			11
23 [6]	297 [2629] **15**	681 [3023] **14**	1088 [9632] **13**	1464 [12952] **12**	1770 [15662] **10**			16
30 [8]	247 [2183] **20**	640 [5662] **19**	1038 [9188] **18**	1430 [12655] **17**	1793 [15864] **15**	2123 [18786] **9**		21
38 [10]	197 [1740] **25**	583 [5159] **24**	1001 [8860] **23**	1377 [12189] **22**	1749 [15479] **19**	2090 [18498] **14**		26
45 [12]	131 [1157] **30**	531 [4695] **29**	940 [8315] **28**	1330 [11770] **27**	1702 [15066] **24**	2041 [18059] **19**	2329 [20613] **14**	31
53 [14]	67 [594] **36**	484 [4282] **35**	869 [7689] **33**	1267 [11217] **32**	1642 [14532] **30**	1990 [17612] **24**	2300 [20353] **15**	36
61 [16]		391 [3457] **40**	769 [6805] **39**	1172 [10374] **37**	1567 [13866] **36**	1914 [16941] **32**	2258 [19986] **21**	41
68 [18]		294 [2602] **45**	686 [6072] **44**	1076 [9523] **43**	1489 [13177] **40**	1846 [16334] **38**	2188 [19366] **27**	46
76 [20]		182 [1607] **50**	614 [5435] **49**	988 [8746] **48**	1392 [12320] **47**	1743 [15429] **44**	2301 [18553] **37**	51
83 [22]		87 [770] **55**	487 [4310] **54**	872 [7720] **53**	1283 [11356] **52**	1632 [14442] **48**	2021 [17883] **46**	56
91 [24]			456 [4032] **60**	749 [6632] **60**	1146 [10143] **58**	1533 [13570] **58**	1872 [16568] **50**	61
Max. Cont. 95 [25]			293 [2589] **63**	704 [6232] **62**	1052 [9313] **62**	1465 [12961] **59**	1843 [16306] **53**	64
Max. Inter. 114 [30]				246 [2174] **75**	645 [5711] **74**	1047 [9265] **73**		76

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

Theoretical Torque - Nm [lb-in]

Rotor Width mm [in]	17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]
127.1 [5.003]	410 [3631]	821 [7261]	1231 [10892]	1641 [14522]	2051 [18153]	2462 [21783]	2872 [25414]

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

▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

DISPLACEMENT PERFORMANCE

2K1

2094cm³ [127.7in³/rev.]

Pressure - bars [psi] — Max. Cont.: 104 [1500]; Max. Inter.: 121 [1750]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500] (Max. Cont.)	121 [1750] (Max. Inter.)	Theoretical rpm
2 [0.5]	438 [3878] **0.8**	892 [7894] **0.8**						1
4 [1]	440 [3891] **1**	922 [8162] **1**	1398 [12375] **1**					2
8 [2]	460 [4073] **3**	956 [8458] **3**	1460 [12923] **3**					4
15 [4]	443 [3920] **7**	963 [8525] **7**	1491 [13192] **6**	1980 [17520] **6**				8
23 [6]	402 [3560] **10**	924 [8179] **10**	1470 [13012] **10**	1963 [17370] **9**				11
30 [8]	337 [2985] **14**	884 [7824] **14**	1425 [12613] **14**	1920 [16995] **13**	2390 [21152] **9**	2668 [23613] **8**		15
38 [10]	275 [2431] **17**	814 [7205] **17**	1350 [11944] **16**	1869 [16538] **16**	2343 [20733] **13**	2663 [23564] **9**		19
45 [12]	173 [1535] **21**	723 [6398] **21**	1262 [11171] **21**	1795 [15886] **20**	2286 [20232] **17**	2665 [23588] **12**		22
53 [14]	66 [587] **25**	619 [5479] **24**	1155 [10221] **24**	1702 [15063] **23**	2206 [19519] **21**	2637 [23333] **13**		26
61 [16]		496 [4391] **28**	1018 [9009] **28**	1587 [14046] **27**	2107 [18645] **26**	2574 [22777] **20**		29
68 [18]		368 [3257] **32**	910 [8052] **32**	1466 [12973] **31**	1980 [17527] **30**	2471 [21866] **26**		33
76 [20]		225 [1991] **36**	755 [6686] **36**	1304 [11537] **36**	1859 [16449] **35**	2359 [20878] **30**		37
83 [22]		71 [628] **39**	622 [5507] **39**	1171 [10367] **39**	1682 [14885] **38**	2212 [19575] **36**		40
91 [24]			429 [3794] **43**	984 [8704] **43**	1544 [13665] **42**	2067 [18291] **40**		44
Max. Cont. 95 [25]			354 [3129] **45**	891 [7883] **45**	1428 [12636] **45**	1971 [17445] **43**		46
Max. Inter. 114 [30]				430 [3803] **54**	959 [8485] **54**	1492 [13207] **53**		55

