

Vane motor

Series MV015

RA 10551

Edition: 2013-11



- ▶ Maximum operating pressure:
 - 3000 psi (207 bar) – Code 61

Features

Use: Medium speed, high torque applications requiring reliability in demanding mobile equipment applications. Small size, high torque at start and stall, and through-hole are important features.

- ▶ Eight fixed displacement rotating groups ranging from 6 in³ to 15 in³ (98 cm³/rev to 246 cm³/rev)
- ▶ Starting and stall torques up to 94% of theoretical torque
- ▶ Speed to 2000 RPM continuous
- ▶ Up to 150 HP (112 kW)
- ▶ Can conform to SAE 'C' mounting specification
- ▶ Customizable for direct drive applications
- ▶ High power to weight ratio
- ▶ High reliability in demanding applications
- ▶ Long service life

Contents

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Ordering code

01	02	03	04	05	06	07	08	09											
MV015	-	61	-	1S	-	011	-	30	-	B1	-	T	B	-	000				

01	Motor Series																		MV015
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Port Options – Rear housing and speed selection. Consult factory for two-speed design.

02	Code 61																		
	Cast rear housing with 1-1/4" 4-bolt flange, single speed																		61

Rotary Group Designation

03	Standard speed																		1S
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Displacement Options

04	Single rotating group																		
	6 in ³ (98 cc)/rev.																		006
	7 in ³ (115 cc)/rev.																		007
	8 in ³ (131 cc)/rev.																		008
	9.5 in ³ (156 cc)/rev.																		009
	10.5 in ³ (172 cc)/rev.																		010
	11.5 in ³ (188 cc)/rev.																		011
	13 in ³ (213 cc)/rev.																		013
	15 in ³ (246 cc)/rev.																		015

Shaft Selection

05		Weights	lbs.	kg					
	Keyed shaft conforming to SAE C		48	22					30
	Splined shaft conforming to SAE C		48	22					31
	Wheel motor with tapered shaft conforming to SAE J501		63	29					32
	Keyed shaft out front & rear tachometer shaft		47	21					34
	Splined shaft out front & rear tachometer shaft		47	21					49
	Manually retractable splined shaft		67	30					50
	Smooth shaft – configured to customer specifications		N/A	N/A					52
	Hollow shaft with CA21-1 male drill rod threads		61	28					53

Bearing Selection

06	Shaft and bearing combinations								
		30	31	32	34	49	50	52	53
	B1	●	●	–	●	●	●	●	–
	B4	○	○	–	○	○	–	–	–
	T1	–	–	●	–	–	–	–	●
	● = available ○ = upon request – = not available								
	Note: Other shaft and bearing combinations may be available. Consult factory.								

Shaft Seal (see page 6)

07	TCN (radial lip seal) in FKM (Viton) only (only shaft seal for 53 hollow shaft code)								T
	Quad ring								Q

Main Body O-rings (see page 5 for seal material specifications)

08	NBR (Buna) – standard (only main body option for 53 hollow shaft code)								B
	FKM (Viton) – optional								V

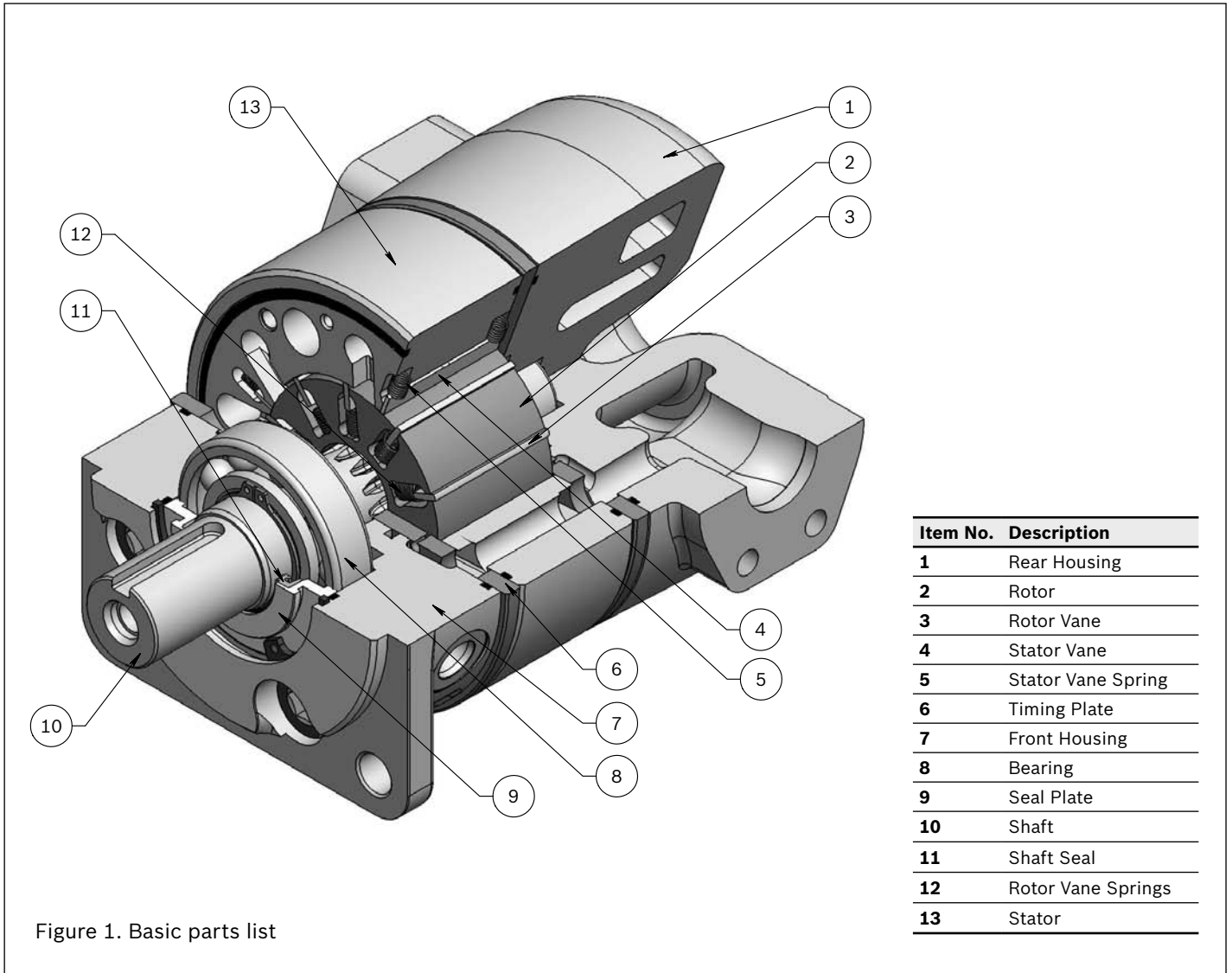
Special Index Number

09	Standard design – special features are designated with a three-digit code (consult factory)								000
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Technical data

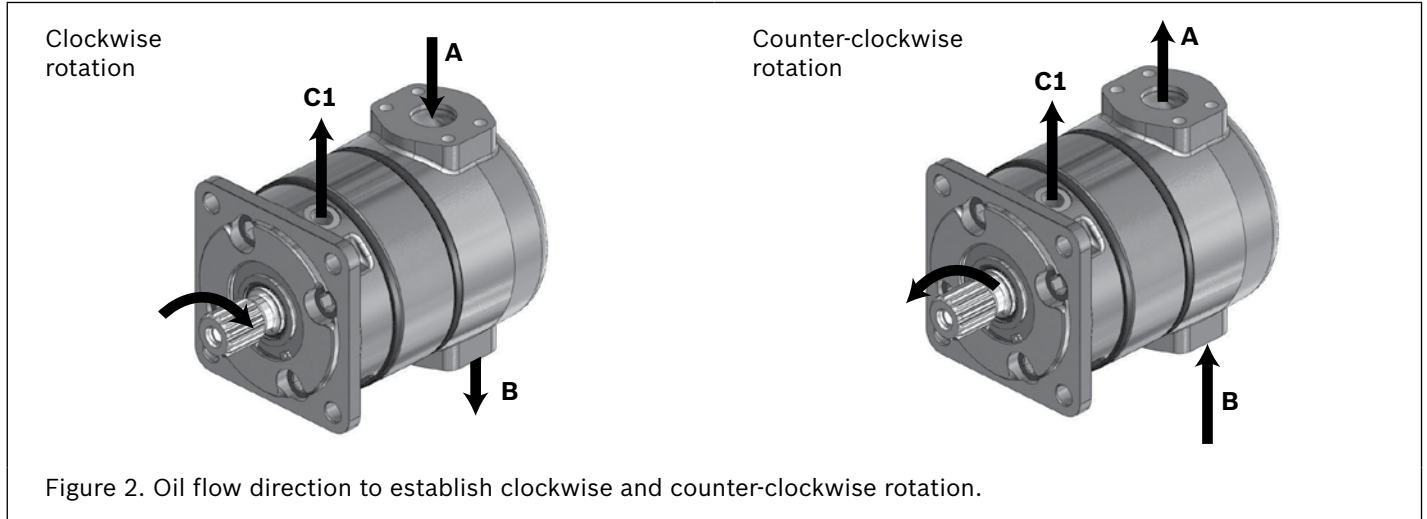
The 15 series motors are hydraulically balanced internally and therefore no significant radial loads are induced on the motor bearings which contribute to long service life. The motor can be configured with various bearing options to accommodate external radial and axial loading. This data sheet details standard motors (see Figure 1); technically feasible, custom solutions may be offered. Please consult factory.

Oil supply lines are connected to ports A and B. Case drain lines can be installed on the C1 port. Reference motor unit drawings for additional case line locations and Case Drain section on page 23 for details. Using the “A” port as the inlet will provide clockwise shaft rotation as seen from the front of the shaft. Using the “B” port will provide counter-clockwise shaft rotation also seen from the front of the shaft (see Figure 2).



Technical data

2-port motor



Motor specifications

Standard Series Code 61	Displacement		Pressure				Speed		Torque @ 3000 psid (207 bar)*	
	(in ³ /rev)	(cm ³ /rev)	Continuous		Intermittent		Continuous (rpm)	Intermittent (rpm)	Continuous	
			(psid)	(bar)	(psid)	(bar)			(lb-ft)	(Nm)
MV015	6	98	3000	207	3500	241	2000	2600	183	248
	7	115					1900	2600	230	312
	8	131					1800	2600	274	372
	9.5	156					1700	2300	308	418
	10.5	172					1600	2300	352	477
	11.5	188					1600	2300	395	536
	13	213					1500	2000	428	580
	15	246					1500	2000	509	690

* Torque values are average performance data measured at maximum speeds with 100 SUS (20cSt) and standard rotating group.

Note:

1. Intermittent duty cycle is six (6) seconds per minute.
2. Higher speeds or pressure may be permissible under certain conditions. Consult factory.

Technical data

Choice of hydraulic fluid

Bosch Rexroth Rineer high torque vane motors are primarily designed to operate on conventional petroleum based hydraulic oils. The hydraulic oil can be chosen in consultation with the oil supplier or your local sales office, bearing the following requirements in mind:

General

The oil shall have FZG (90) fail stage minimum 11 described in IP 334 (DIN 51354). The oil must also contain inhibitors to prevent oxidation, corrosion and foaming. The viscosity of mineral oil is highly dependent on the temperature. The final choice of oil must depend on the operating temperature that can be expected at the motor or that has been established in the system and not in the hydraulic tank.

High temperatures in the system greatly reduce the service life of oil and rubber seals, as well as resulting in low viscosity, which in turn provides poor lubrication. Content of water shall be less than 0.1%.

Oil used in the system should be filtered by a minimum of 25 micron filter.

Fluid Cleanliness

System Pressure	
≤ 3000 psi / 207 bar	
19/17/14*	

* ISO 4406 Standard

Viscosity

Minimum Operating Viscosity	100 SUS / 20 cSt
Maximum Operating Viscosity	250 SUS / 54 cSt

Minimum operating viscosities must be met even at maximum temperature. Operating below 20 cSt will result in reduced life expectancy.

Maximum fluid temperature should not exceed 180 °F (82 °C).

Please consult with a Bosch Rexroth Rineer Applications Engineer when using fire resistant fluid, water glycols, biodegradable fluids, or viscosities outside above recommendations.

Seals

Buna N (NBR)

Temperature Range:

–65 °F to +250 °F (–54 °C to +121 °C)

Buna N is a copolymer of butadiene and acrylonitrile with excellent compatibility with petroleum products. For exposure in low temperatures it is necessary to sacrifice some high temperature resistance. The product is superior in compression set, cold flow, tear, and abrasion resistance. Inferior in resistance to ozone, sunlight or weather. It is generally recommended for petroleum, water, diester, and water-glycol. Not recommended for use with halogenated hydrocarbons, phosphate ester, ketones, acids, and brake fluids.

Fluorocarbon (FKM) (Viton)

Temperature Range:

–20 °F to +350 °F (–29 °C to +177 °C)

Viton is a linear copolymer of vinylidene fluoride and hexafluoro propylene which offers the widest temperature range and chemical resistance. The product is compatible and recommended for use with most fluids and gases such as petroleum, silicate ester, diester, halogenated hydrocarbons, and most phosphate esters. Viton has very good ozone, weather and aging resistance. It is not recommended for ketones, glycol based brake fluids, superheated steam, formic and acetic acids.

Technical data

Bosch Rexroth Rineer offers two types of rotary seals, namely radial lip seal and quad ring. The lip seal is only available in FKM. The quad seal is available in both NBR and FKM. The radial lip seal accommodates external radial loads imposed on the shaft to a greater degree than quad seal designs. All designs will accommodate axial loading on the shaft.

Heat failure of the material is the most common failure mode for a rotary seal. Reducing the friction at the shaft / seal interface is the most effective method of reducing heat build up on the seal. The higher the pressure to be sealed combined with high shaft speeds results in increased friction (heat buildup), decreasing seal life. Properly performing rotary seals offer unique challenges. Our seals operate with an oil film under the seal / shaft contact area that separates the two surfaces reducing surface wear and providing cooling to the contact area. Slippage oil which by-passes the vanes, rotor and timing plate interface accumulates in the case and lubricates the bearings and seals.

Shaft seal options

Seal Type	Maximum Case Pressure	External Loading
Radial Lip Seal	35 psig (2.4 bar)	Radial / Axial
Quad Seal	100 psig (6.9 bar)	Low Radial / Axial

Technical data

Selecting / Sizing a Motor

Motor selection is dependent on the application and generally the required horsepower, motor speed range, and available supply pressure are to be defined. Alternatively desired output torque and speed for a given application can be used. Motor speed (shaft speed) is a function of flow delivered to the motor and displacement. Torque output is a function of differential pressure and motor displacement. The charts illustrated are based on actual performance data and account for losses in a given motor.

For example:

An application requirement is 50 hp (37.28 kW) at 1000 rpm with an available supply pressure of 2700 psi (186 bar) and a return line pressure of 200 psi (14 bar). The pressure differential is 2500 psi (172 bar).

