

High Torque Vane Motor

MV037 Series Technical Data Sheet



- ▶ Maximum operating pressure:
 - Code 61: 3000 psi (207 bar)
 - Code 62: 4500 psi (310 bar)

Features

- ▶ Ideal for medium speed, high torque applications requiring reliability in a small size
- ▶ High power to weight ratio
- ▶ 2-port single rotary groups with displacements ranging from 12 in³ to 37 in³ (197 cc to 606 cc)
- ▶ 2-port double rotary groups with displacements ranging from 64 in³ to 74 in³ (1049 cc to 1213 cc)
- ▶ 4-port double rotary groups with displacements ranging from 24 in³ to 74 in³ (393 cc to 1213 cc), capable of two or three-operation with external valving
- ▶ High torque at start and stall, up to 94% of the theoretical value
- ▶ Continuous operating speeds of up to 1000 RPM
- ▶ Available with up to 450 HP (336 kW)
- ▶ Able to conform to SAE 'D' mounting specification
- ▶ Available with optional through-hole shaft
- ▶ Customizable for direct drive applications
- ▶ High reliability in demanding applications

- ▶ Long service life
- ▶ Support and spare parts available for repairs

Overview of contents

Features	1
Ordering Code	2
Technical Data	6
Bearing Data and Unit Dimensions	18
Engineering Guidelines	30

Ordering code

01		02		03		04		05		06		07		08		09		10	
MV037	-	A2	-	1S	-	012	-	30	-	B1	-	T	B	B	-	000			

01	Motor Series	MV037
----	---------------------	--------------

Port Options – Rear port orientation can be specified. Consult your Rineer representative.

02	Code 61	
	1-1/2" 4-bolt flange, 2-port	A2
	1-1/2" 4-bolt flange, 4-port	A4
	SAE 24	
	O-ring boss, 2-port	C2
	Code 62	
	1-1/4" 4-bolt flange, 2-port	D2
	1-1/4" 4-bolt flange, 4-port	D4

Rotary Group Designation

03	Code 61 – standard speed	1S
	Code 62 – standard speed	2S

Displacement Options

04	2-port, single rotating group	
	12 in ³ (197 cc)/rev.	012
	16 in ³ (262 cc)/rev.	016
	20 in ³ (328 cc)/rev.	020
	26 in ³ (426 cc)/rev.	026
	32 in ³ (524 cc)/rev.	032
	37 in ³ (606 cc)/rev.	037
	2-port, double rotating group	
	64 in ³ (1049 cc)/rev. – 32/32 rotating groups	064
	69 in ³ (1131 cc)/rev. – 32/37 rotating groups	069
	74 in ³ (1213 cc)/rev. – 37/37 rotating groups	074
	4-port, double rotating group	
	24 in ³ (393 cc)/rev. – 12/12 rotating groups, suitable for series/parallel circuit	024
	32 in ³ (524 cc)/rev. – 16/16 rotating groups, suitable for series/parallel circuit	032
	36 in ³ (590 cc)/rev. – 16/20 rotating groups, requires logic circuit for operation as a two or three speed	036
	40 in ³ (656 cc)/rev. – 20/20 rotating groups, suitable for series/parallel circuit	040
	46 in ³ (754 cc)/rev. – 20/26 rotating groups, requires logic circuit for operation as a two or three speed	046
	52 in ³ (852 cc)/rev. – 26/26 rotating groups, suitable for series/parallel circuit	052
	58 in ³ (951 cc)/rev. – 26/32 rotating groups, requires logic circuit for operation as a two or three speed	058
	64 in ³ (1049 cc)/rev. – 32/32 rotating groups, suitable for series/parallel circuit	064
	69 in ³ (1131 cc)/rev. – 32/37 rotating groups, requires logic circuit for operation as a two or three speed	069
	74 in ³ (1213 cc)/rev. – 37/37 rotating groups, suitable for series/parallel circuit	074

Motors assembled with largest displacement rotating group closest to front housing

Ordering code

01	02	03	04	05	06	07	08	09	10							
MV037	-	A2	-	1S	-	012	-	30	-	B1	-	T	B	B	-	000

Shaft Selection

05	Keyed	30
	Splined	31
	Wheel motor with tapered shaft according to SAE J501	32
	Shaftless for direct mount	33
	Keyed shaft out front and rear	34
	Internally keyed	35
	Internally splined	36
	Splined shaft out front and rear	40
	Tapered thrust shaft with key	41
	Keyed shaft out front, customer specified rear	42
	Splined shaft out front, customer specified rear	43
	Hollow shaft with API NC26 (2-3/8") internal flush threads	53

Bearing Selection

06	See shaft and bearing combinations for availability	
----	---	--

Shaft Seal (see page 9)

07	TCN (radial lip seal)	T
	Quad ring	Q
	No shaft seal	0

Main Body O-rings (see page 9 for seal material specifications)

08	NBR (Buna) – not available in Code 62	B
	FKM (Viton) – Code 61 optional, Code 62 required	V

Pedestal O-rings (see page 9 for seal material specifications)

09	NBR (Buna) – standard for Code 61, not available for Code 62	B
	FKM (Viton) – optional for Code 61, not available for Code 62	V
	Disogrin – required for Code 62	D

Special Index Number

10	Standard design – special features are designated with a three-digit code (consult your Rineer representative)	000
----	--	------------

Ordering code

Shaft and bearing combinations

Code 61, 2-port, single rotating group

	30	31	33	34	35	36	40	41	42	43	53
B1	●	●	●	●	●	●	●	—	●	●	—
B2	○	—	—	—	—	—	—	●	—	—	—
B3	●	●	—	—	—	—	—	—	—	—	—
T1	—	—	—	—	—	—	—	—	—	—	●

Code 61, 2-port, double rotating group

	30	33
B1	—	●
B3	●	—

Code 61, 4-port, double rotating group

	31
B3	●

SAE 24, 2-port, single rotating group

	30	31	33	34	35	36	40	41	42	53
B1	●	●	●	●	●	●	●	—	○	—
B2	—	—	—	—	—	—	—	●	—	—
T1	—	—	—	—	—	—	—	—	—	●

Code 62, 2-port, single rotating group

	30	31	32	36	35	53
B0	—	—	—	●	—	—
B1	—	●	—	—	●	—
B3	●	●	—	—	●	—
T1	●	●	●	—	—	—
T4	—	—	—	—	—	●

Code 62, 2-port, double rotating group

	31
T1	●

Code 62, 4-port, double rotating group

	30	33	53
B3	—	○	—
T1	●	—	—
T4	—	—	●
T5	—	—	●

● = available ○ = upon request — = not available

Note: Other shaft and bearing combinations may be available. Consult your Rineer representative.

Ordering code

Weights

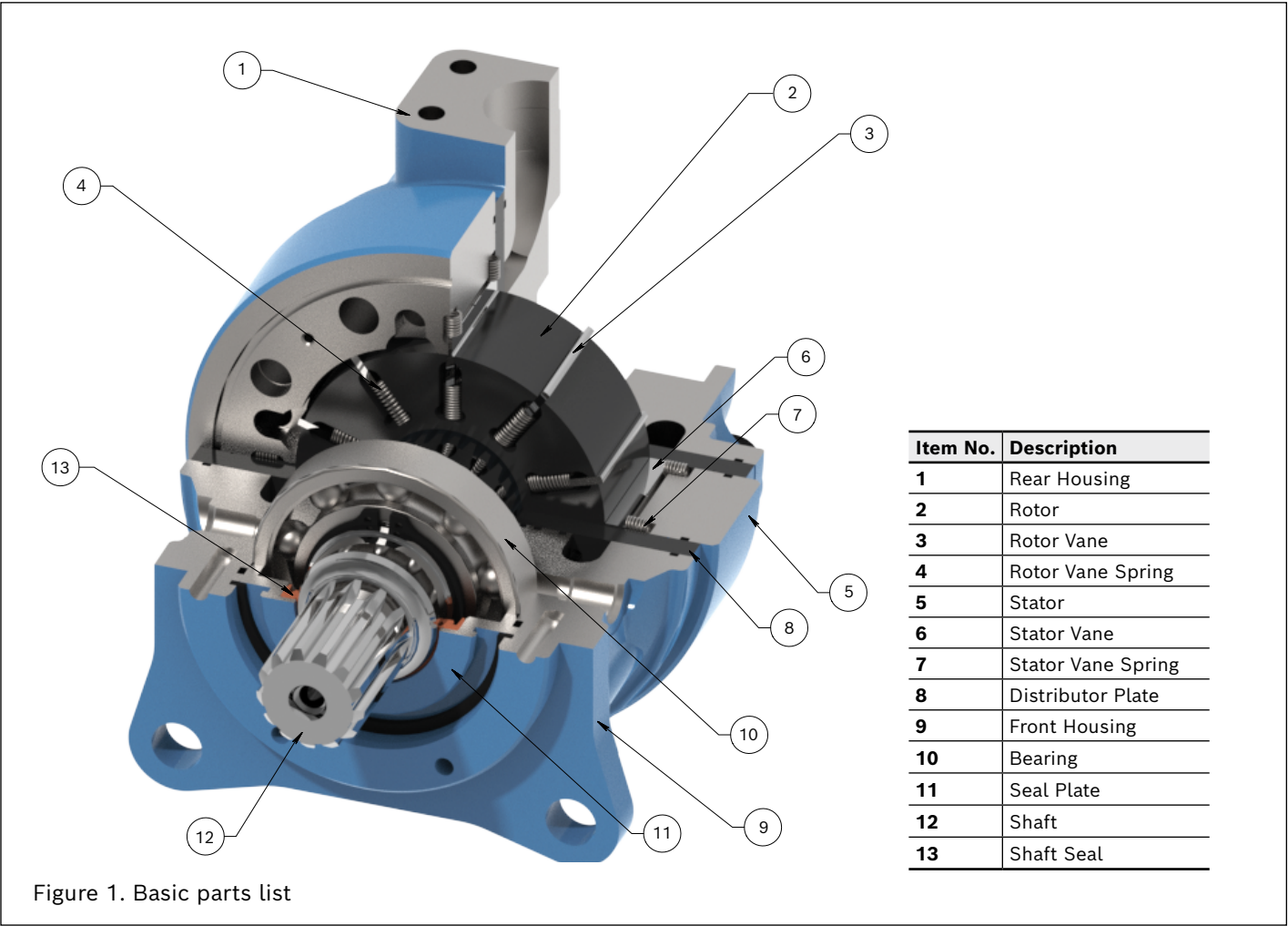
Type of motor	lbs.	kg
Code 61, 2-port	97	44
Code 61, 2-port, 33 shaft	98	44
Code 61, 2-port, 34 & 40 shaft	100	45
Code 61, 2-port, 35 & 36 shaft	92	42
Code 61, 2-port, 41 shaft	110	50
Code 61, 2-port, 42 & 43 shaft	97	44
Code 61, 2-port, 53 shaft	129	59
Code 61, 2-port, double stack	138	62
Code 61, 2-port, double stack, 33 shaft	117	53
Code 61, 4-port	171	77
SAE 24, 2-port	113	51
SAE 24, 2-port, 33 shaft	87	40
SAE 24, 2-port, 34 & 40 shaft	99	45
SAE 24, 2-port, 35 & 36 shaft	92	42
SAE 24, 2-port, 41shaft	111	50
SAE 24, 2-port, 42 shaft	97	44
Code 62, 2-port	100	45
Code 62, 2-port, 32 shaft	113	51
Code 62, 2-port, 33 shaft	84	38
Code 62, 2-port, 36 shaft	97	44
Code 62, 2-port, 43 shaft	100	46
Code 62, 2-port, 53 shaft	132	60
Code 62, 2-port, double stack	146	66
Code 62, 4-port	183	83
Code 62, 4-port, 33 shaft	162	74
Code 62, 4-port, 53 shaft	285	130