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

Theoretical Torque - Nm [lb-in]

17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]
574 [5084]	1149 [10167]	1723 [15251]	2298 [20334]	2872 [25418]	3447 [30502]	4021 [35585]

Rotor Width
177.9 [7.003]

mm [in]

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

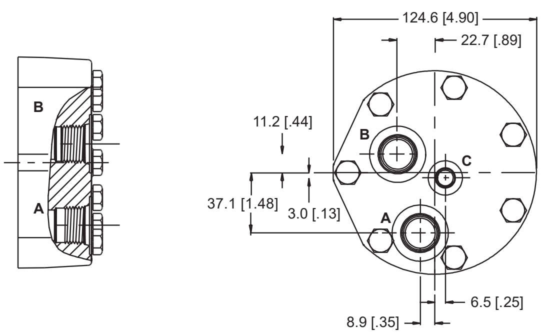
▶ Performance data is typical. Performance of production units varies slightly from one motor to another. See page 7 for additional information on product testing.

PORTING

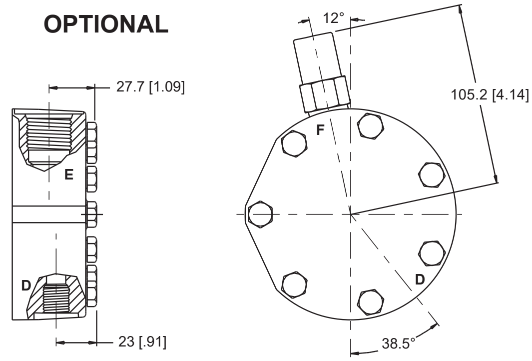
END PORTED - OFFSET

1 Main Ports **A, B**: 7/8 - 14 UNF
Drain Port **C**: 7/16 - 20 UNF

STANDARD



OPTIONAL



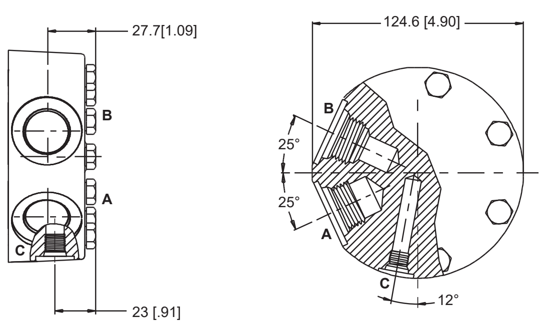
D: Internal Drain **E**: 10 Series/2-Way Valve Cavity 7/8-14 UNF **F**: Valve Cartridge Installed

SIDE PORTED - RADIAL

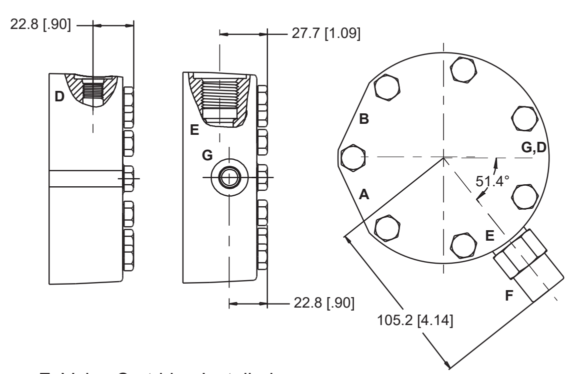
2 Main Ports **A, B**: G 3/4
Drain Port **C**: G 1/4

5 Main Ports **A, B**: 1 1/16 - 12 UN
Drain Port **C**: 7/16 - 20 UNF

STANDARD



OPTIONAL



D: Internal Drain **E**: 10 Series/2-Way Valve Cavity 7/8-14 UNF **F**: Valve Cartridge Installed
G: Internal Drain Placement With Valve Cavity

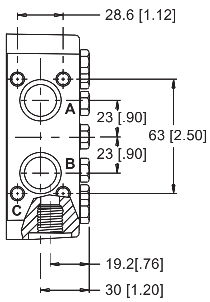
▶ Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