Calculations:

Theoretical torque (ideal no losses):

Metric:

$$T = \frac{P \times 9549.09}{n} = \frac{37.28 \times 9549.09}{1000} = 356 \text{ N-m}$$

U.S.:

$$T = \frac{P \times 5252}{n} = \frac{50 \times 5252}{1000} = 263 \text{ lb-ft}$$

Theoretical displacement (ideal no losses):

for condition $T = 356 \text{ N-m}$ ($T = 263 \text{ lb-ft}$)

Metric:

$$d = \frac{T \times 62.81}{p} = \frac{356 \times 62.81}{172} = \sim 130 \text{ cc}$$

U.S.:

$$d = \frac{T \times 75.4}{p} = \frac{263 \times 75.4}{2500} = 8 \text{ cir}$$

Referencing the chart “Torque 8 cir (131 cc)”

An 8 cir (131 cc) displacement motor at a pressure 2500 psid (172 bar) will develop torque of approximately 230 lb-ft (312 N-m).

Referencing the chart “Total Required Flow 8 cir (131 cc)”

An 8 cir (131 cc) displacement motor at a pressure of 2500 psid (172 bar) operating at 1000 rpm will require a total flow of approximately 44 gpm (167 lpm).

Nomenclature

Symbol	Measurable Quantity	U.S.	Metric
d	Displacement	cir or $\frac{\text{in}^3}{\text{rev}}$	cc or $\frac{\text{cm}^3}{\text{rev}}$
Q	Input flow	gpm or $\frac{\text{gal}}{\text{min}}$	lpm or $\frac{\text{liters}}{\text{min}}$
n	Shaft speed	rpm or $\frac{\text{revolutions}}{\text{min}}$	rpm or $\frac{\text{revolutions}}{\text{min}}$
P	Power	hp	kW
Δp	Differential pressure	psid	bar
T	Torque	lb-ft	N-m

Calculation Fundamentals

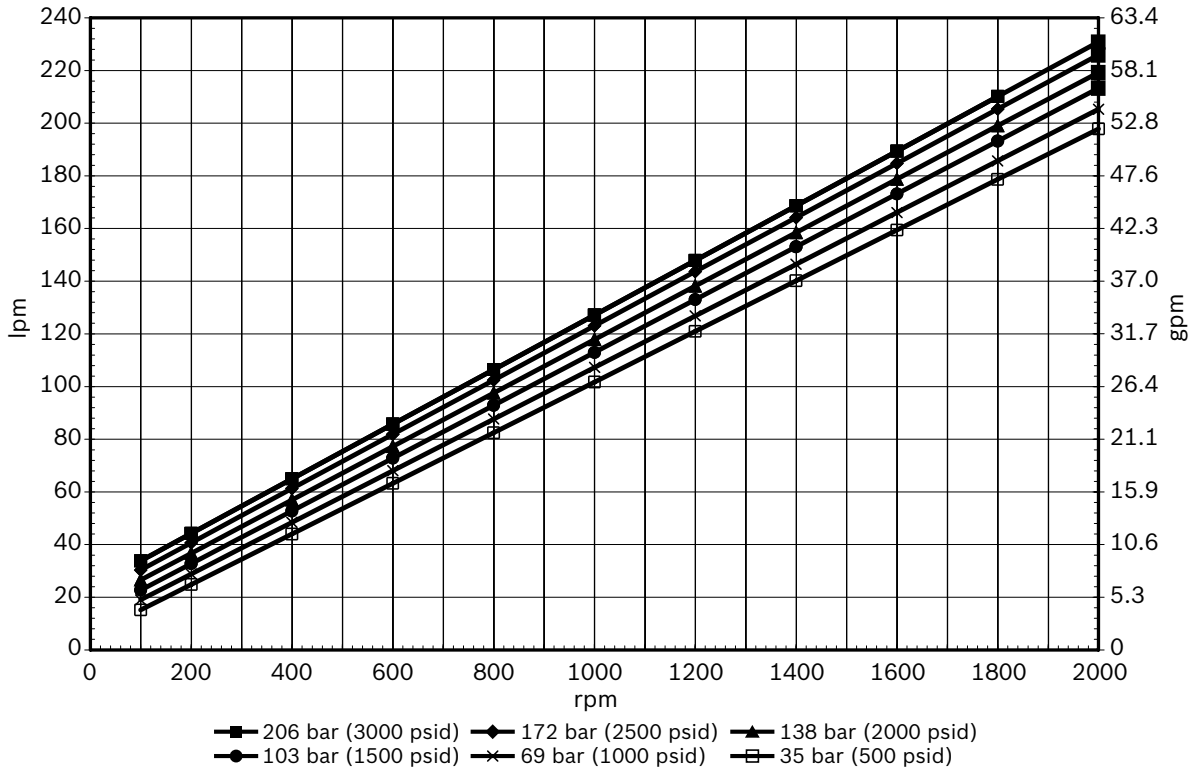
U.S.	Metric
$T = \frac{P \times 5252}{n}$	$T = \frac{P \times 9549.09}{n}$
$T = \frac{d \times \Delta p}{75.4}$	$T = \frac{d \times \Delta p}{62.81}$
$P_{\text{shaft}} = \frac{T \times n}{5252}$	$P_{\text{shaft}} = \frac{T \times n}{9549.09}$
$P_{\text{shaft}} = \frac{Q \times \Delta p}{1714}$	$P_{\text{shaft}} = \frac{Q \times \Delta p}{599.29}$
$Q = \frac{d \times n}{231}$	$Q = \frac{d \times n}{1000}$
$n = \frac{P \times 5252}{T}$	$n = \frac{P \times 9549.09}{T}$
$d = \frac{T \times 75.4}{\Delta p}$	$d = \frac{T \times 62.81}{\Delta p}$

Unit Conversions

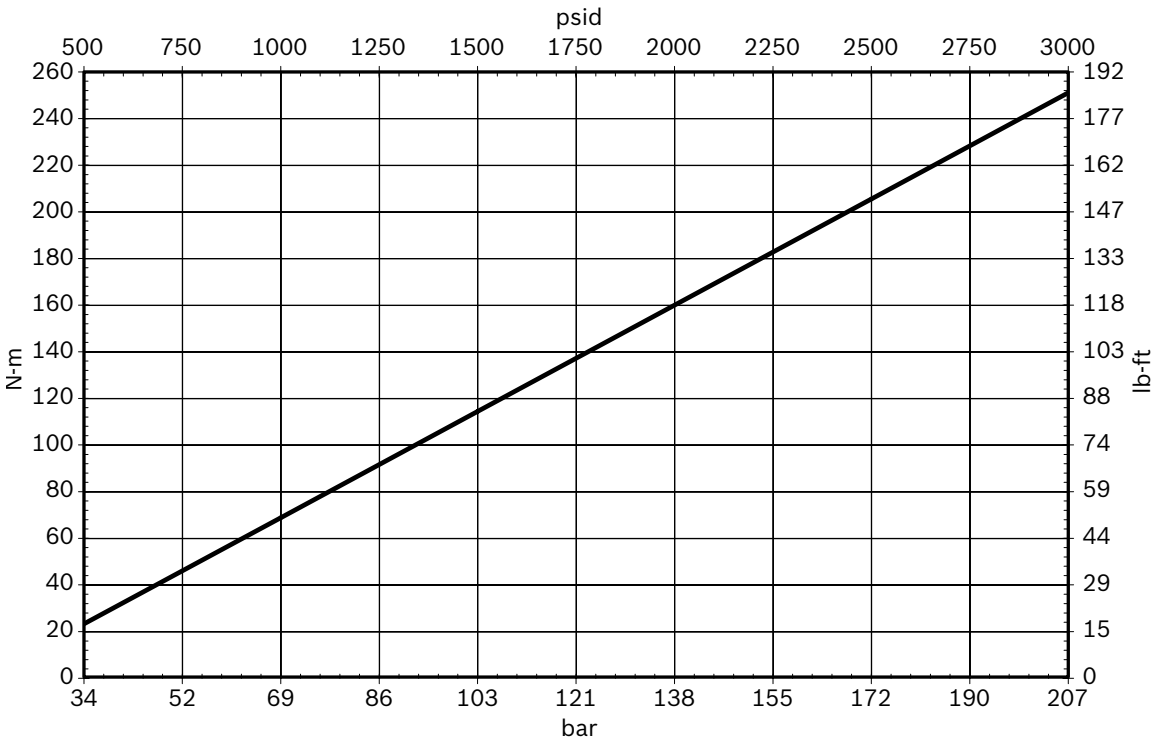
Quantity	Symbol	Metric	Convert	U.S.
Torque	T	N-m	÷ 1.356	lb-ft
Power	P	kW	x 1.341	hp
Displacement	d	cm^3/rev	÷ 16.385	in^3/rev
Input flow	Q	lpm	÷ 3.78	gpm
Rotational speed	n	rpm	=	rpm
Pressure	p	bar	x 14.504	psi

Technical data

Total required flow – 6 cir (98 cc)

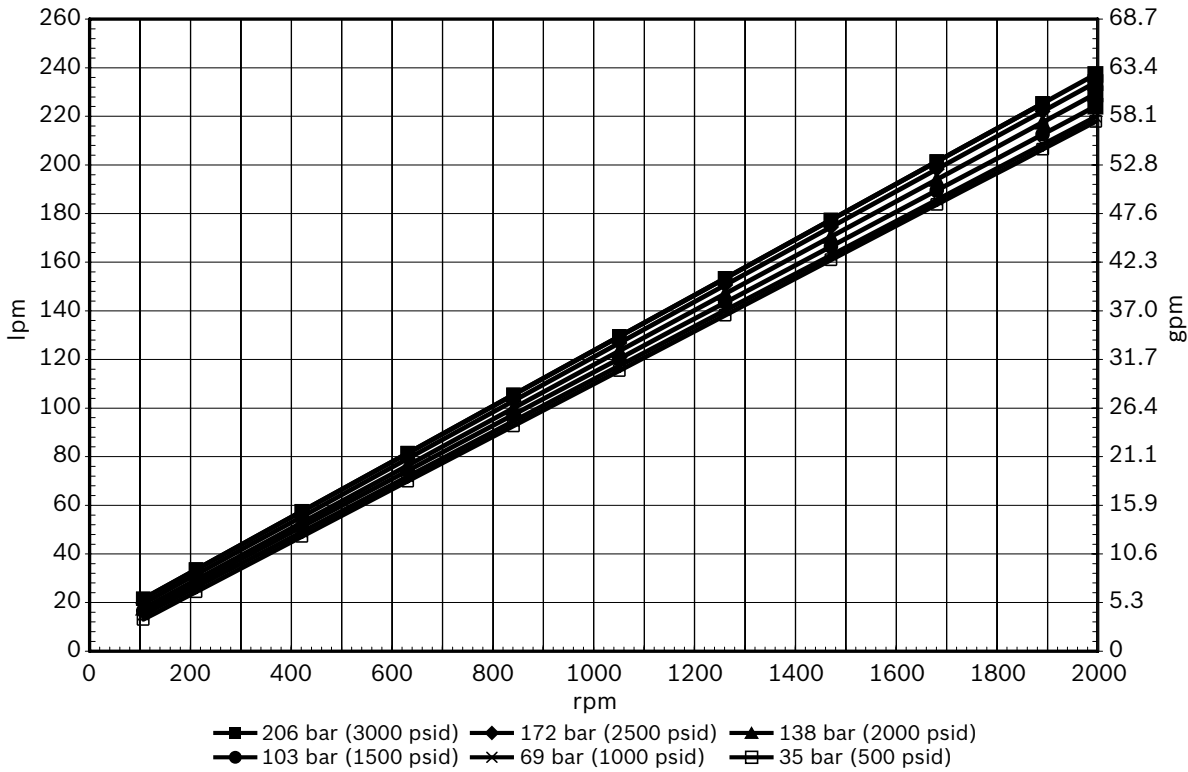


Torque – 6 cir (98 cc)

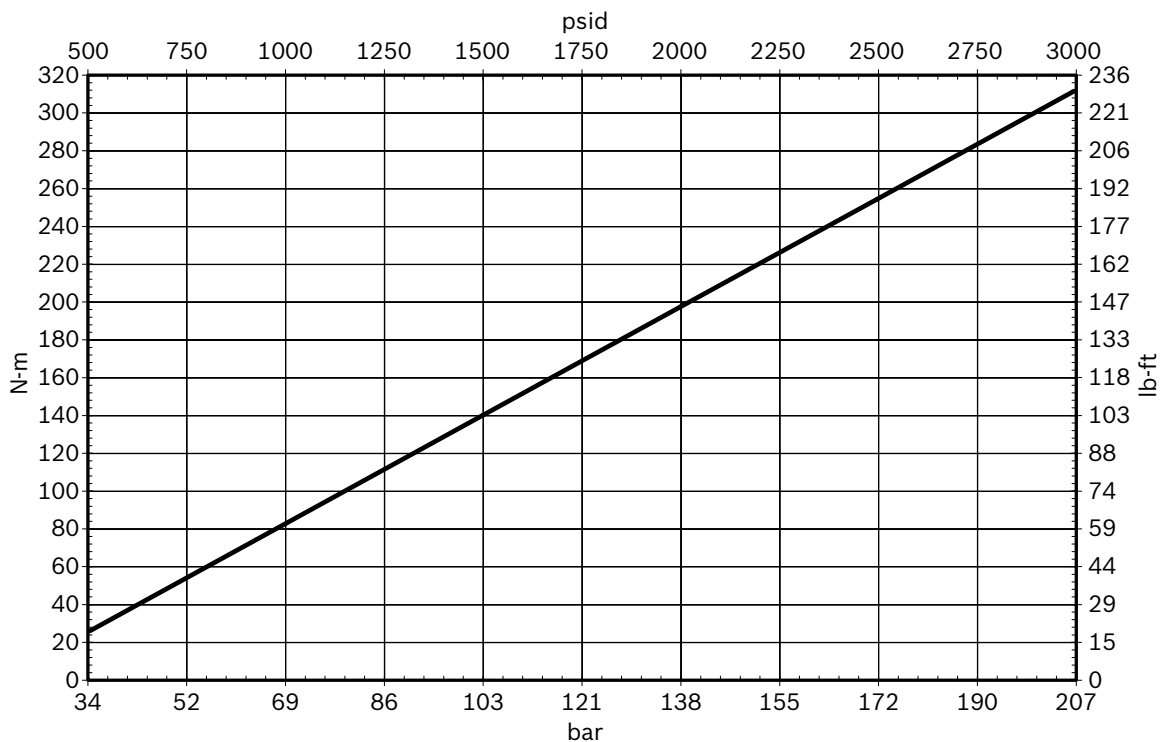


Technical data

Total required flow – 7 cir (115 cc)