Technical data

The MV037 series motors are hydraulically balanced internally. No significant radial loads are self-induced on the motor bearings, contributing to a long service life, and the ability to run at maximum speed and torque simultaneously. The motor can be configured with various bearing options to accommodate external radial and axial loading. This data sheet details standard configurations (see Figure 1), but custom, application-specific solutions may be available. Please consult your Rineer representative.

Oil supply lines are connected to ports A and B on 2-port, single and double rotating group motors (Figures 2 and 3), and to A1, A2, B1 and B2 on 4-port, double rotating group motors (Figure 4). Case drain lines should be installed on the C1 or C2 port. Reference motor unit drawings beginning on page 18 for additional case line locations and Case Drain section on page 10 for details.

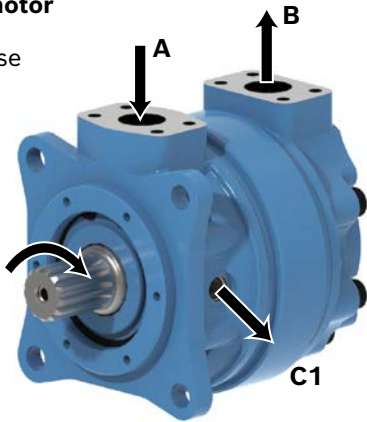
Using the “A” port(s) as the inlet will provide clockwise shaft rotation as seen from the front of the shaft. Using the “B” port(s) will provide counterclockwise shaft rotation also seen from the front of the shaft (see Figures 2, 3, and 4).



Technical data

2-port motor

Clockwise rotation



Counter-clockwise rotation

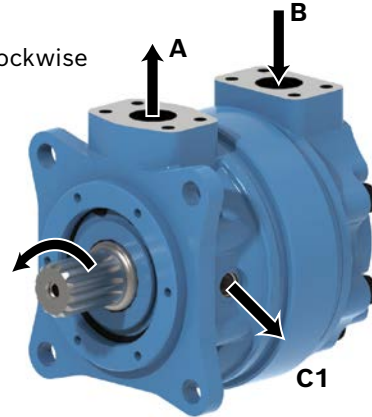
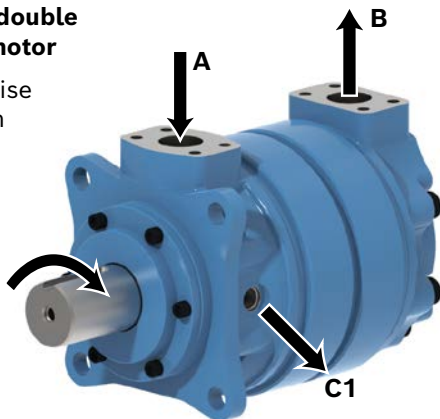


Figure 2. Oil flow direction to establish clockwise and counter-clockwise rotation on 2-port configuration motors.

2-port double stack motor

Clockwise rotation



Counter-clockwise rotation

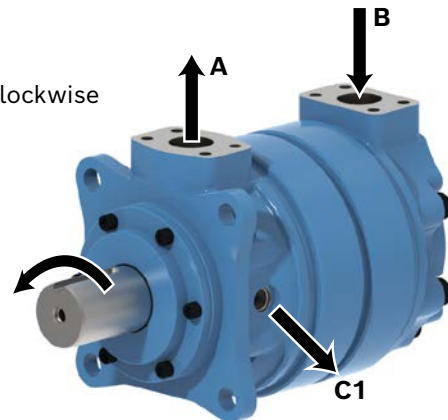
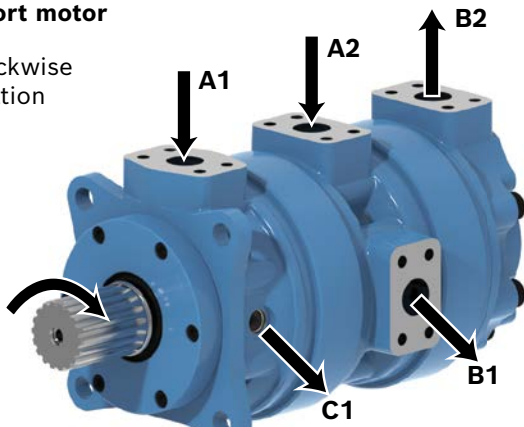


Figure 3. Oil flow direction to establish clockwise and counter-clockwise rotation on 2-port double stack configuration motors.

4-port motor

Clockwise rotation



Counter-clockwise rotation

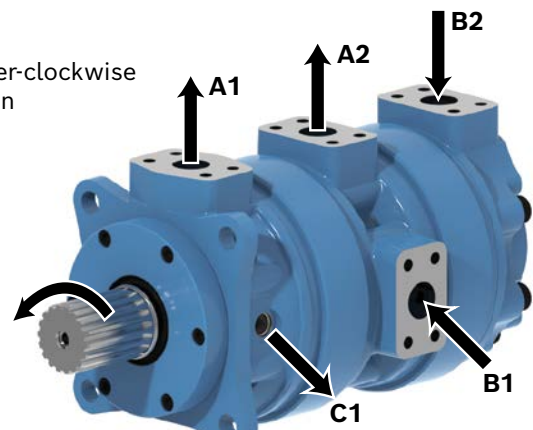


Figure 4. Oil flow direction to establish clockwise and counter-clockwise rotation on 4-port double stack configuration motors.

Technical Data

Motor specifications

Standard Series Code 61	Displacement		Pressure				Speed		Torque @ 3000 psid (207 bar)*	
	(in ³ /rev)	(cm ³ /rev)	Continuous		Intermittent		Continuous	Intermittent	Continuous	
			(psi)	(bar)	(psi)	(bar)	(rpm)	(rpm)	(lb-ft)	(Nm)
MV037-A,C	12	197	3000	207	3500	241	1000	1200	410	556
	16	262					1000	1200	553	750
	20	328					1000	1200	722	979
	26	426					800	1000	920	1247
	32	524					700	950	1143	1550
	37	606					600	800	1315	1783

High Performance Series Code 62	Displacement		Pressure				Speed		Torque @ 4500 psid (310 bar)*	
	(in ³ /rev)	(cm ³ /rev)	Continuous		Intermittent		Continuous	Intermittent	Continuous	
			(psi)	(bar)	(psi)	(bar)	(rpm)	(rpm)	(lb-ft)	(Nm)
MV037-D	12	197	4500	310	5000	345	1000	1200	637	864
	16	262					1000	1200	851	1154
	20	328					1000	1200	1104	1497
	26	426					800	1000	1399	1897
	32	524					700	950	1735	2352
	37	606					600	800	2007	2721

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

Note:

1. When considering 2-port double stack, or 4-port motors, any two displacements can be combined. The resultant torque is the sum of the two displacements.
2. Maximum speed is limited by the highest displacement selected.
3. Intermittent duty cycle is six (6) seconds per minute.
4. Higher speeds or pressure may be permissible under certain conditions. Consult your Rineer representative.

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	≥ 3000 psi / 207 bar
19/17/14*	18/16/13

* ISO 4406 Standard

Viscosity

Minimum Operating Viscosity	100 SSU / 20 cSt
Maximum Operating Viscosity	250 SSU / 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 your Rineer representative 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.