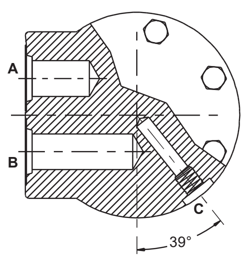
PORTING

SIDE PORTED - MANIFOLD ALIGNED

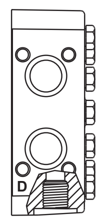
3 Main Ports **A, B**: 11/16" Drilled
Drain Port **C**: 7/16 - 20 UNF

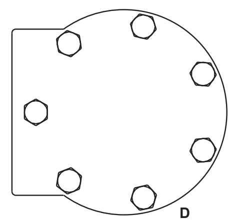
STANDARD





OPTIONAL





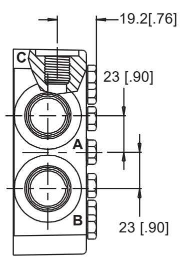
D: Internal Drain

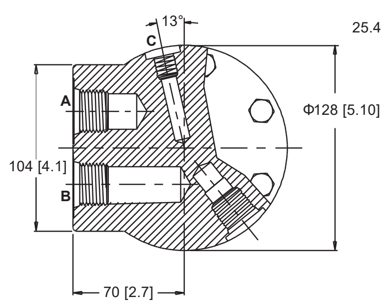
SIDE PORTED - ALIGNED

6 Main Ports **A, B**: 1 1/16 - 12 UN
Drain Port **C**: 7/16 - 20 UNF

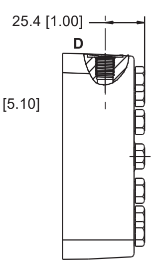
7 Main Ports **A, B**: G 3/4
Drain Port **C**: G 1/4

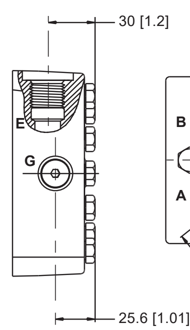
STANDARD

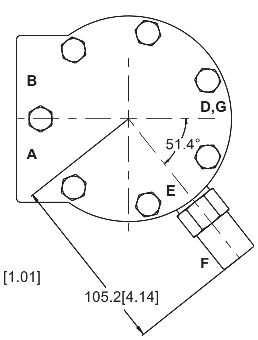




OPTIONAL







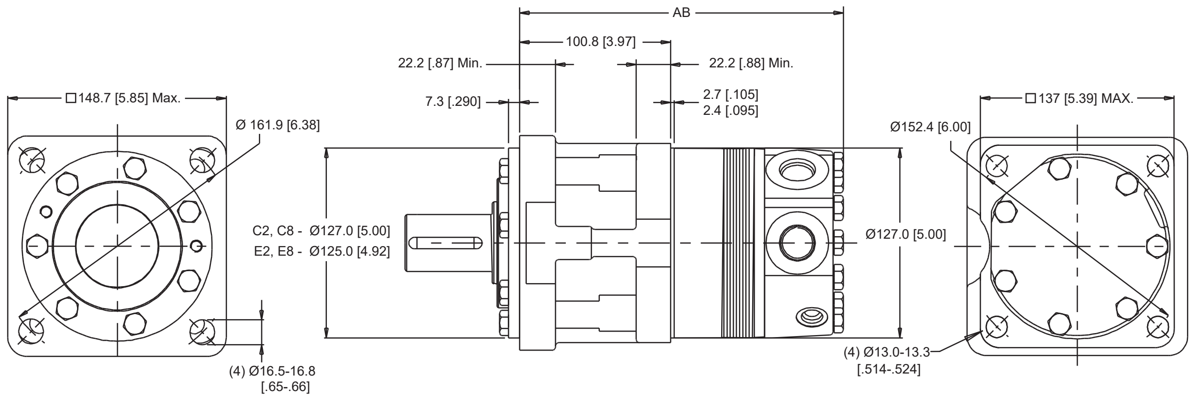
D: Internal Drain **E**: 10 Series/2-Way Valve Cavity 7/8-14 UNF **F**: Valve Cartridge Installed
G: Internal Drain Placement With Valve Cavity