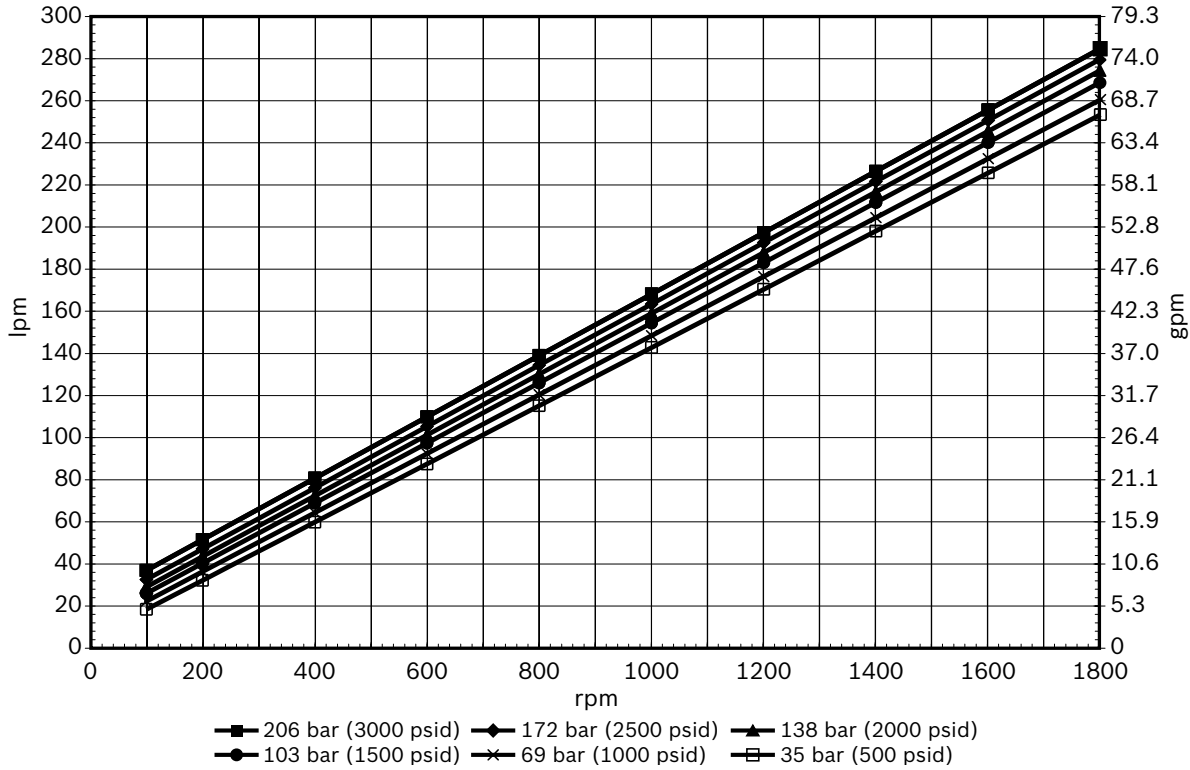


Torque – 7 cir (115 cc)

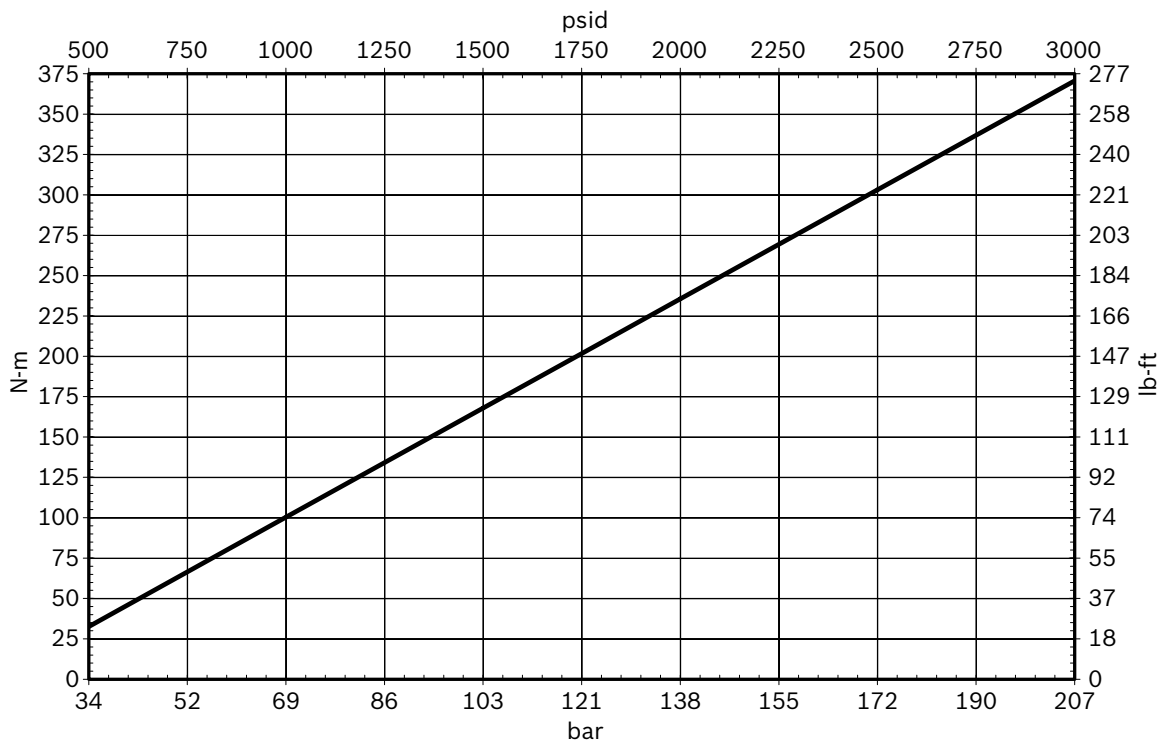


Technical data

Total required flow – 8 cir (131 cc)

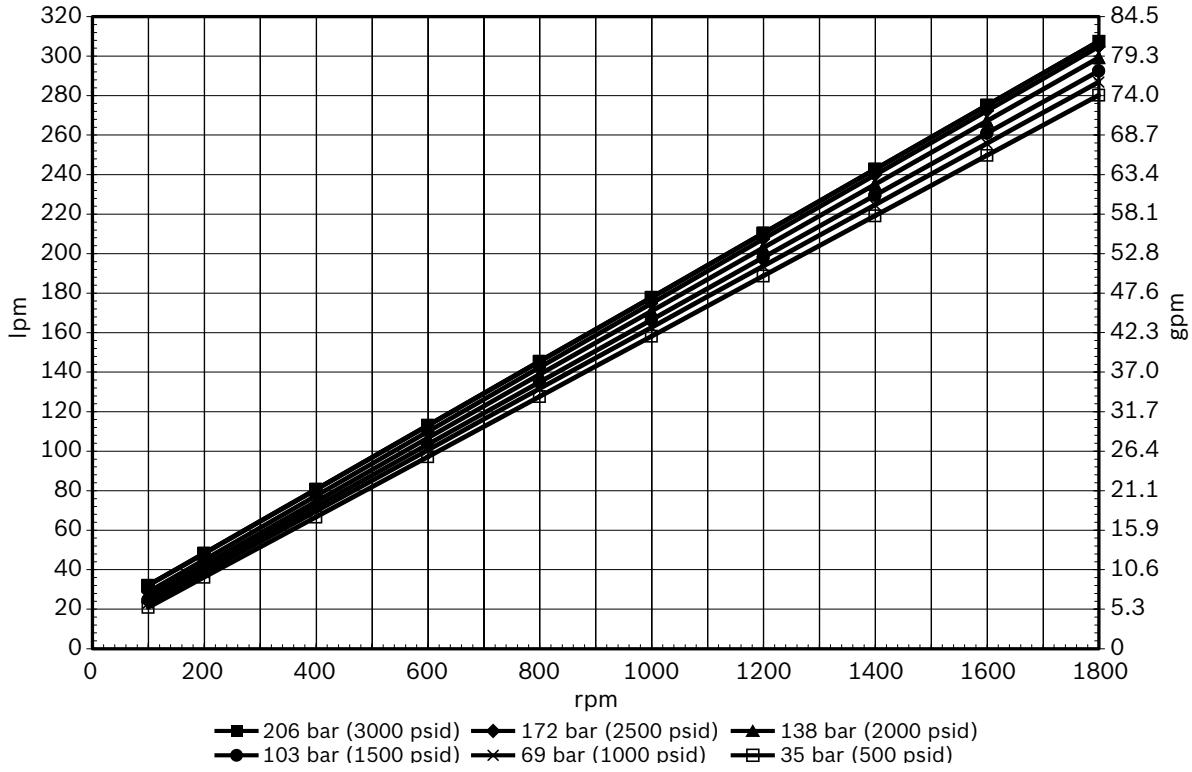


Torque – 8 cir (131 cc)

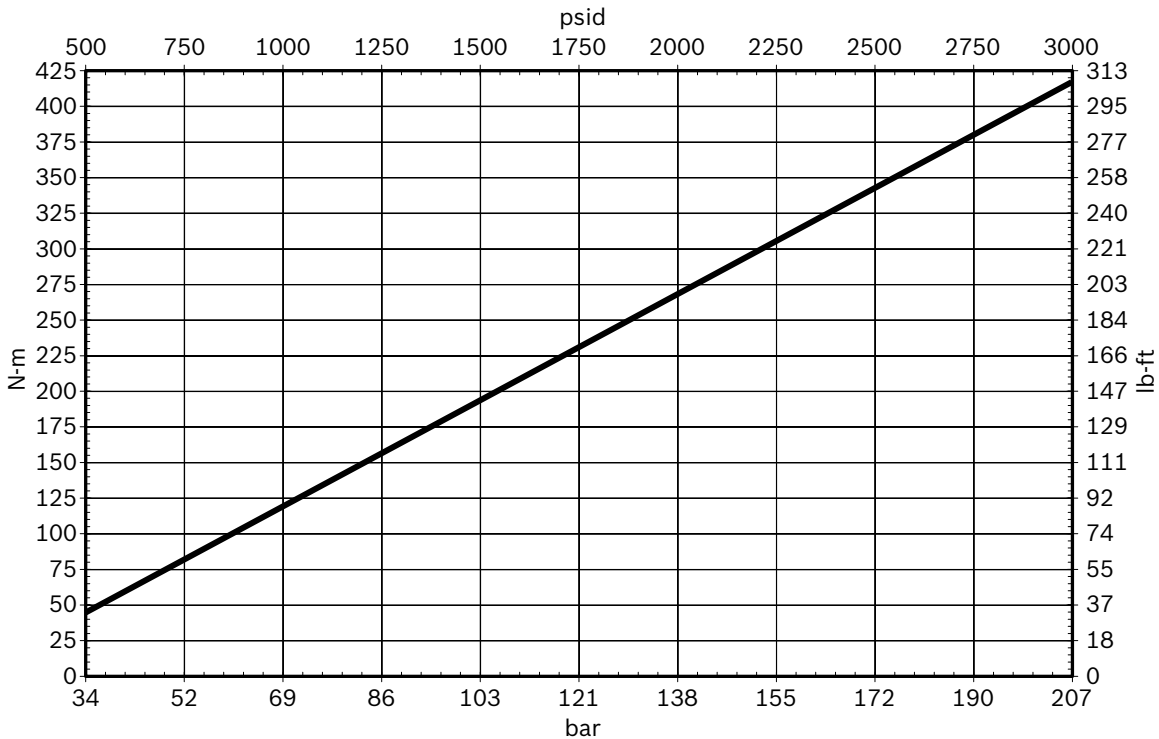


Technical data

Total required flow – 9.5 cir (156 cc)

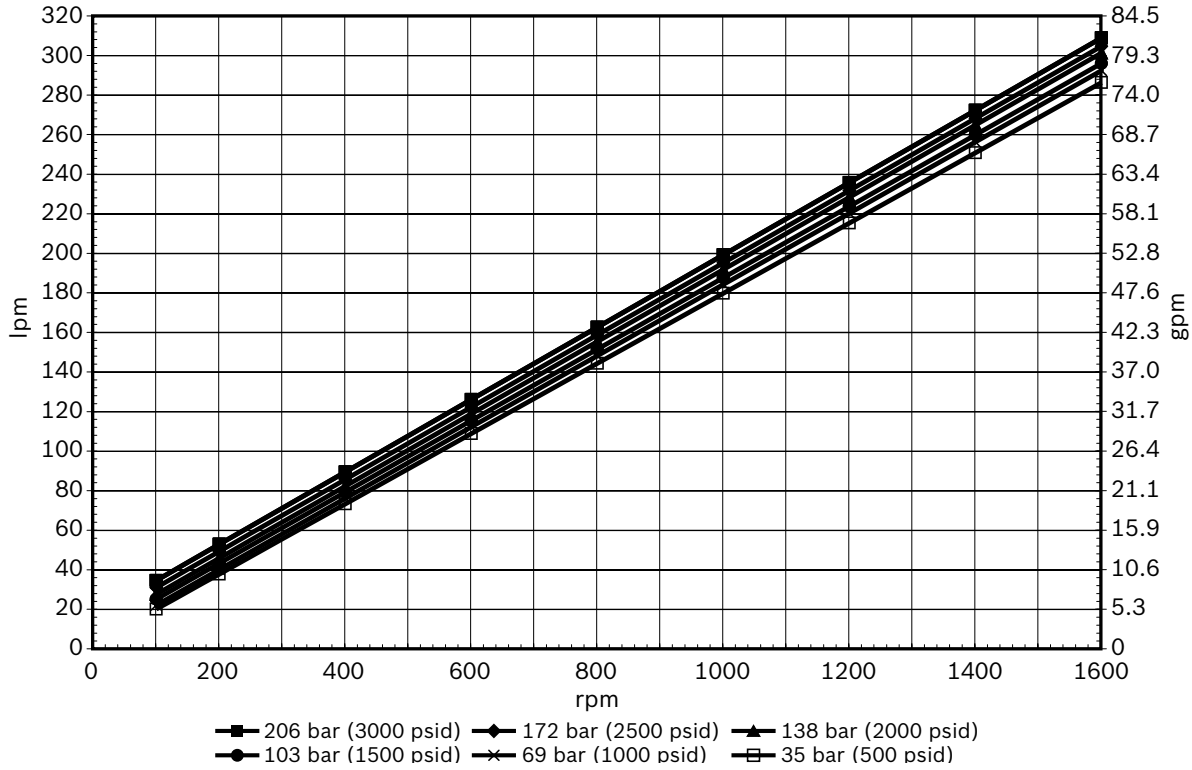


Torque – 9.5 cir (156 cc)