Disogrin (TODI/Polyurethane)

Temperature Range:

–54 °F to +230 °F (–48 °C to +110 °C)

Disogrin is a high performance polyurethane. This compound is primarily used on O-rings for heavy duty applications and possesses extremely high mechanical properties, offering outstanding resistance to abrasion, tear and extrusion over a large range of temperatures. It has high temperature stability resulting in very low compression set required for sealing ensuring maximum service life. It is suitable for use with petroleum based fluids and some biodegradable (synthetic and natural Ester) fluids.

Technical data

Bosch Rexroth Rineer offers two types of rotary seals, namely a lip seal and quad ring seal designs in both NBR and FKM materials. Radial lip seals accommodate external radial loads imposed on the shaft and higher speeds to a greater degree than quad seal designs. Both 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 buildup 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
No Shaft Seal	500 psig (35 bar)	N/A

When the motor is mated to a gearbox, bearing box, or overhung load adapter, it is possible to specify the motor to have no shaft seal which would allow motor case flow to flush the companion component. In this instance, the driven component must have a case connection to allow flow back to tank at a pressure low enough for the rating of its shaft seal.

Case Drain

The 37 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. The case drain line must be run to the reservoir with minimum restriction as to not exceed the rated capacity of the seals, and any unused case drain ports must be plugged. Never plug all case drain ports as this will cause buildup 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 3 gpm (11 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.

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 200 rpm with an available supply pressure of 3200 psi (221 bar) and a return line pressure of 200 psi (14 bar). The pressure differential is 3000 psi (207 bar).

Calculations:

Theoretical torque (ideal no losses):

Metric:

$$T = \frac{P \times 9549.09}{n} = \frac{37.28 \times 9549.09}{200} = \sim 1780 \text{ N-m}$$

U.S.:

$$T = \frac{P \times 5252}{n} = \frac{50 \times 5252}{200} = \sim 1313 \text{ lb-ft}$$

Theoretical displacement (ideal no losses):
for condition $T = 1780 \text{ N-m}$ ($T = 1313 \text{ lb-ft}$)

Metric:

$$d = \frac{T \times 62.81}{p} = \frac{1780 \times 62.81}{207} = \sim 540 \text{ cc}$$

U.S.:

$$d = \frac{T \times 75.4}{p} = \frac{1313 \times 75.4}{3000} = \sim 33 \text{ in}^3$$

Referencing the chart “Torque 37 in³ (606 cc)”

A 37 in³ (606 cc) displacement motor at a pressure 3000 psid (207 bar) will develop torque of approximately 1313 lb-ft (1780 N-m).

Referencing the chart “Total Required Flow 37 in³ (606 cc)”

A 37 in³ (606 cc) displacement motor at a pressure of 3000 psid (207 bar) operating at 200 rpm will require a total flow of approximately 36 gpm (136.3 lpm).

Nomenclature

Symbol	Measurable Quantity	U.S.	Metric
d	Displacement	in ³ or $\frac{\text{in}^3}{\text{rev}}$	cc or $\frac{\text{cm}^3}{\text{rev}}$
Q	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

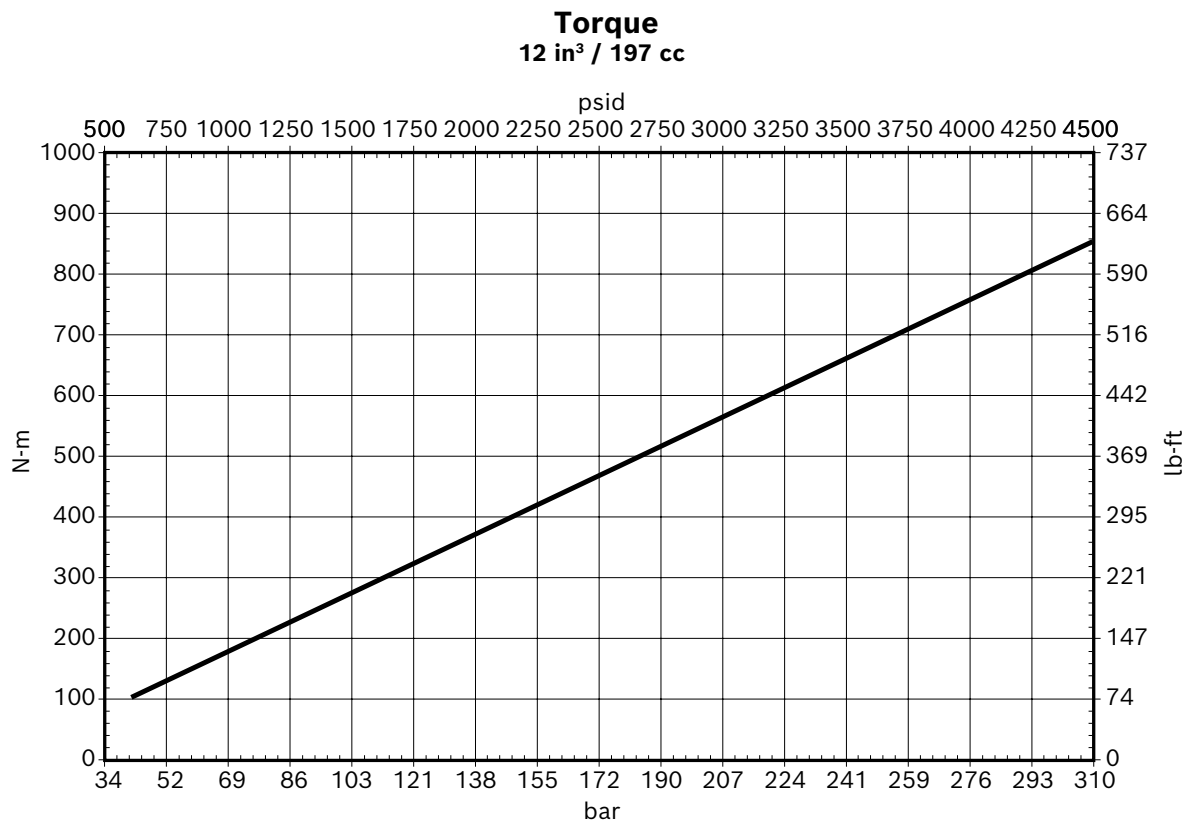
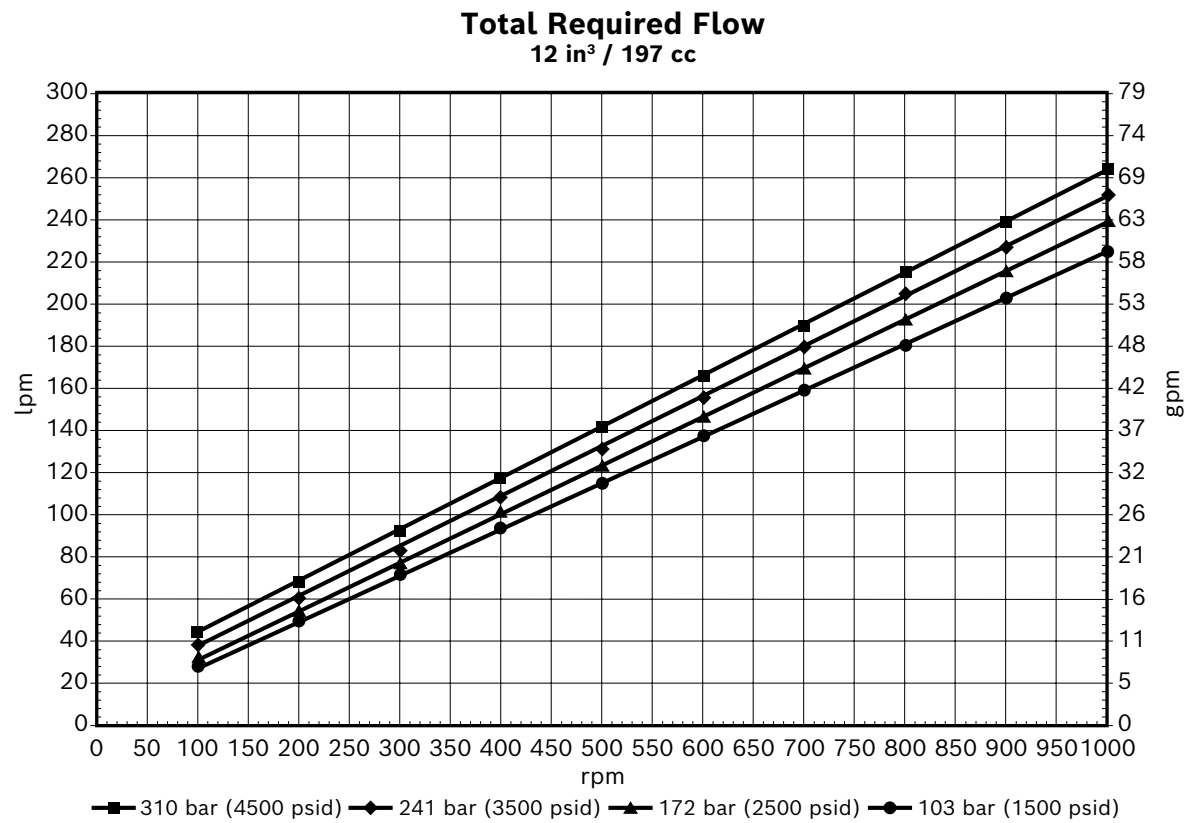
U.S.	Metric
$T = \frac{P \times 5252}{n}$	$T = \frac{P \times 9549.09}{n}$
$T = \frac{d \times \Delta p}{75.4}$	$T = \frac{d \times \Delta p}{62.81}$
$P_{\text{shaft}} = \frac{T \times n}{5252}$	$P_{\text{shaft}} = \frac{T \times n}{9549.09}$
$P_{\text{shaft}} = \frac{Q \times \Delta p}{1714}$	$P_{\text{shaft}}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