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

HOUSINGS

4-HOLE, SAE C MOUNT

C2 End Ports **C8** Side Ports **E2** End Ports **E8** Side Ports



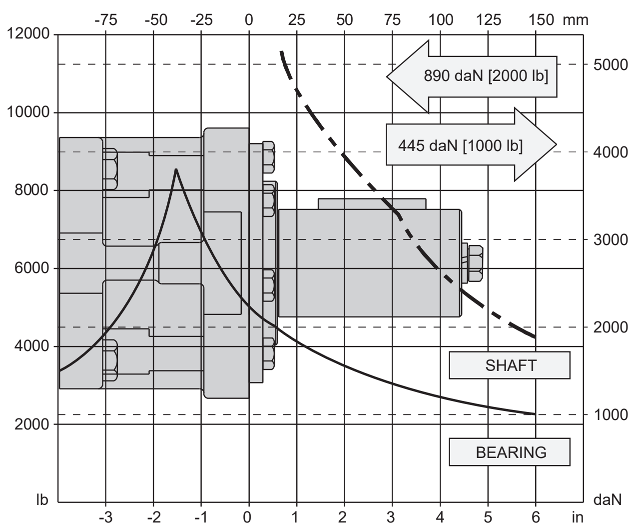
- Porting options listed on pages 24-25.
- Dimensions shown are without paint. Paint thickness can be up to 0.13 [.005].

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 on page 8.

SAE C MOUNTS



LENGTH & WEIGHT CHART

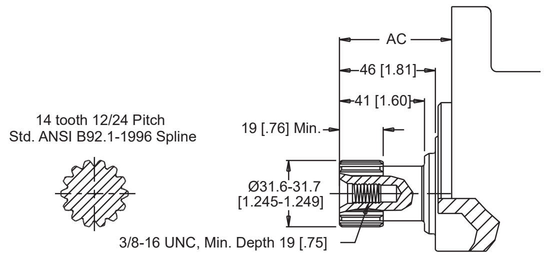
Dimension AB is the overall motor length from the rear of the motor to the mounting surface.

AB	Endcovers on pg. 24 mm [in]	Endcovers on pg. 25 mm [in]	Weight kg [lb]
300	206 [8.14]	209 [8.25]	20.2 [44.6]
375	213 [8.39]	216 [8.50]	20.8 [45.8]
470	220 [8.69]	223 [8.80]	21.4 [47.1]
540	227 [8.93]	230 [9.04]	21.9 [48.2]
750	245 [9.64]	248 [9.75]	23.3 [51.3]
930	260 [10.24]	263 [10.35]	24.4 [53.8]
1K1	270 [10.64]	273 [10.75]	25.3 [55.7]
1K5	308 [12.14]	311 [12.25]	28.3 [62.5]
2K1	359 [14.14]	362 [14.25]	32.3 [71.3]

- All WT series motor weights can vary ± 1.4kg [3 lb] depending on model configurations such as housing, shaft, endcover, options etc.

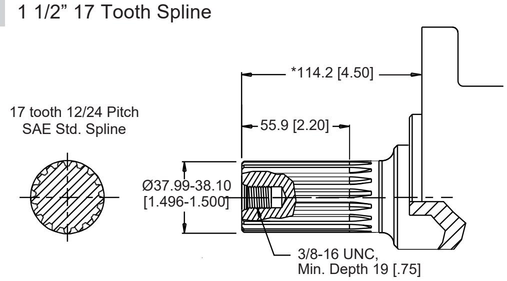
SHAFTS

09 14 Tooth Spline Extended **23** 14 Tooth Spline



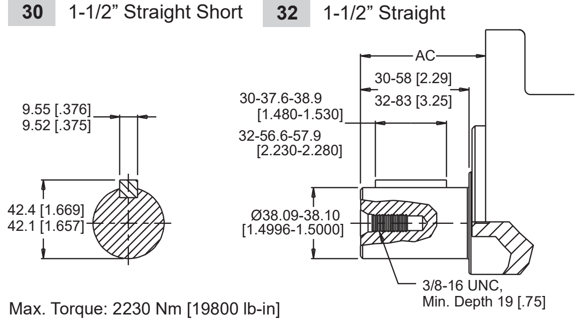
Max. Torque: 2070 Nm [18400 lb-in]

34 1 1/2" 17 Tooth Spline



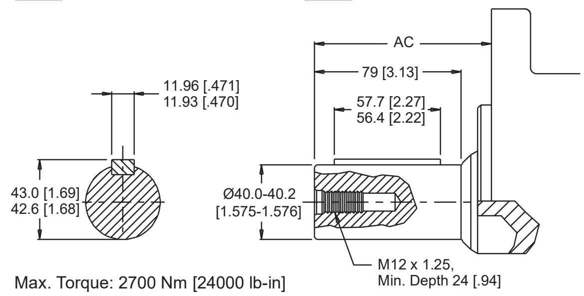
Max. Torque: 2250 Nm [19900 lb-in]