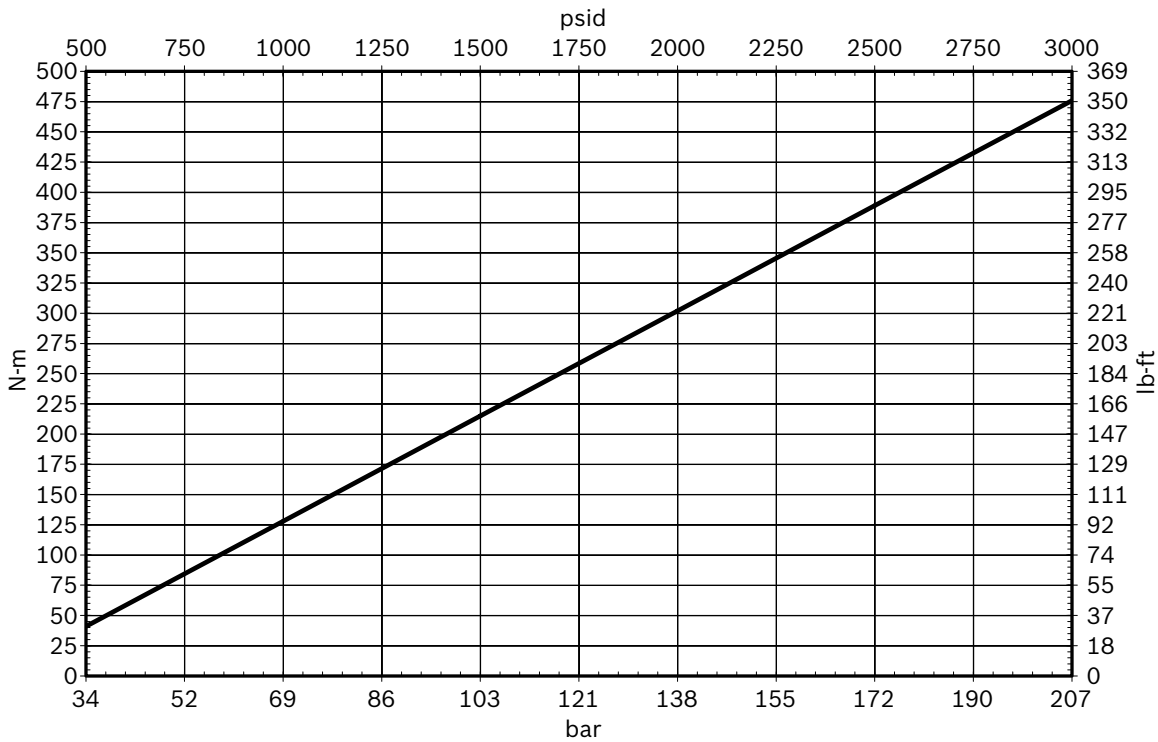


Technical data

Total required flow – 10.5 cir (172 cc)

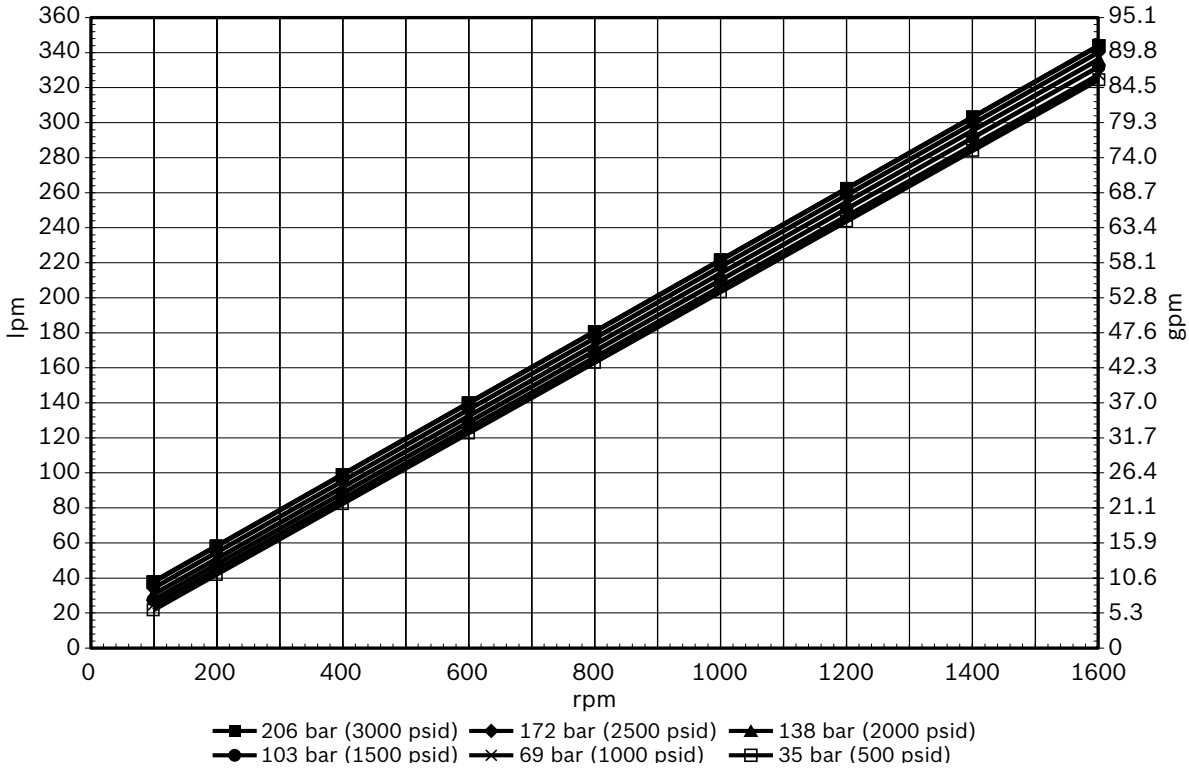


Torque – 10.5 cir (172 cc)

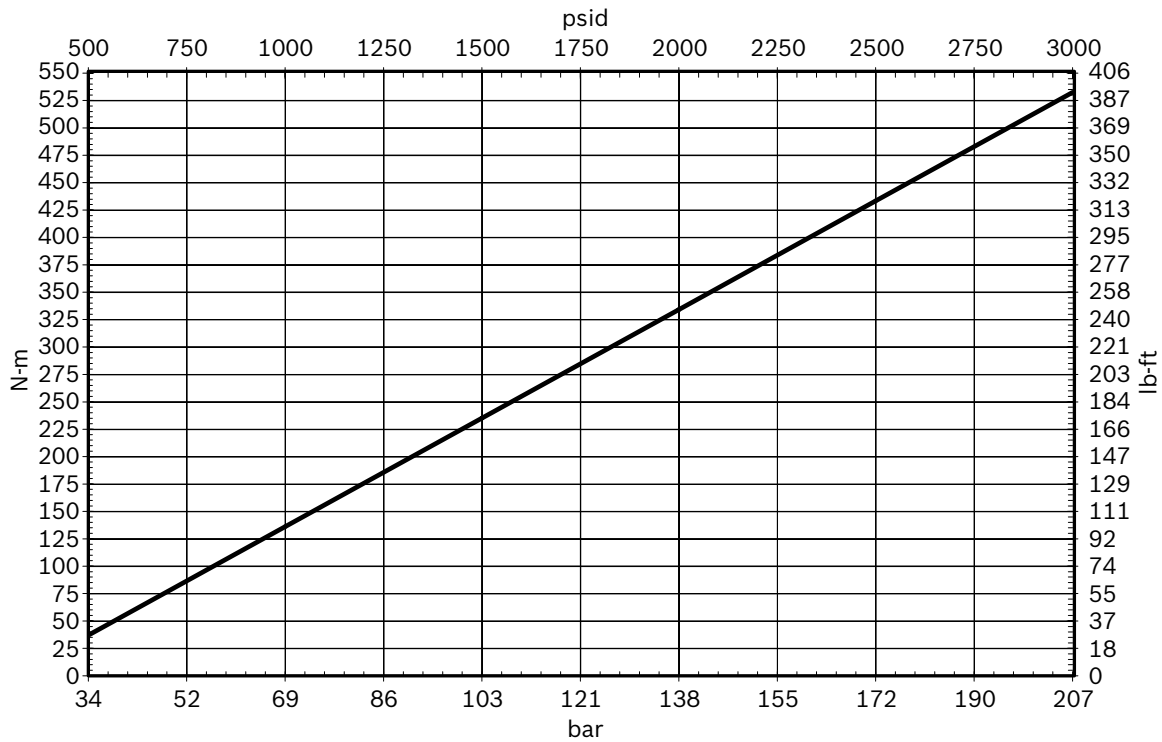


Technical data

Total required flow – 11.5 cir (188 cc)

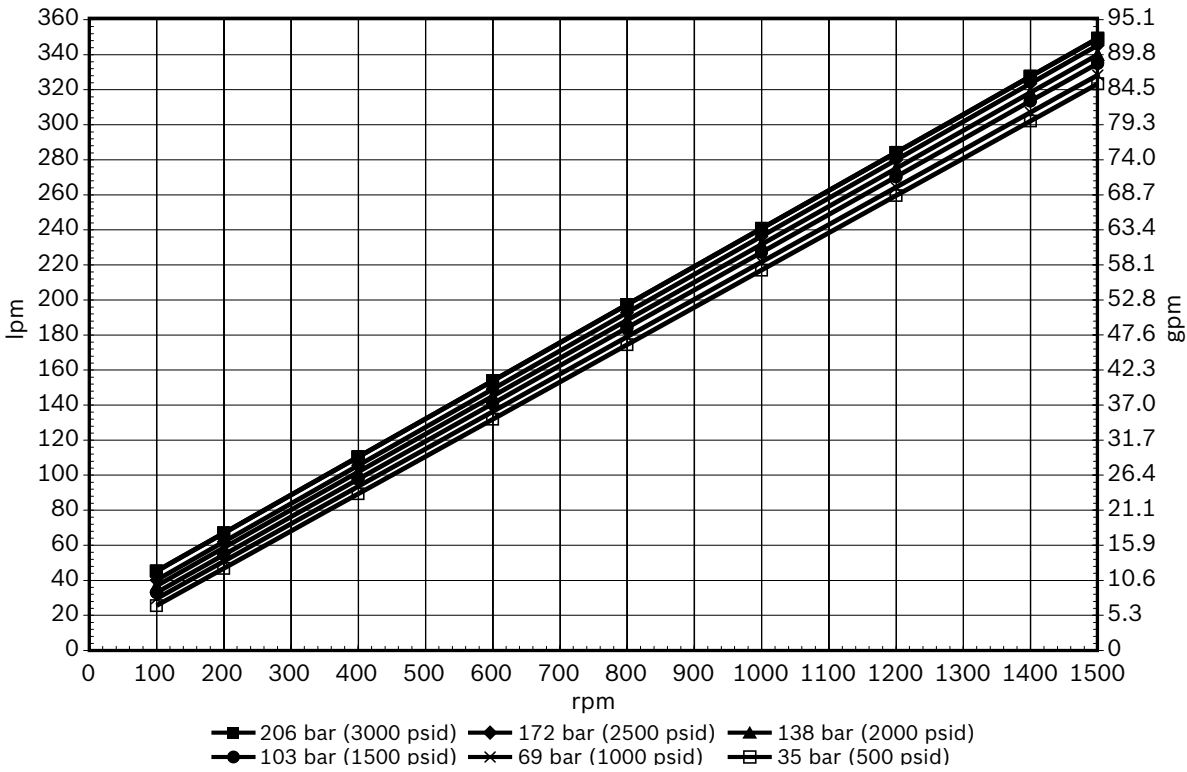


Torque – 11.5 cir (188 cc)

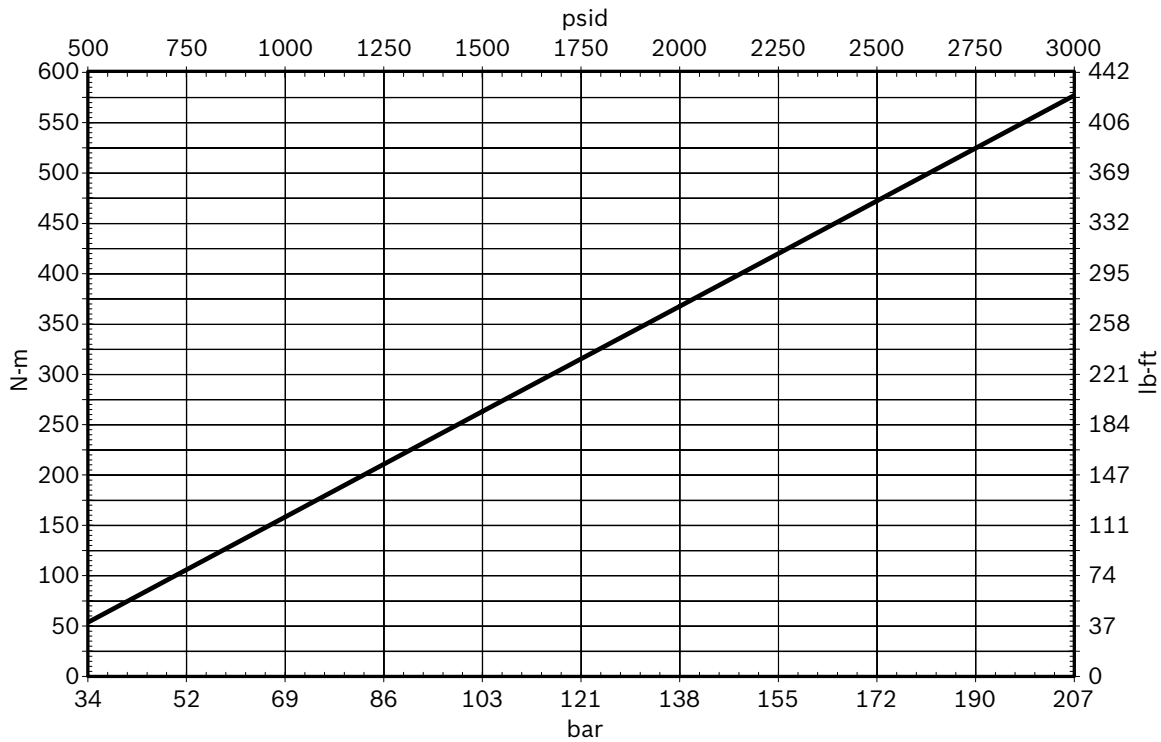


Technical data

Total required flow – 13 cir (213 cc)