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
Flow Rate	Q	lpm	÷ 3.78	gpm
Rotational Speed	n	rpm	=	rpm
Pressure	p	bar	x 14.504	psi

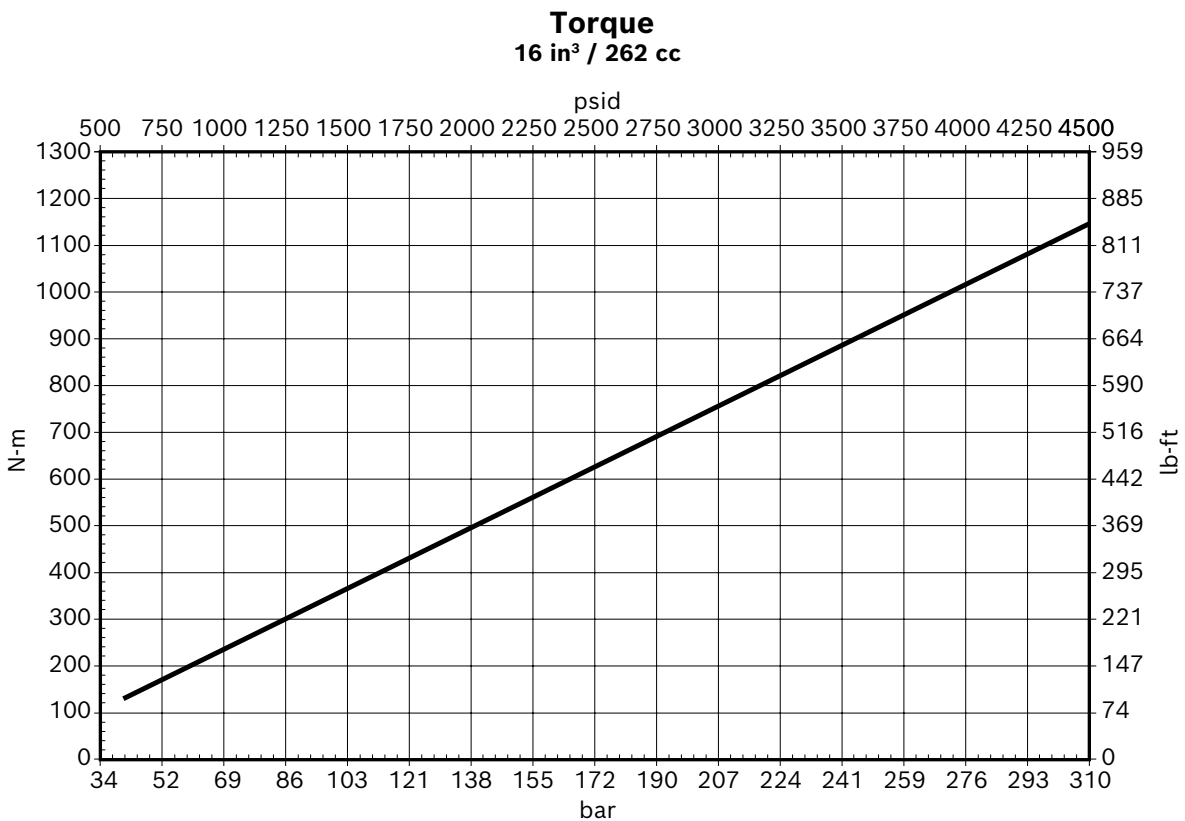
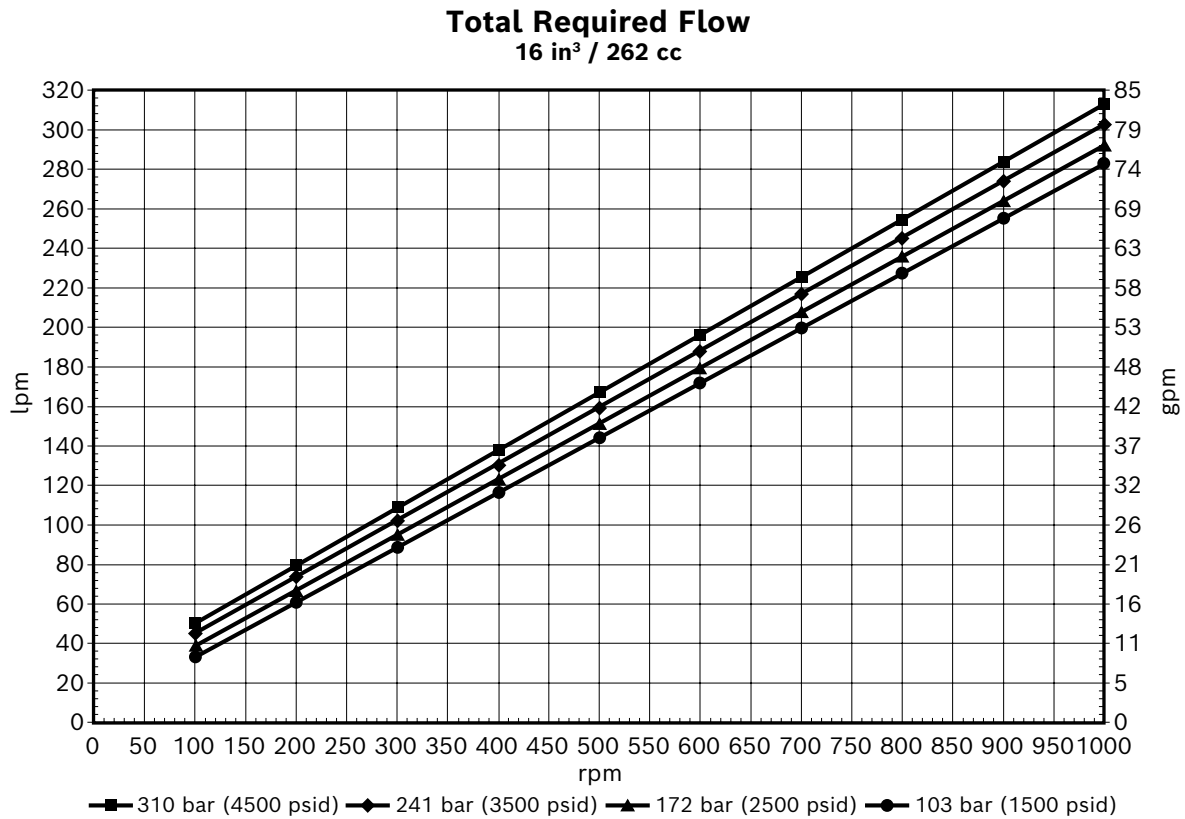
Technical data