30 1-1/2" Straight Short **32** 1-1/2" Straight



Max. Torque: 2230 Nm [19800 lb-in]

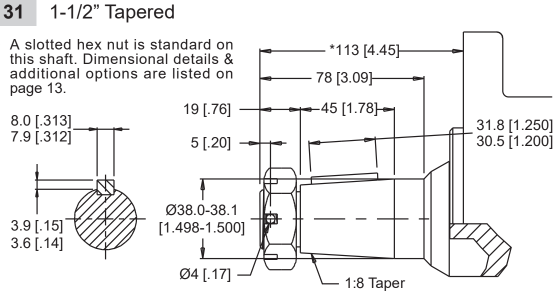
36 40mm Straight **54** 40mm Straight Extended



Max. Torque: 2700 Nm [24000 lb-in]

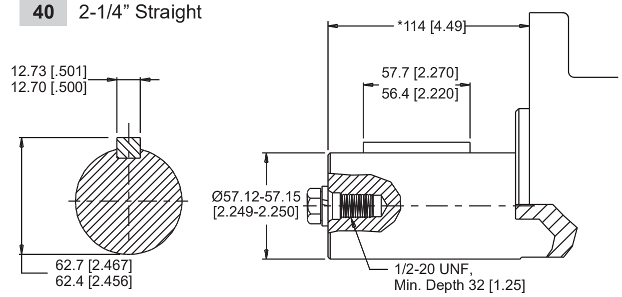
31 1-1/2" Tapered

- ▶ A slotted hex nut is standard on this shaft. Dimensional details & additional options are listed on page 13.



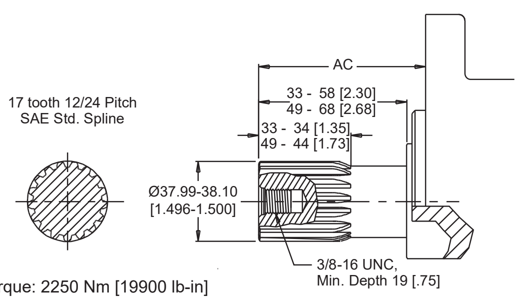
Max. Torque: 2250 Nm [19900 lb-in]

40 2-1/4" Straight



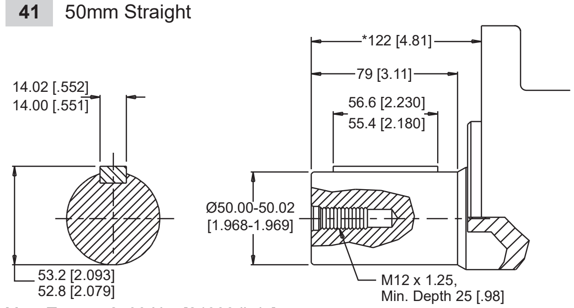
Max. Torque: 2700 Nm [24000 lb-in]

33 17 Tooth Spline **49** 17 Tooth Spline Extended



Max. Torque: 2250 Nm [19900 lb-in]

41 50mm Straight

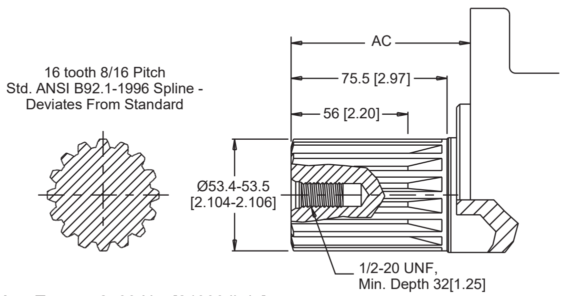


Max. Torque: 2700 Nm [24000 lb-in]

▶ Dimension AC is charted on page 28.