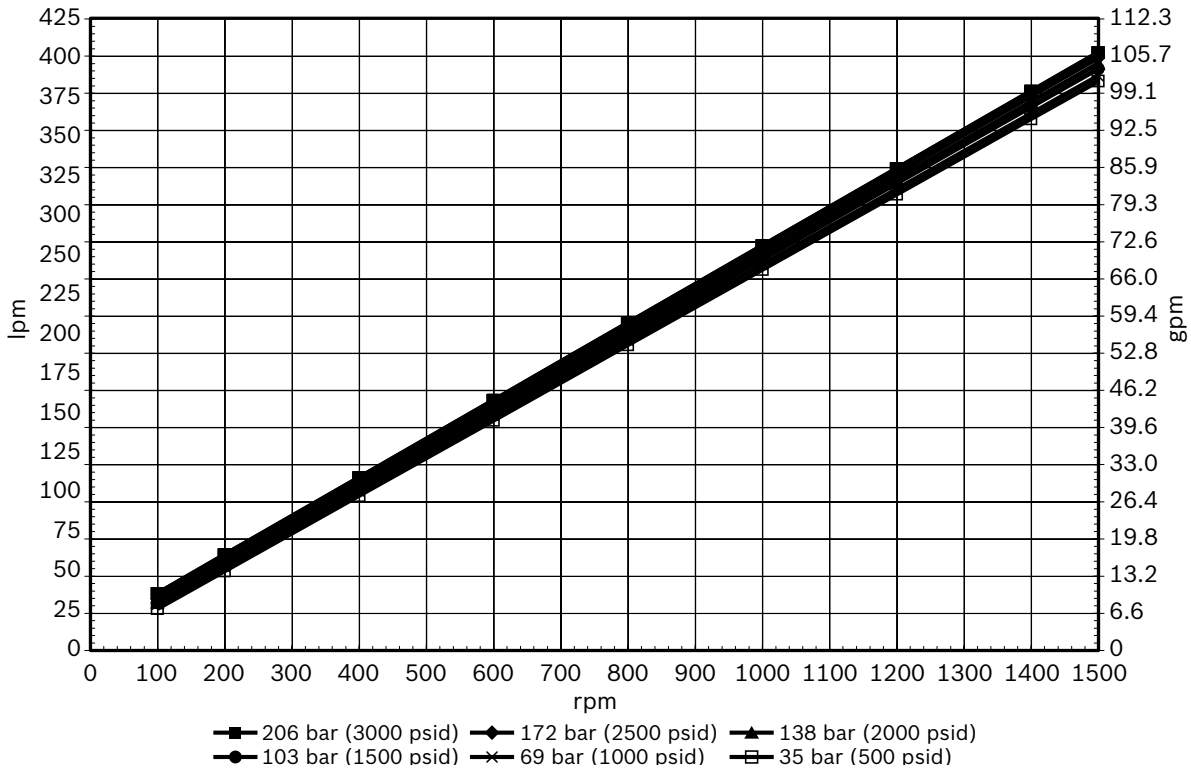


Torque – 13 cir (213 cc)

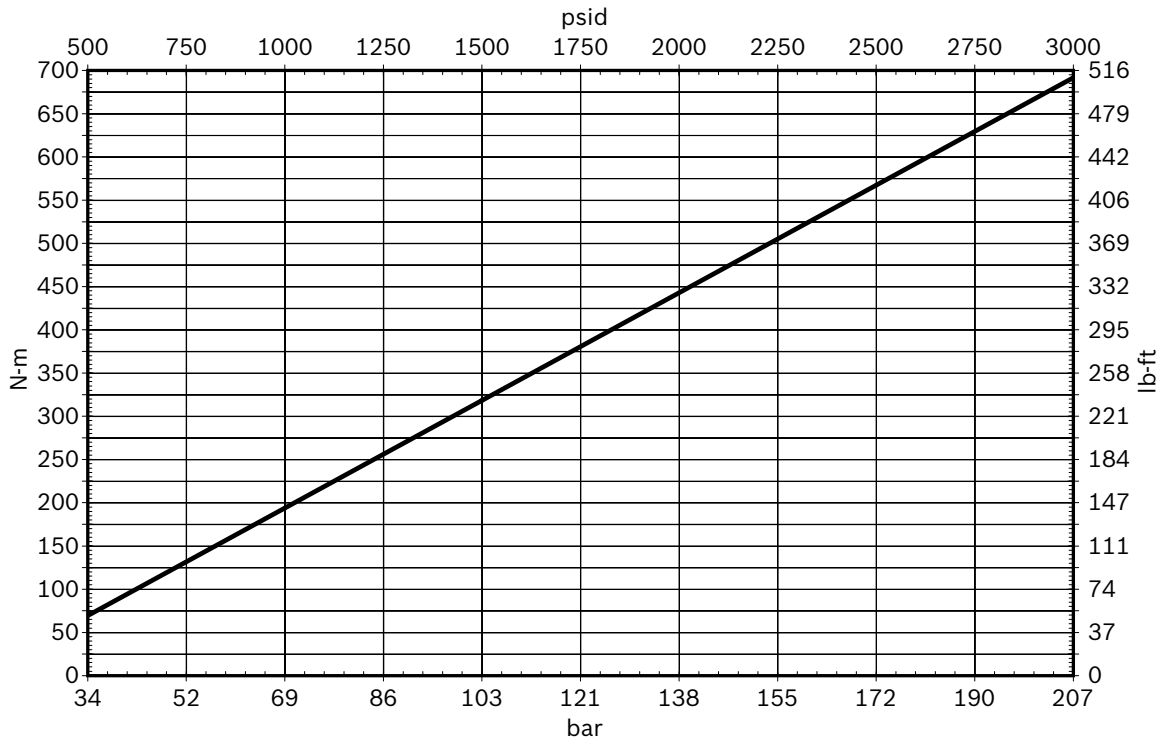


Technical data

Total required flow – 15 cir (246 cc)

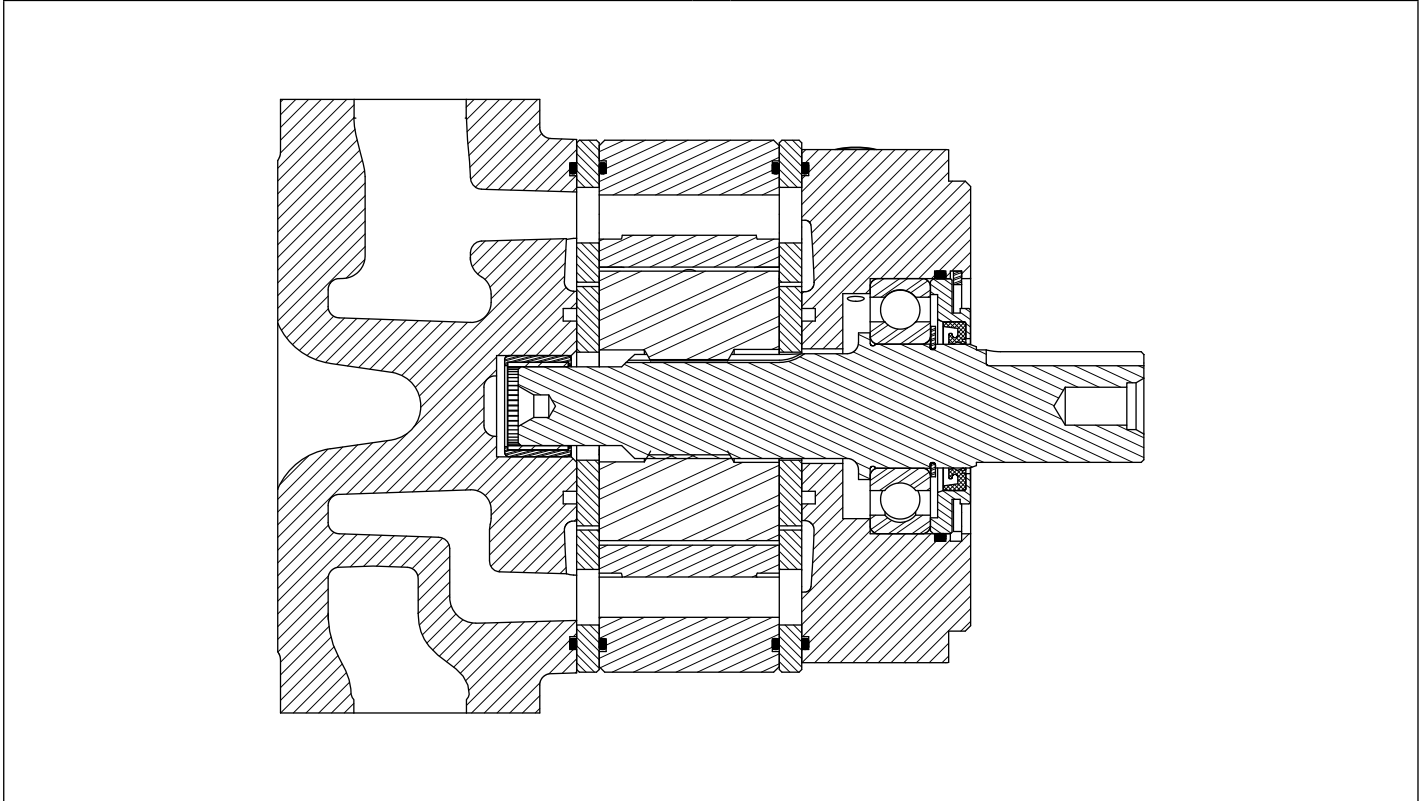


Torque – 15 cir (246 cc)

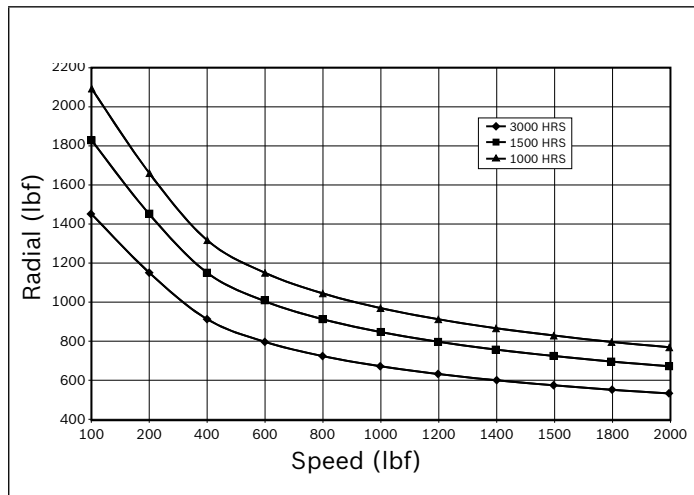


Technical data

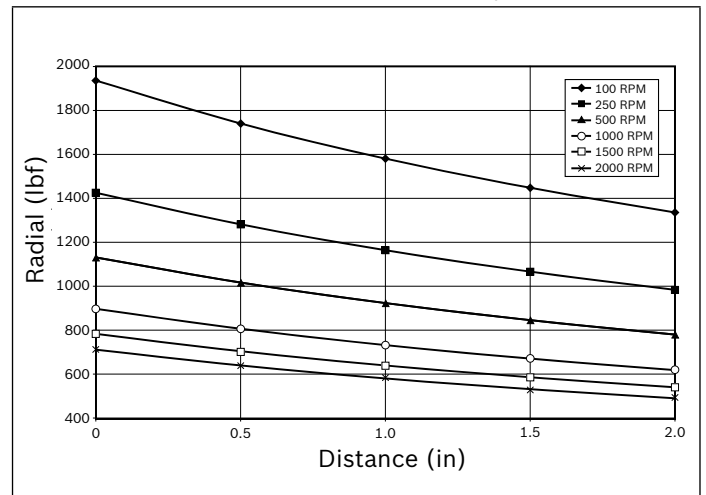
Bearing data – Standard motor (B1 bearing) with shaft code 30, 31, 34, 49, & 52