Flow & output torque – 12 in³



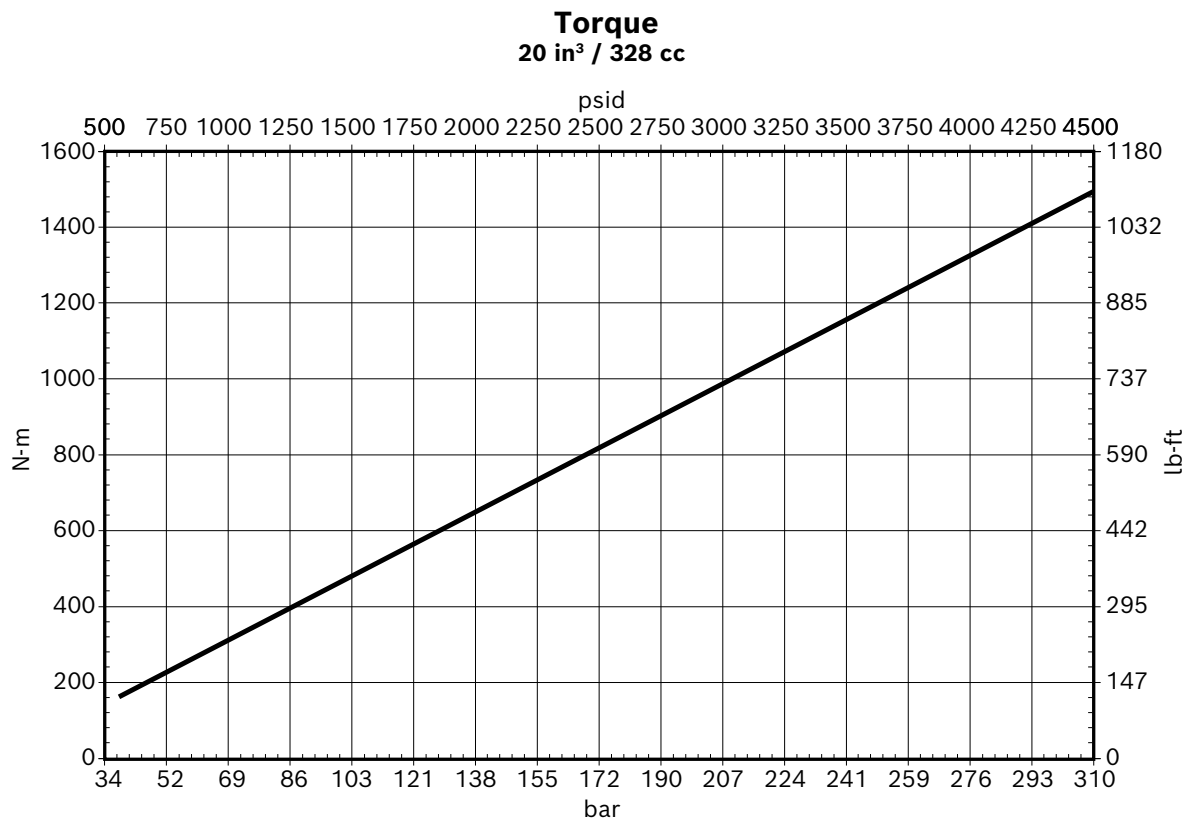
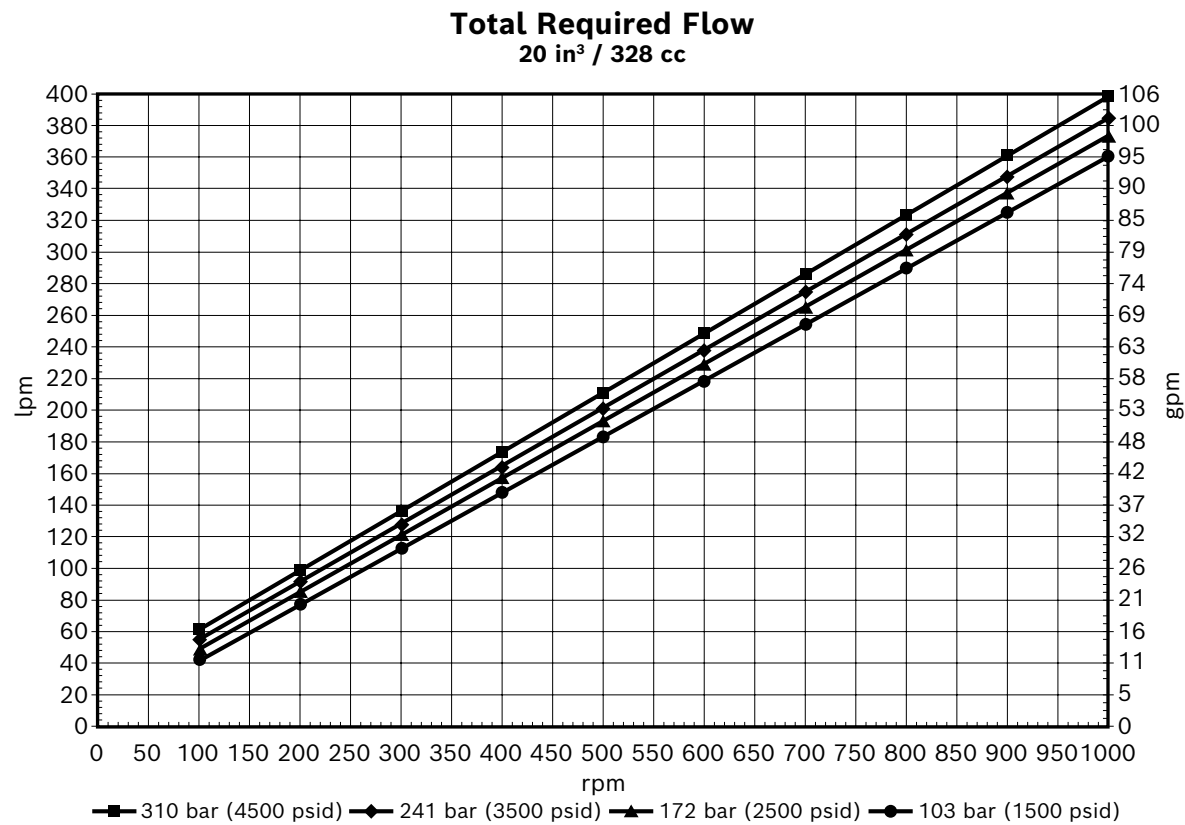
Technical data

Flow & output torque – 16 in³



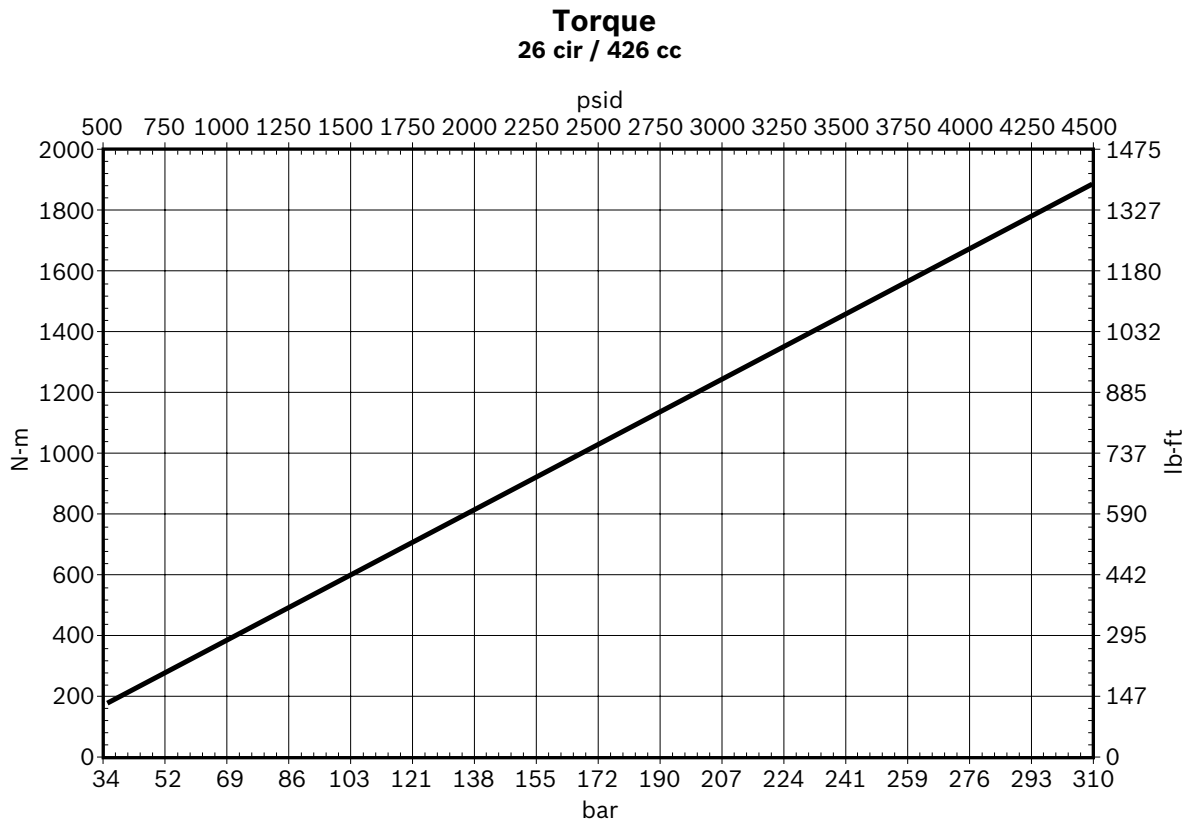
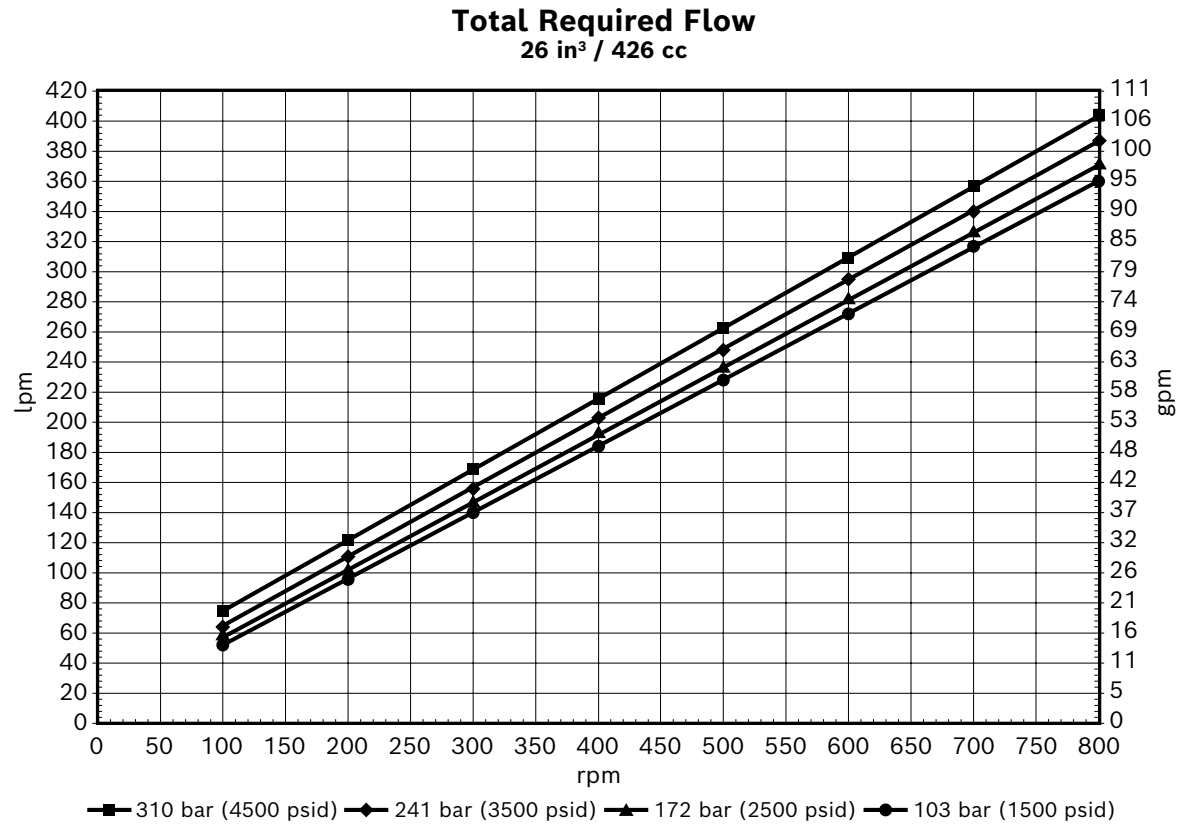
Technical data