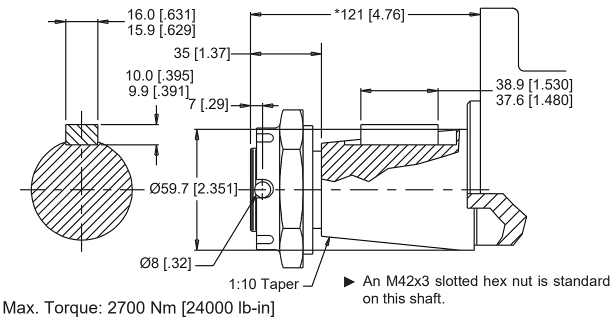
SHAFTS

42 16 Tooth Spline **48** 16 Tooth Spline Extended



Max. Torque: 2700 Nm [24000 lb-in]

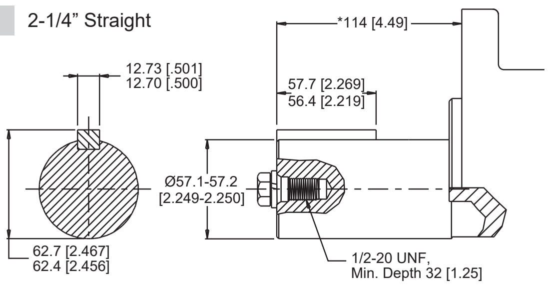
45 60mm Tapered



▶ An M42x3 slotted hex nut is standard on this shaft.

Max. Torque: 2700 Nm [24000 lb-in]

47 2-1/4" Straight



Max. Torque: 2700 Nm [24000 lb-in]

MOUNTING / SHAFT LENGTH CHART

Dimension AC is the overall distance from the motor mounting surface to the end of the shaft and is referenced on detailed shaft drawings on page 27.

AC	Length mm [in]	AC	Length mm [in]
09	86 [3.38]	36	113 [4.45]
23	64.7 [2.55]	42	91 [3.57]
30	77 [3.02]	48	121 [4.77]
32	113 [4.45]	49	99 [3.89]
33	68 [2.69]	54	121 [4.78]

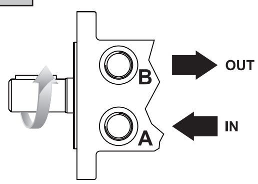
▶ Shaft lengths vary ± 0.8 mm [.030 in.]

ORDERING INFORMATION

1	2	3a	3b	4	5	6	7	8
☐ ☐ ☐	☐ ☐ ☐	☐ ☐	☐	☐ ☐	☐	☐	☐	☐ ☐

1. CHOOSE SERIES DESIGNATION

700	Standard Motor



▶ The 700 series is bi-directional. Reversing the inlet hose will reverse shaft rotation.

2. SELECT A DISPLACEMENT OPTION

300	300 cm³/rev [18.3 in³/rev]	930	929 cm³/rev [56.7 in³/rev]
375	374 cm³/rev [22.8 in³/rev]	1K1	1047 cm³/rev [63.9 in³/rev]
470	464 cm³/rev [28.3 in³/rev]	1K5	1495 cm³/rev [91.2 in³/rev]
540	536 cm³/rev [32.7 in³/rev]	2K1	2093 cm³/rev [127.7 in³/rev]
750	747 cm³/rev [45.6 in³/rev]		

3a. SELECT MOUNT TYPE

▼ **END MOUNTS**

C2	SAE C Mount (5” Pilot)
E2	SAE C Mount (125mm Pilot)

▼ **SIDE MOUNTS**

C8	SAE C Mount (5” Pilot)
E8	SAE C Mount (125mm Pilot)

3b. SELECT PORT SIZE

▼ **END PORT OPTIONS**

1	7/8-14 UNF Offset

▼ **SIDE PORT OPTIONS**

2	G 3/4, Radial
3	11/16” Hole, Aligned Manifold
5	1 1/16-12 UN, Radial
6	1 1/16-12 UN, Aligned
7	G 3/4, Aligned

4. SELECT A SHAFT OPTION

09	14 Tooth Spline Extended	40	2-1/4” Straight
23	14 Tooth Spline	41	50mm Straight
30	1-1/2” Straight Short	42	16 Tooth Spline
31	1-1/2” Tapered	45	60mm Tapered
32	1-1/2” Straight	47	2-1/4” Straight
33	17 Tooth Spline	48	16 Tooth Spline Extended
34	1 1/2” 17 Tooth Spline	49	17 Tooth Spline Extended
36	40mm Straight	54	40mm Straight Extended

▶ For options not listed in the table above, please contact us with your requirements.

5. SELECT A PAINT OPTION

A	Black
B	Black, Unpainted Mounting Surface
Z	No Paint

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 not available on port option 3.

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
AB	Internal Drain
AC	Freeturning Rotor
AD	Internal Drain & Freeturning Rotor