Bearing load at center of output shaft



Load from mounting plate at 3000 hrs L₁₀ bearing life

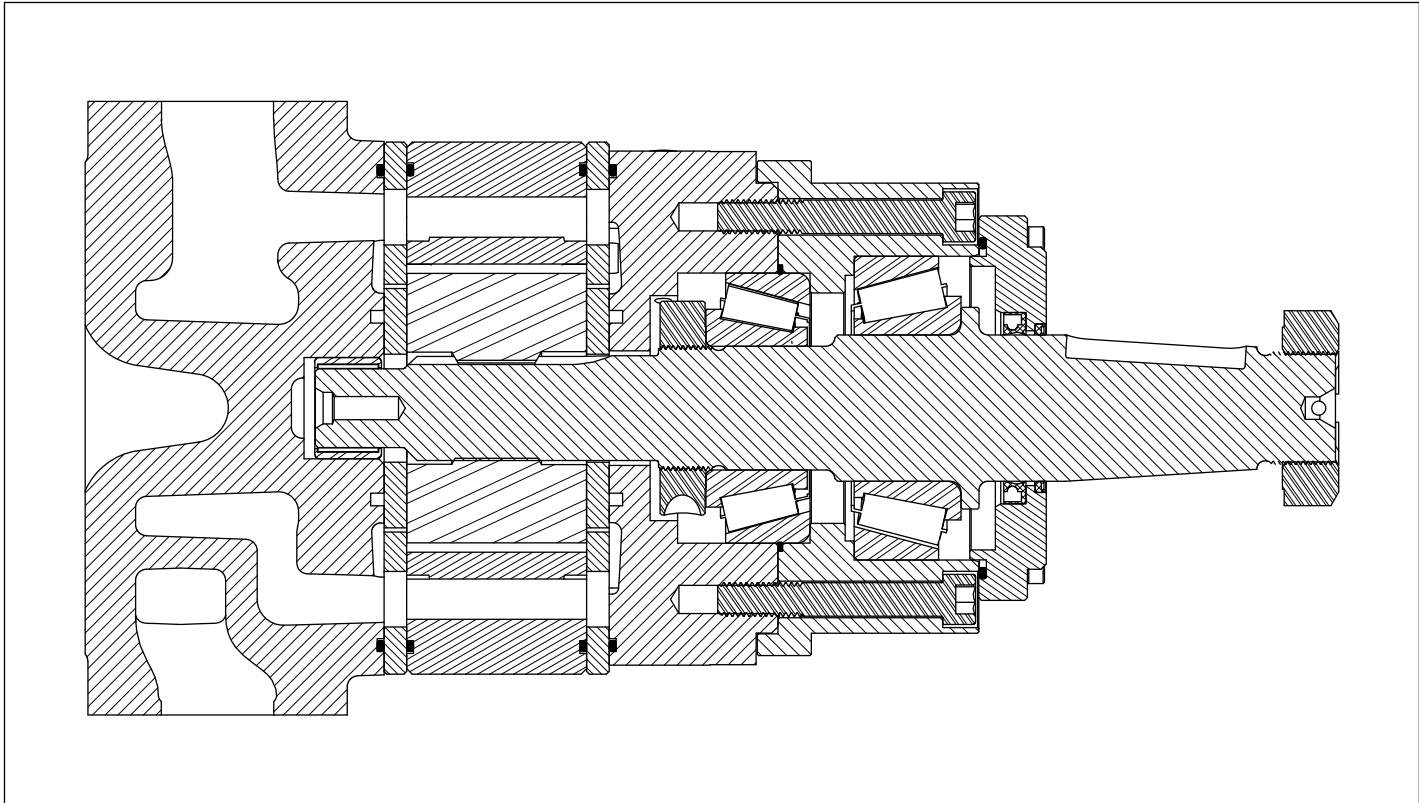


Bearing loading

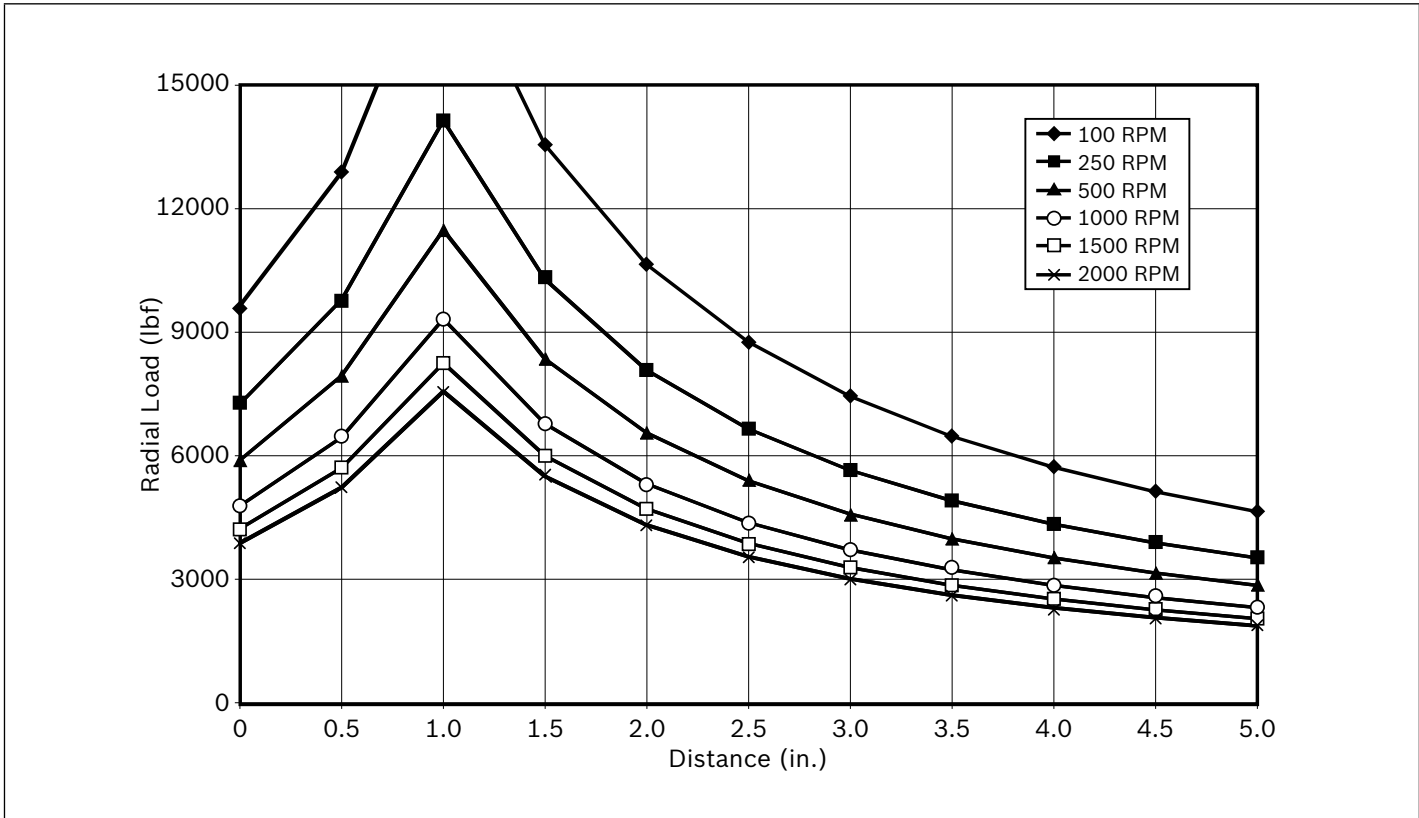
The bearings in the 15 Series can accept radial load per the radial capacity charts above. Thrust loading is not recommended for the standard motor. For thrust-type applications, see the thrust capable motor bearing chart.

Technical data

Bearing data - Wheel motor (T1 bearing)



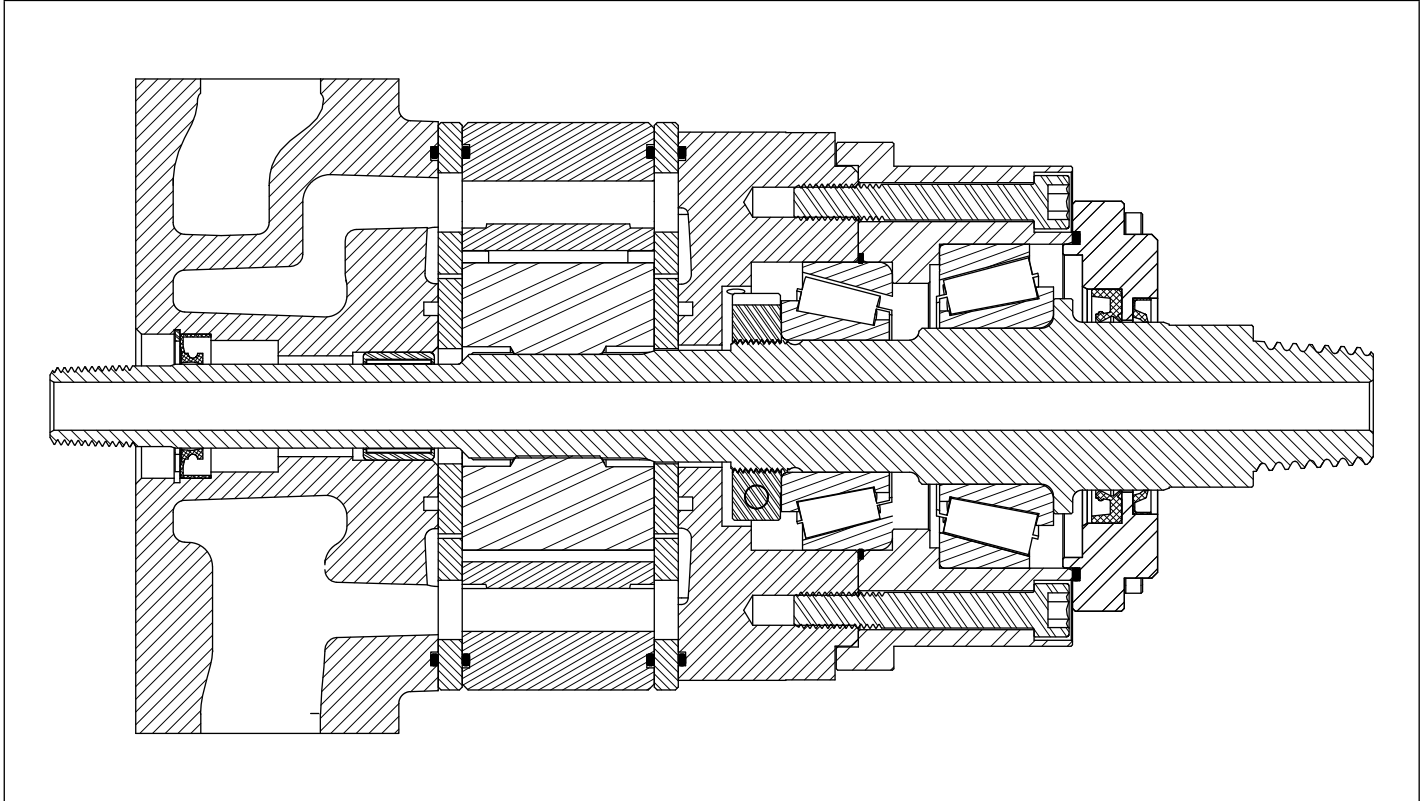
Combined load at 3000 hrs L_{10} bearing life



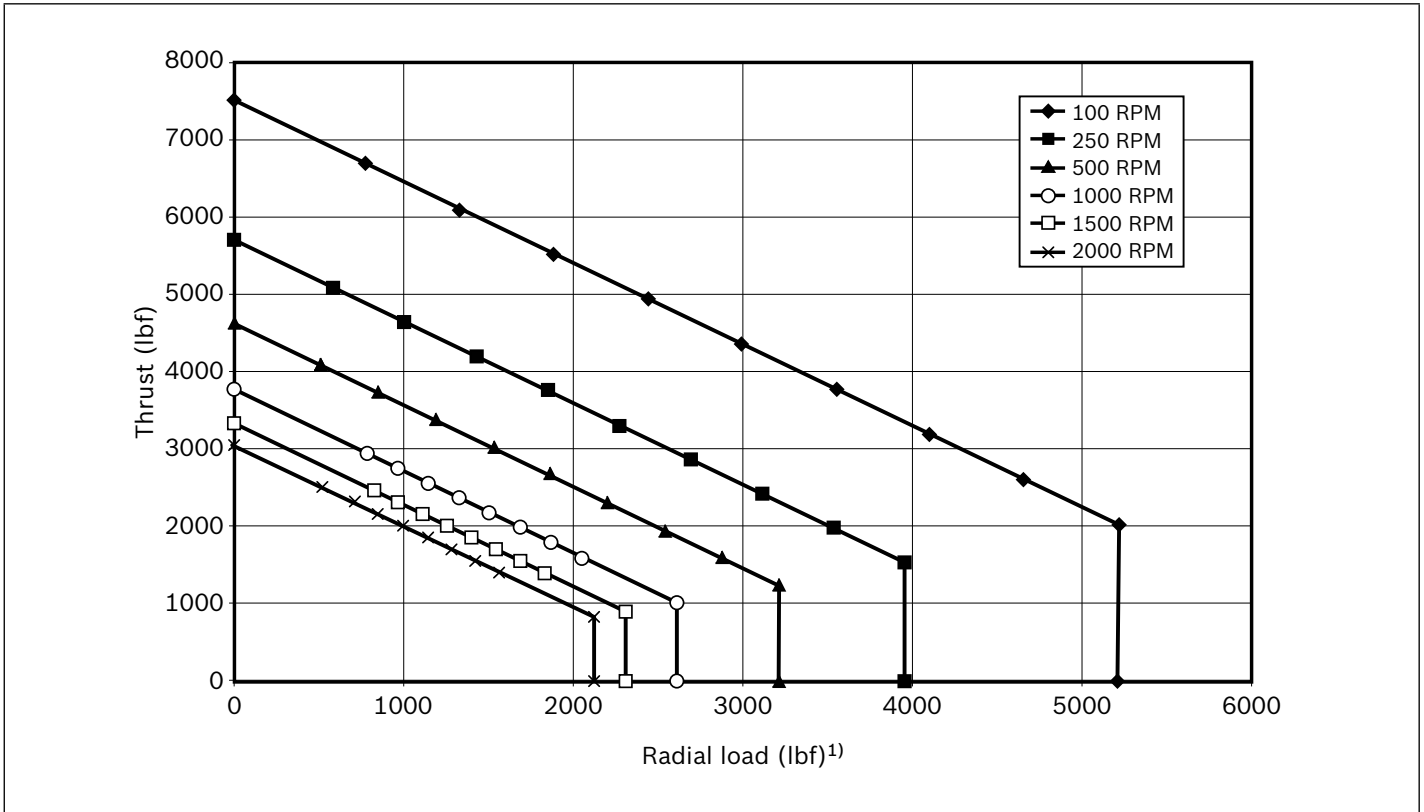
Refer to page 18 for Combined Load Bearing Chart

Technical data

Bearing data - Drill motor (T1 bearing)



Combined load at 3000 hrs L_{10} bearing life

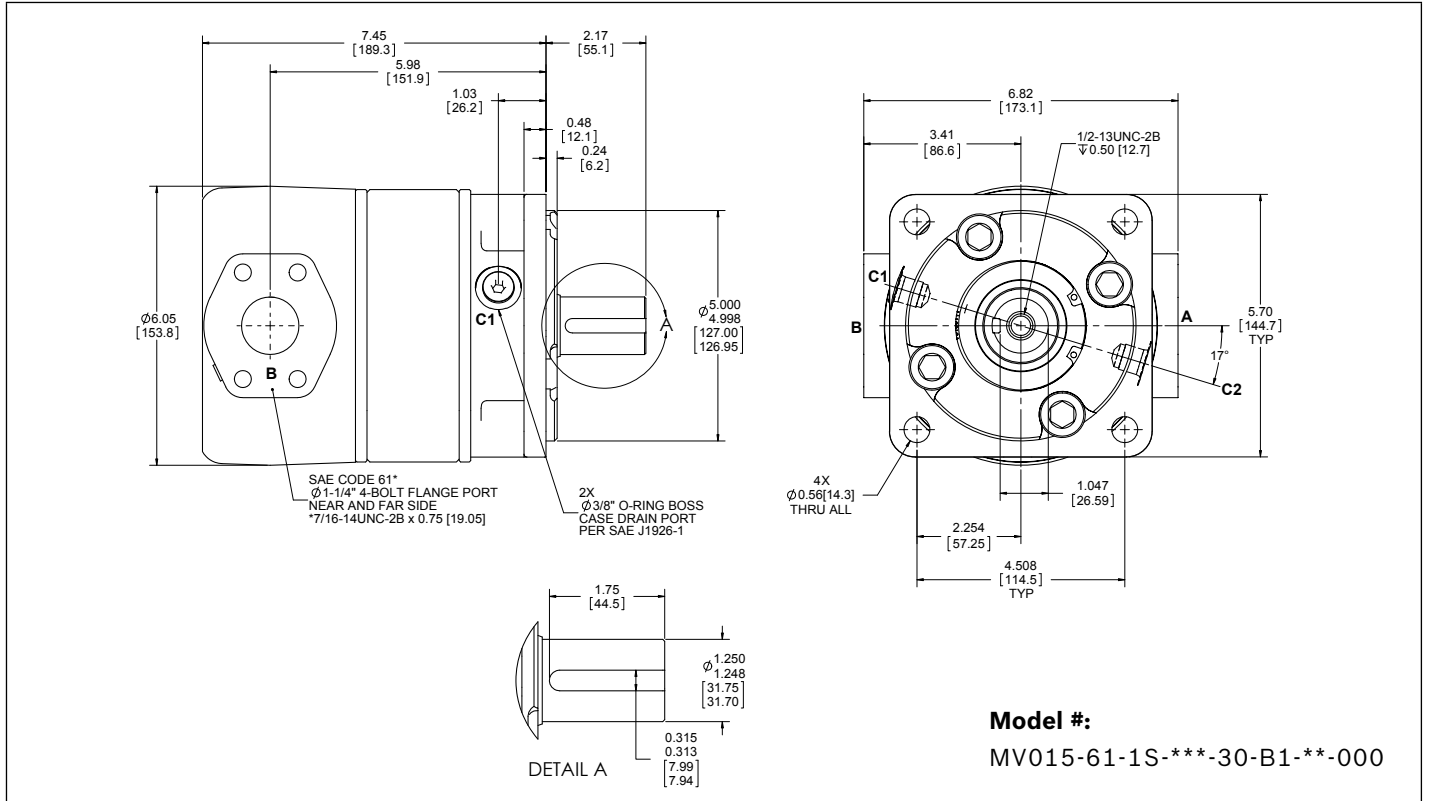


1) Radial load located at center of effective output of the shaft.