Flow & output torque – 20 in³



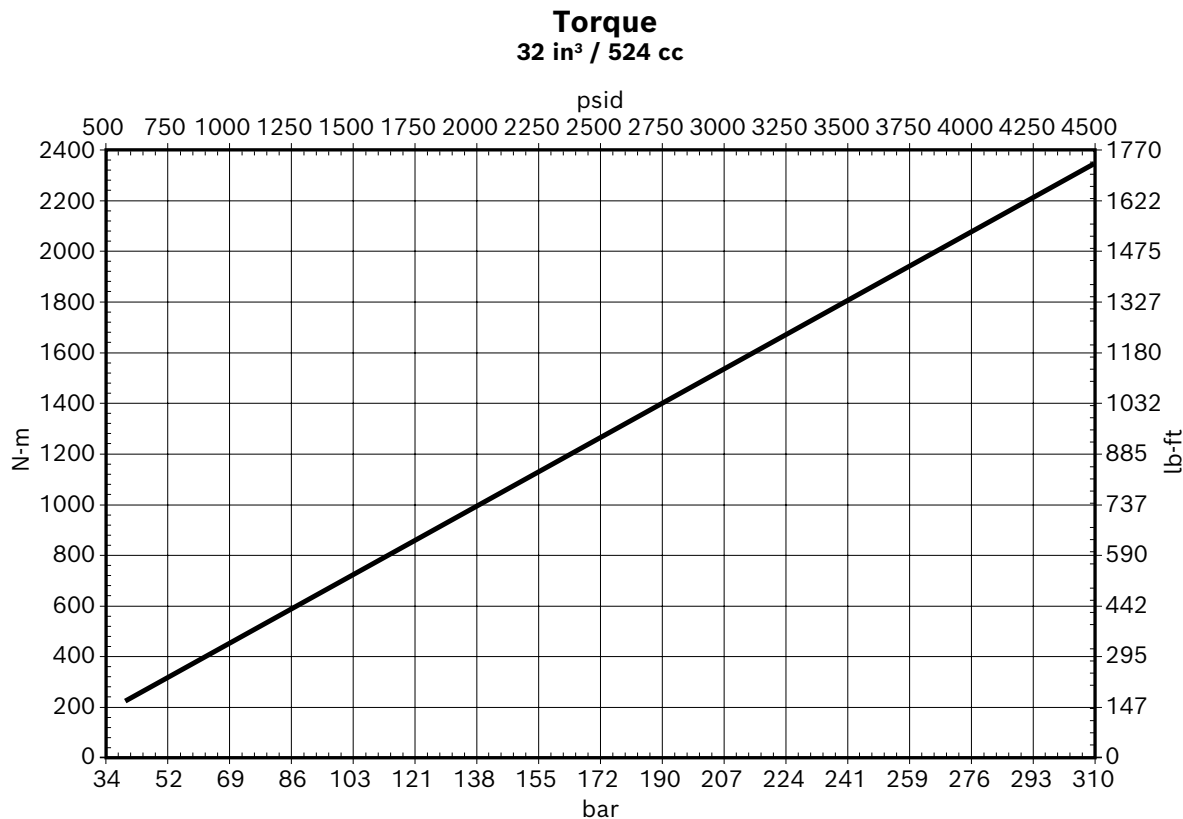
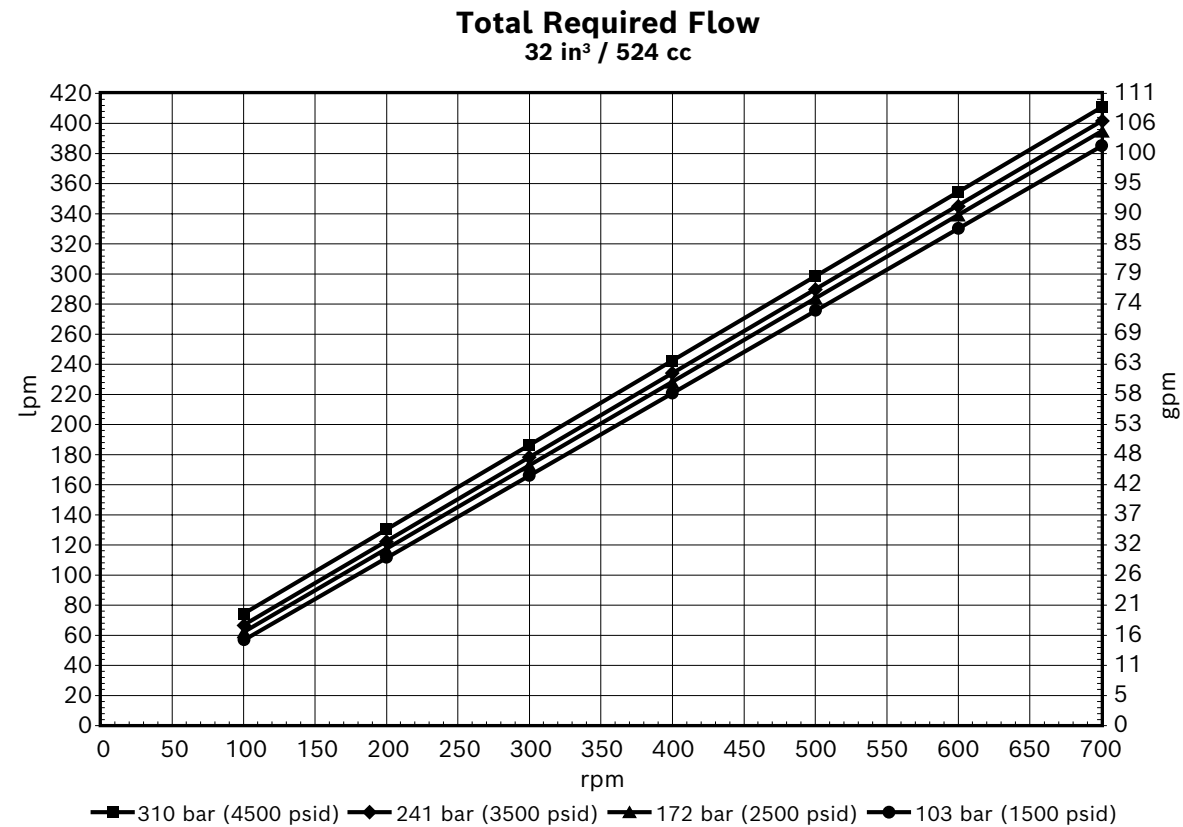
Technical data