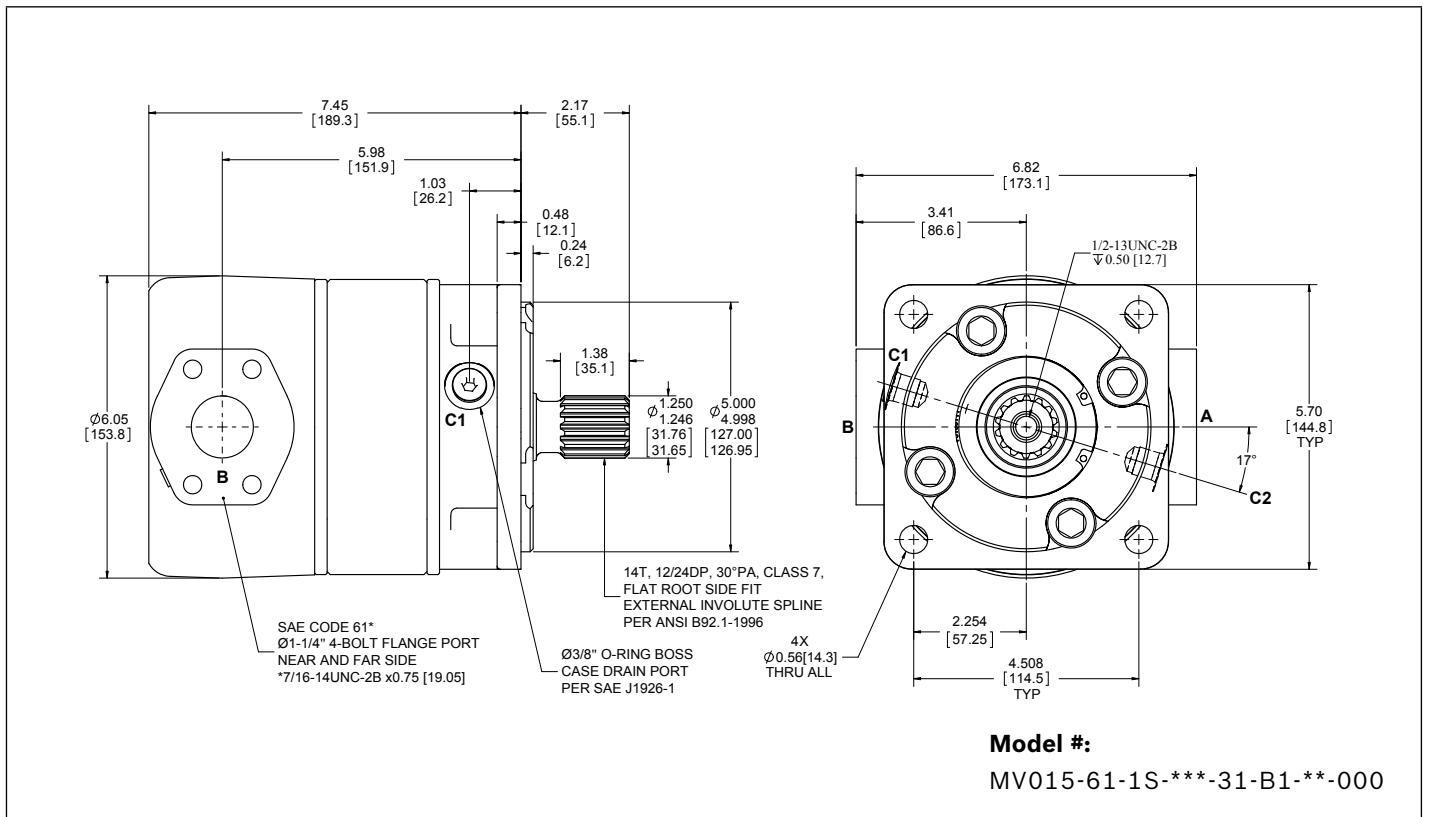
The drawings on the following pages represent basic motor configurations.

Dimensions

Standard key

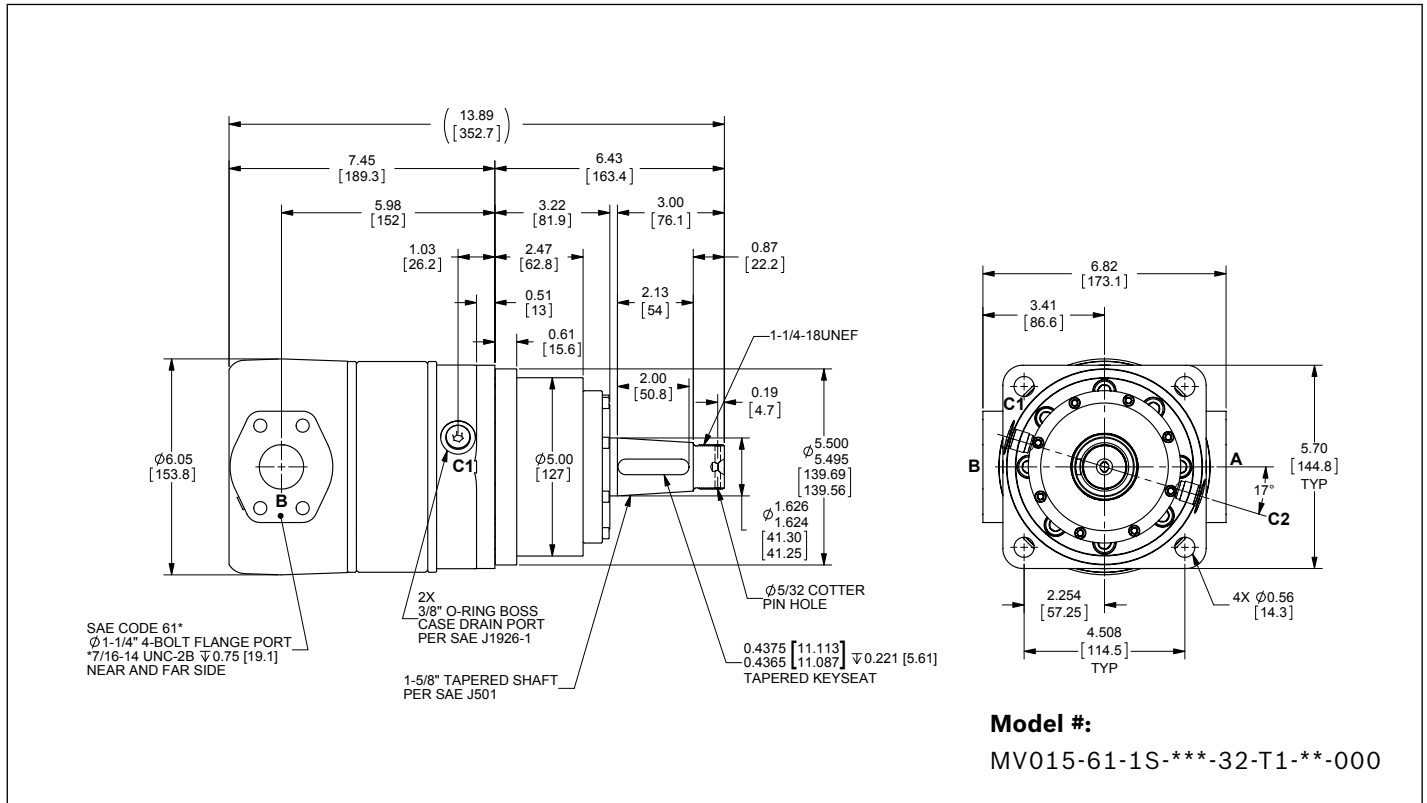


Standard spline

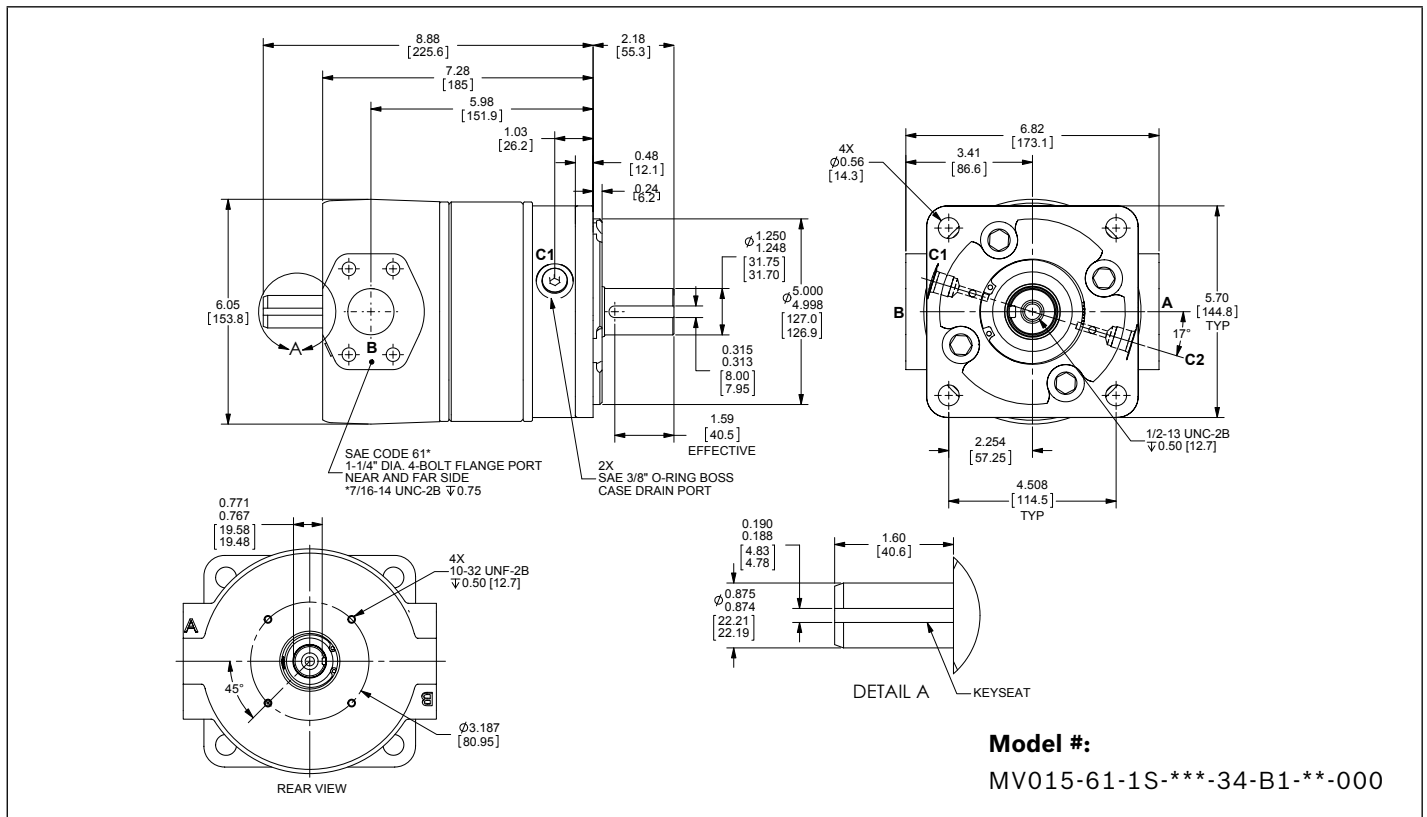


Dimensions

Wheel motor

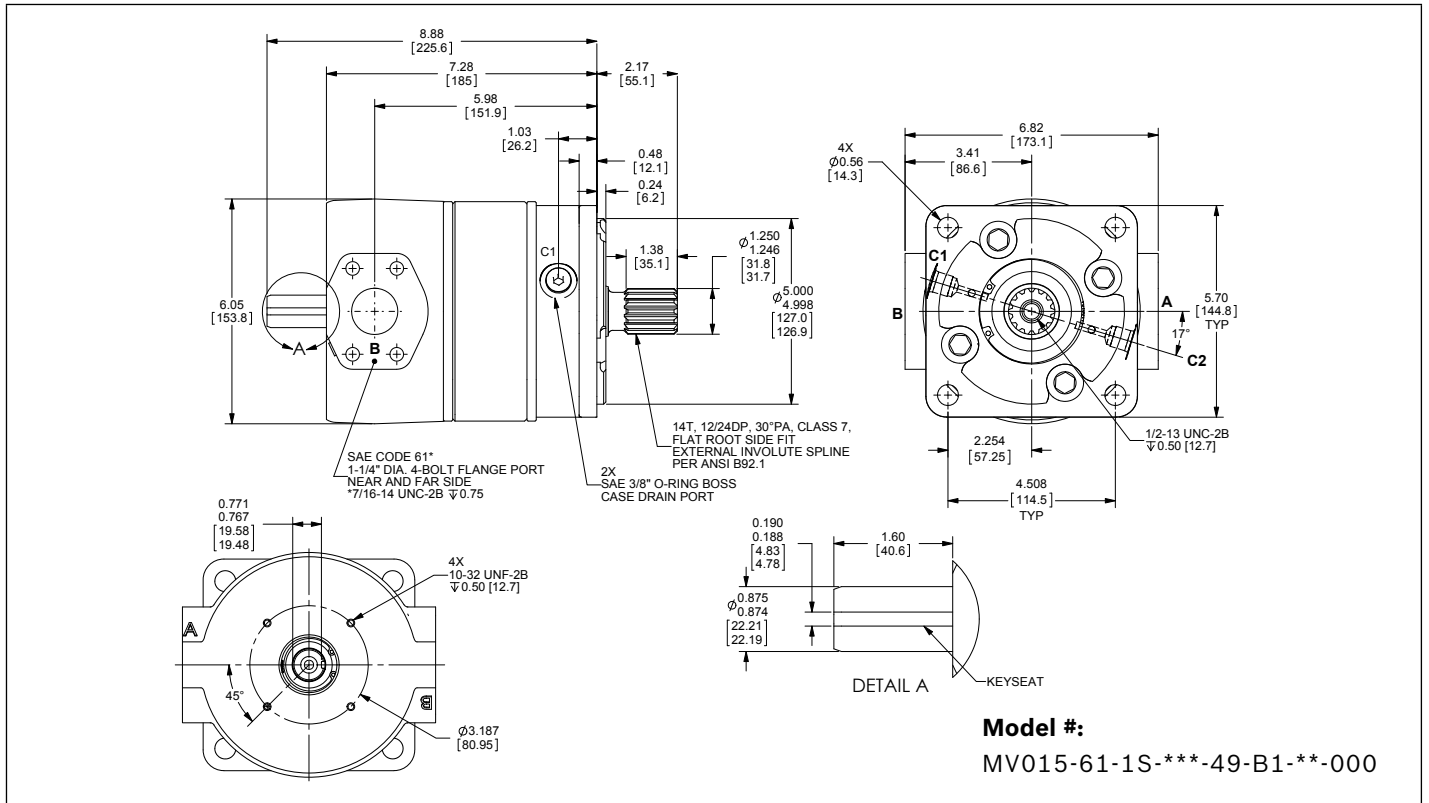


Standard front key with rear tach shaft

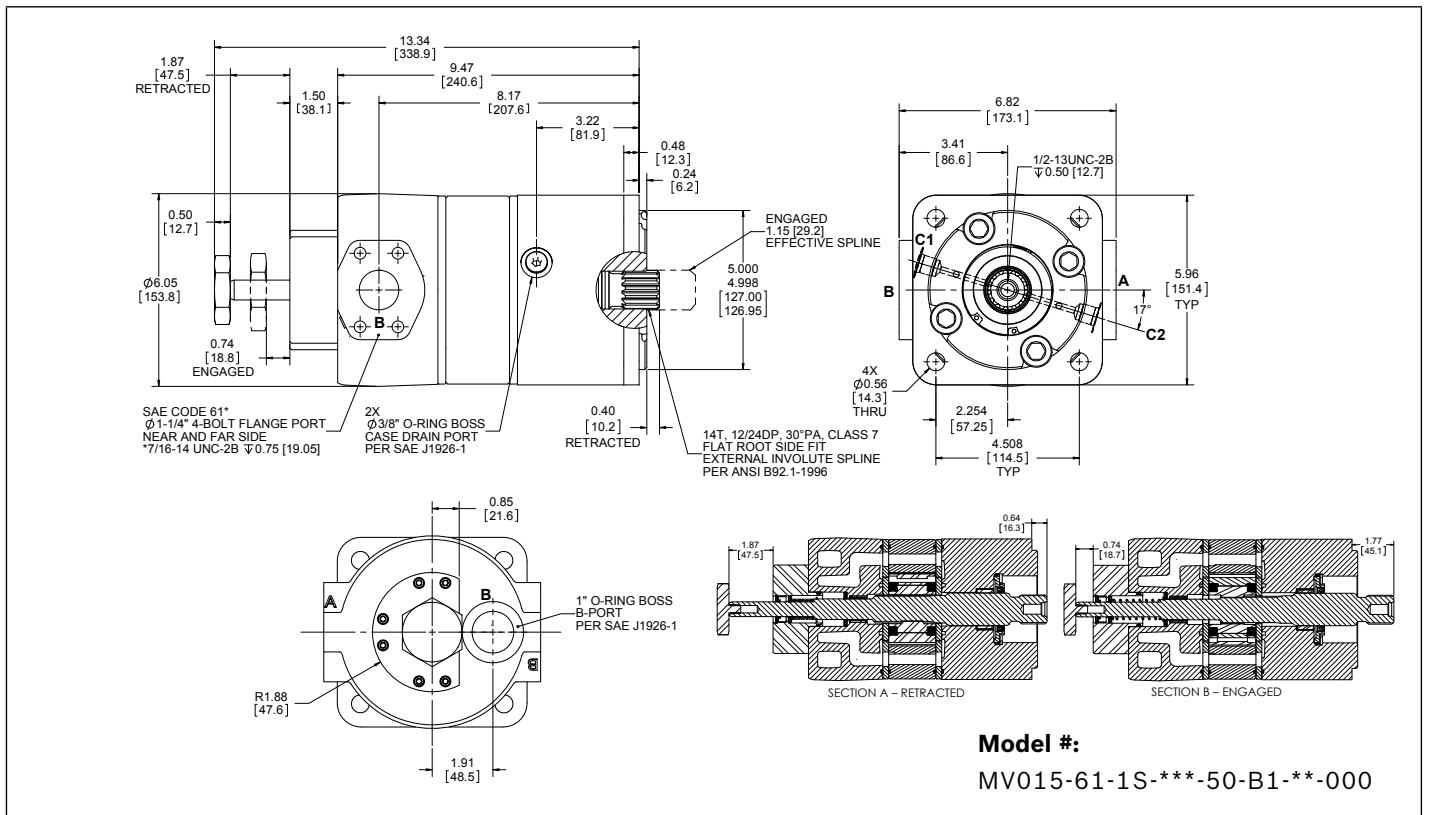


Dimensions

Standard front spline with rear tach shaft

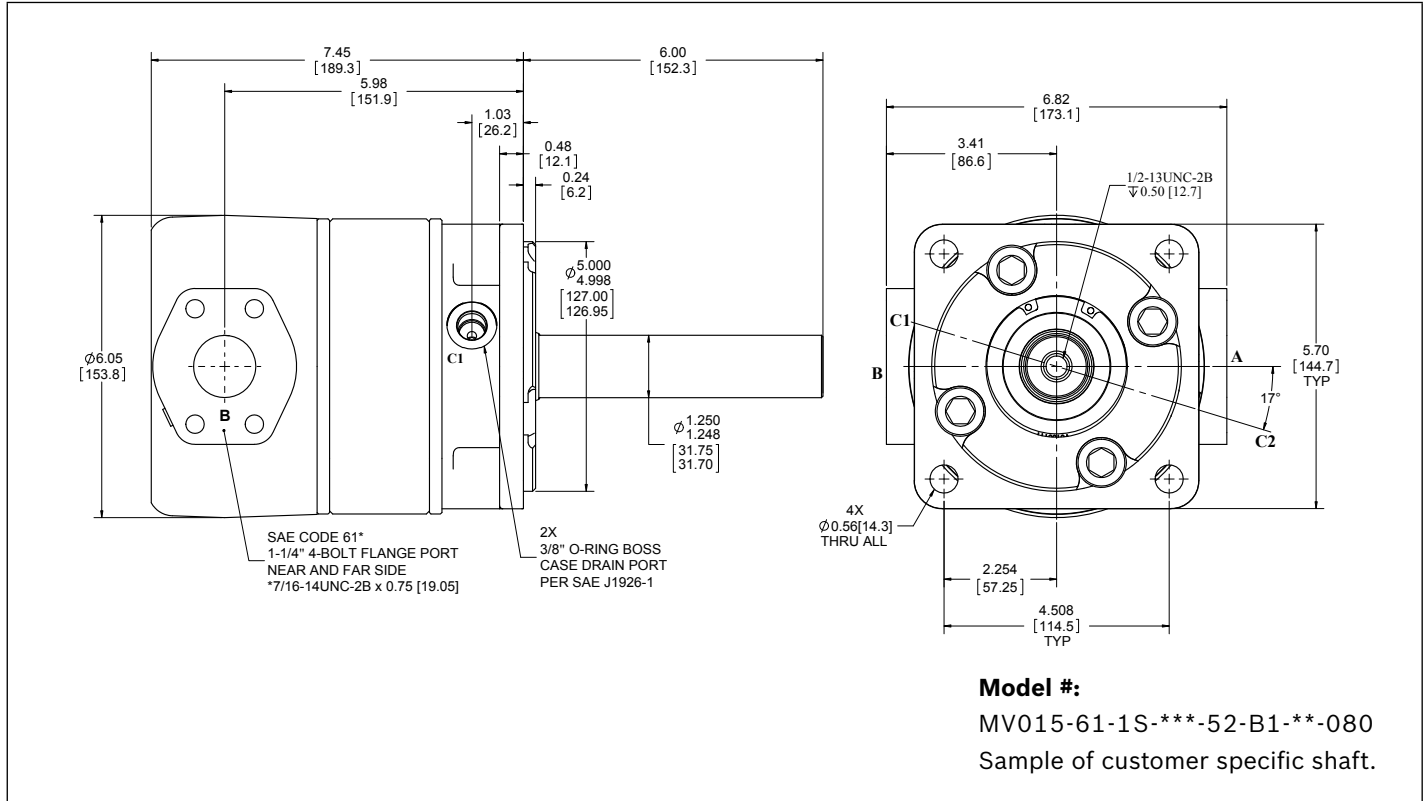


Standard retractable spline shaft

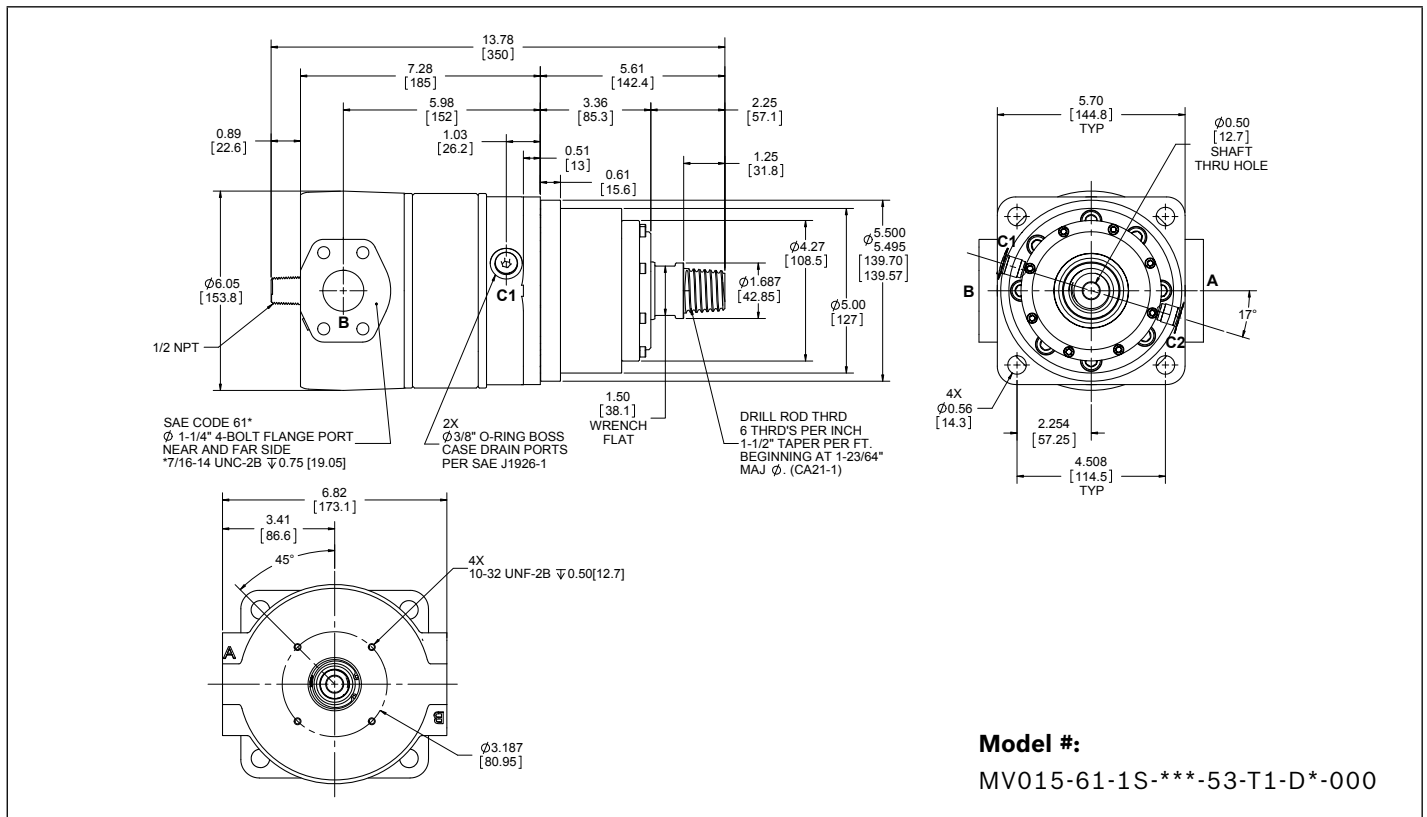


Dimensions

Custom smooth shaft



Standard hollow shaft drill motor



Project planning notes

Case Drain

The 15 Series motor is designed for either internal or external case drains. If operating in an open loop circuit, an external case drain is optional and unused case drain ports should be plugged. If operating in a closed loop circuit, the 15 Series motors **REQUIRE** an external case drain of sufficient size to prevent back pressure in excess of 35 psi (2.4 bar) for radial lip seals or 100 psi (6.9 bar) for quad seals. A case drain line must be run to the reservoir with minimum restriction as to not exceed the rated capacity of the seals; any unused case drain ports must be plugged. Never plug all case drain ports as this will cause build up of pressure in the motor case and blow out the shaft seal. The case drain line should return directly to the reservoir below the surface of the oil, and as far away as possible from the pump suction line. Refer to the unit drawings for case drain port locations. Use of the case drain port at the highest elevation is recommended.

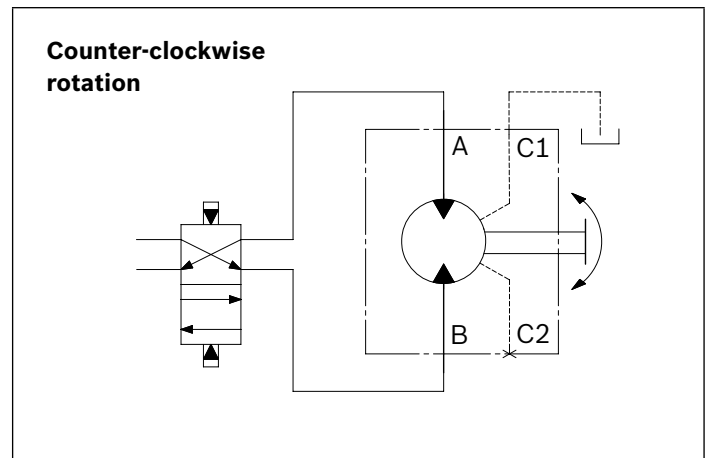
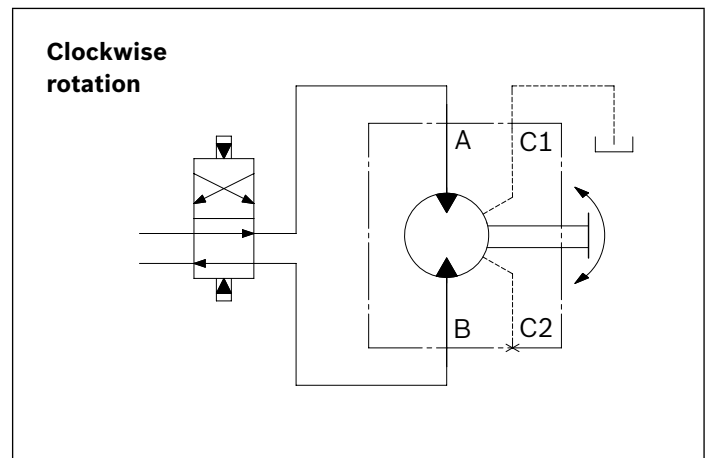
Thermal Shock

Consideration to cold temperature environments must be provided in the event that a temperature differential exists between the motor and the system in excess of 50 °F (28 °C). Contact a Bosch Rexroth Rineer representative if this is a possibility. In cold temperature environments it may be necessary to warm up the oil in the hydraulic system before the system is used. Typically the warm up is limited to the oil, the pump and directional control valve; leaving other components in the circuit such as the motor cold. When a directional control valve is shifted, the warm oil in the hydraulic system flows through a cold motor resulting in a non-uniform expansion of the internal parts of the motor which may lead to galling and component failure. Low pressure oil can be circulated through the motor case at a maximum flow rate of 1 gpm (4 lpm) or idled at low speed of 20 rpm maximum until the motor temperature is within 50 °F (28 °C) or less than system oil temperature.

Circuit design

2-port motor circuit

When fluid flow is provided to the “A” port, the rotation of the shaft as seen from its end will be clockwise. The “B” port will be return line flow. Using the “B” port for inlet flow will simply reverse the direction of rotation of the shaft and the “A” port will become the return line port.



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