Flow & output torque – 26 in³



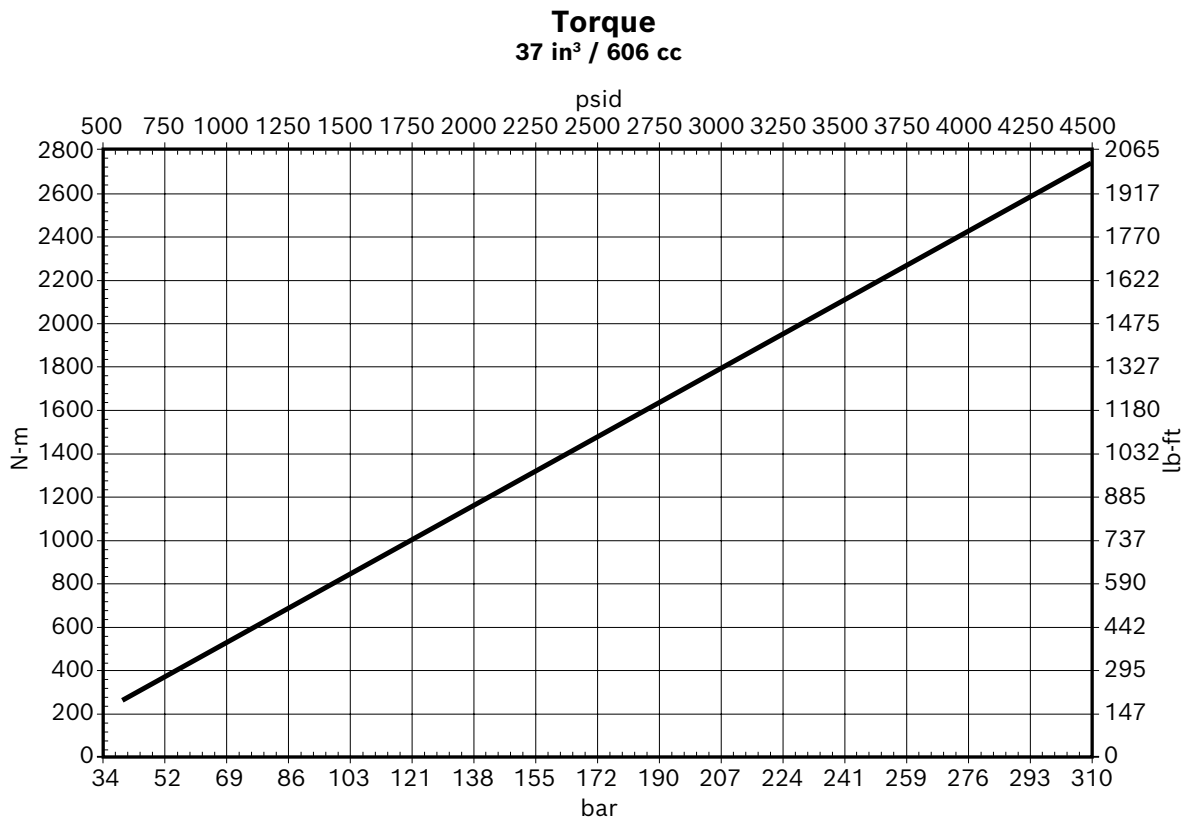
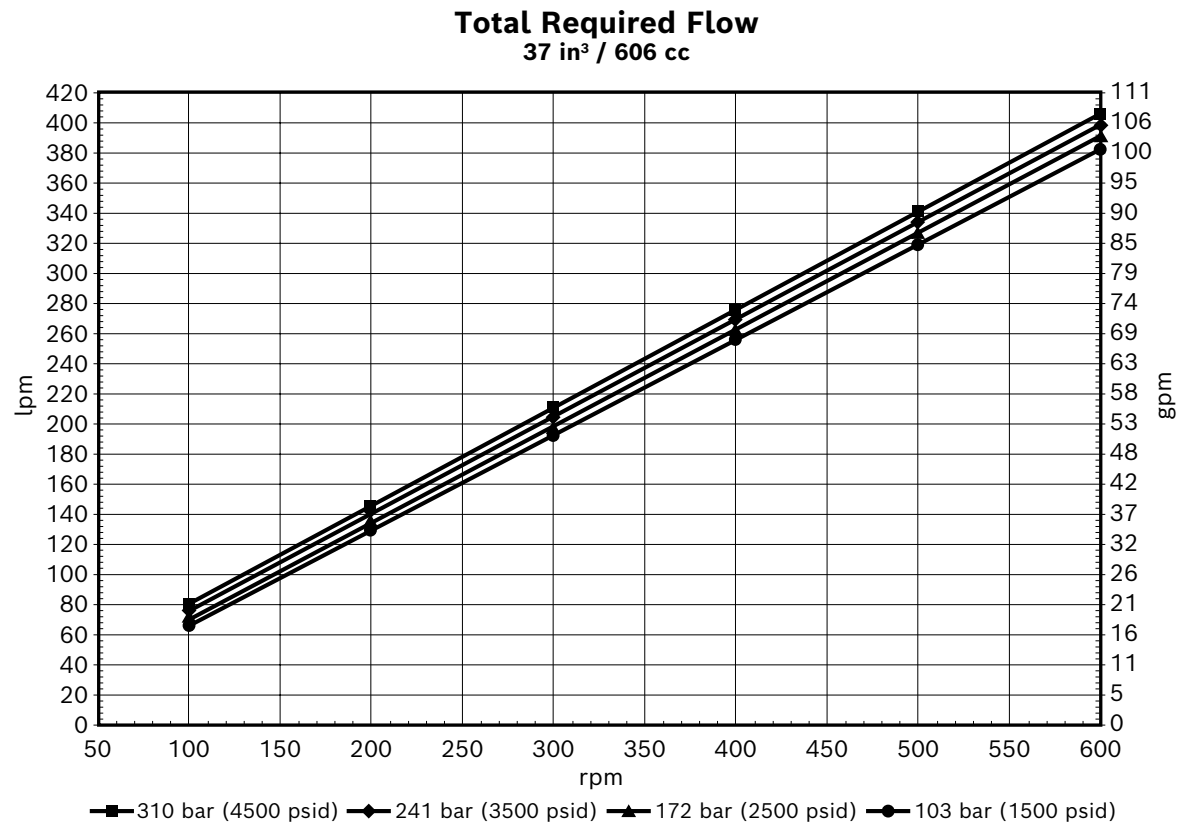
Technical data

Flow & output torque – 32 in³



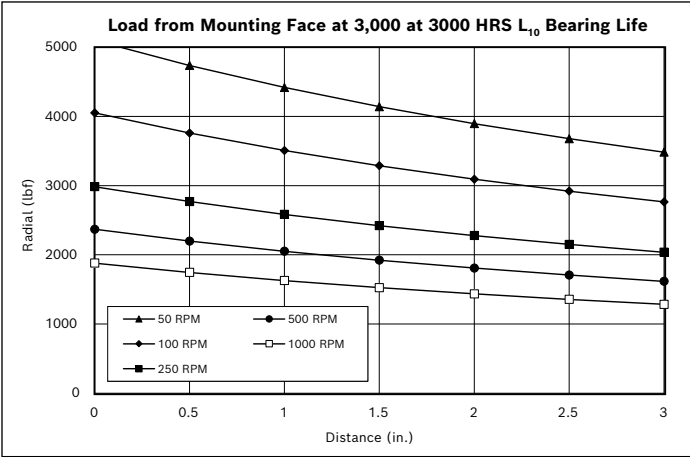
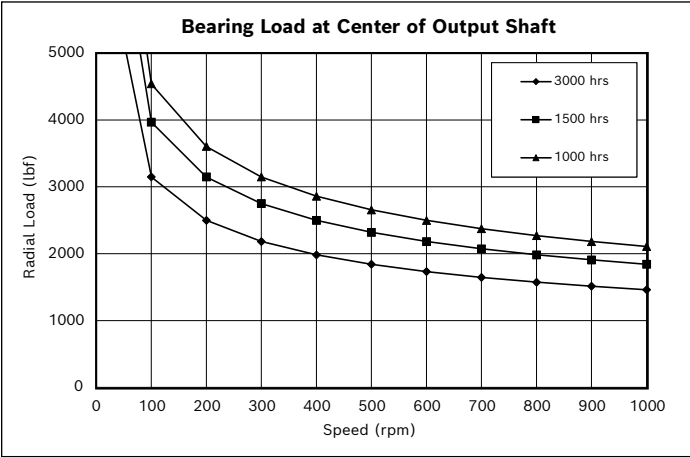
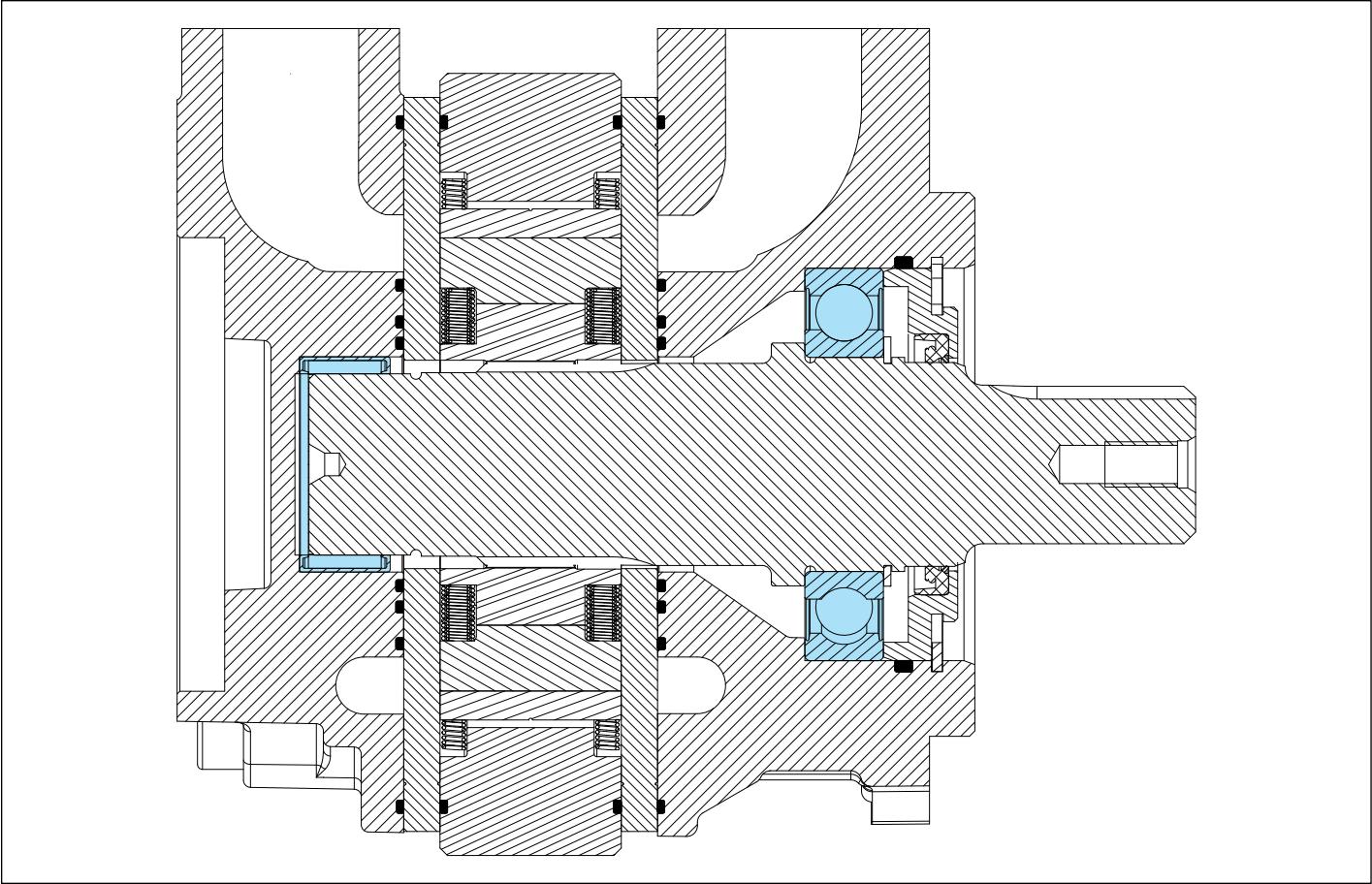
Technical data

Flow & output torque – 37 in³



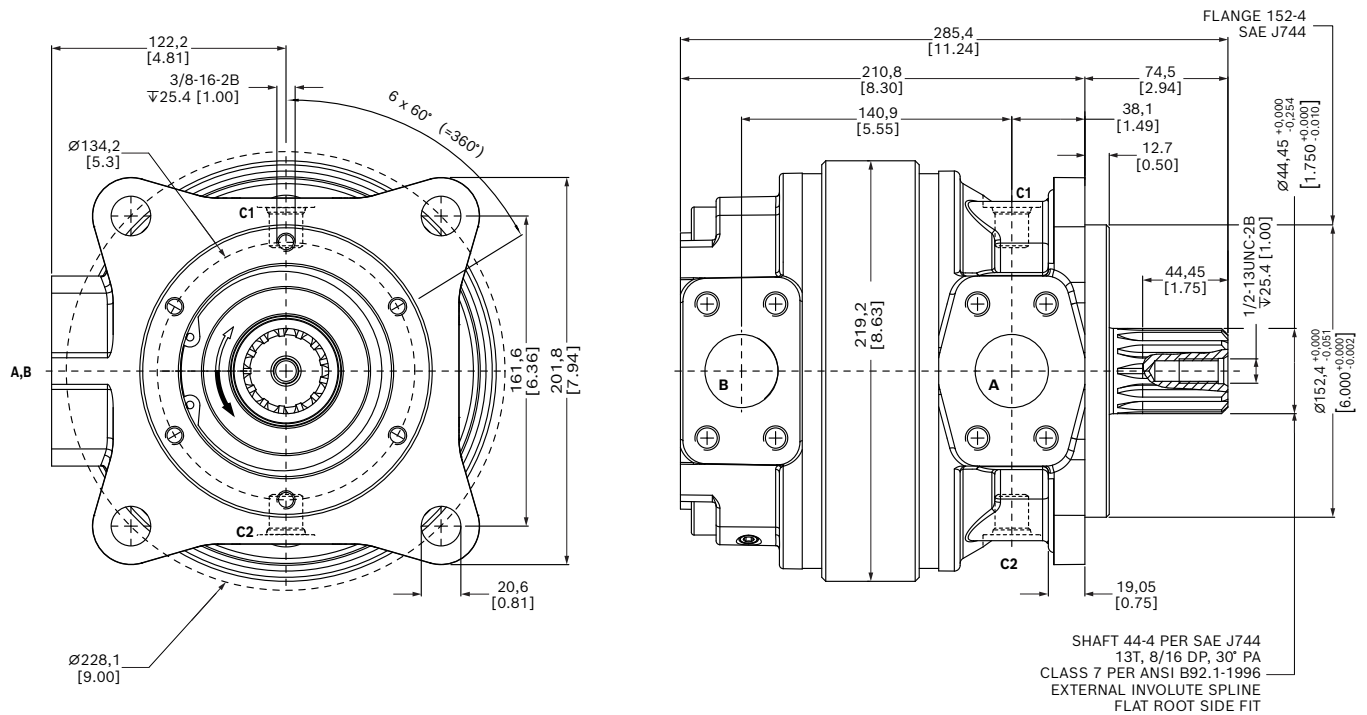
Technical data

Bearing data – Code 61 Motor (B1 Bearing)



Technical data

Unit dimensions – Code 61 Motor (B1 Bearing)

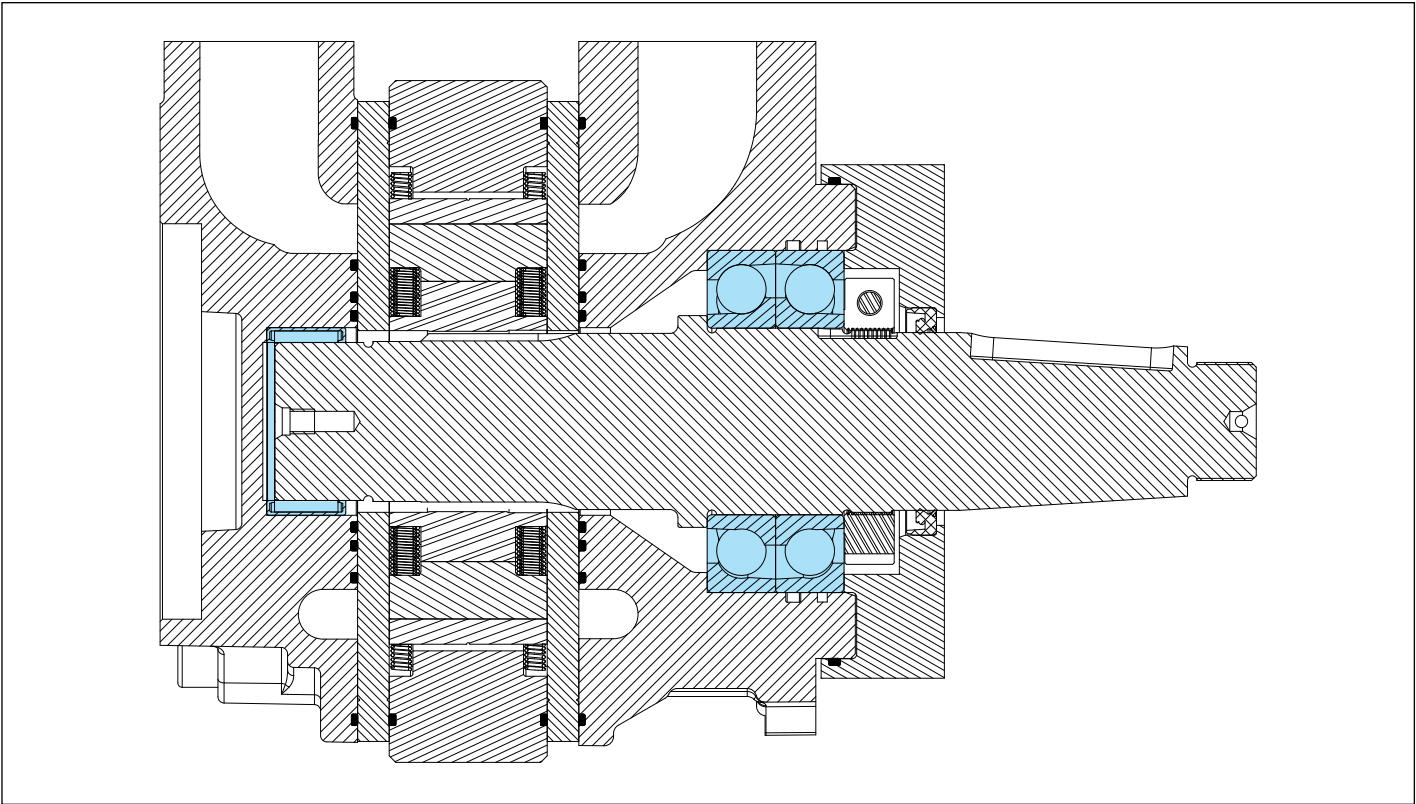


Model #:

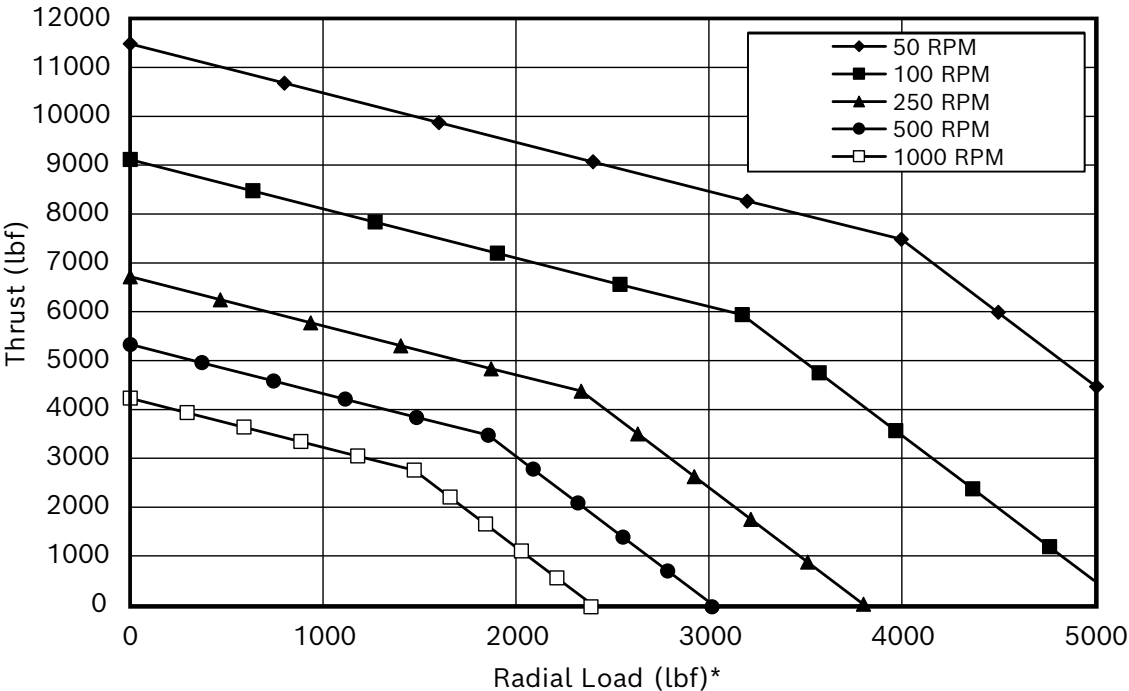
MV037-A2-1S-***-31-B1-***-000

Technical data

Bearing data – Code 61 Motor (B2 Bearing)

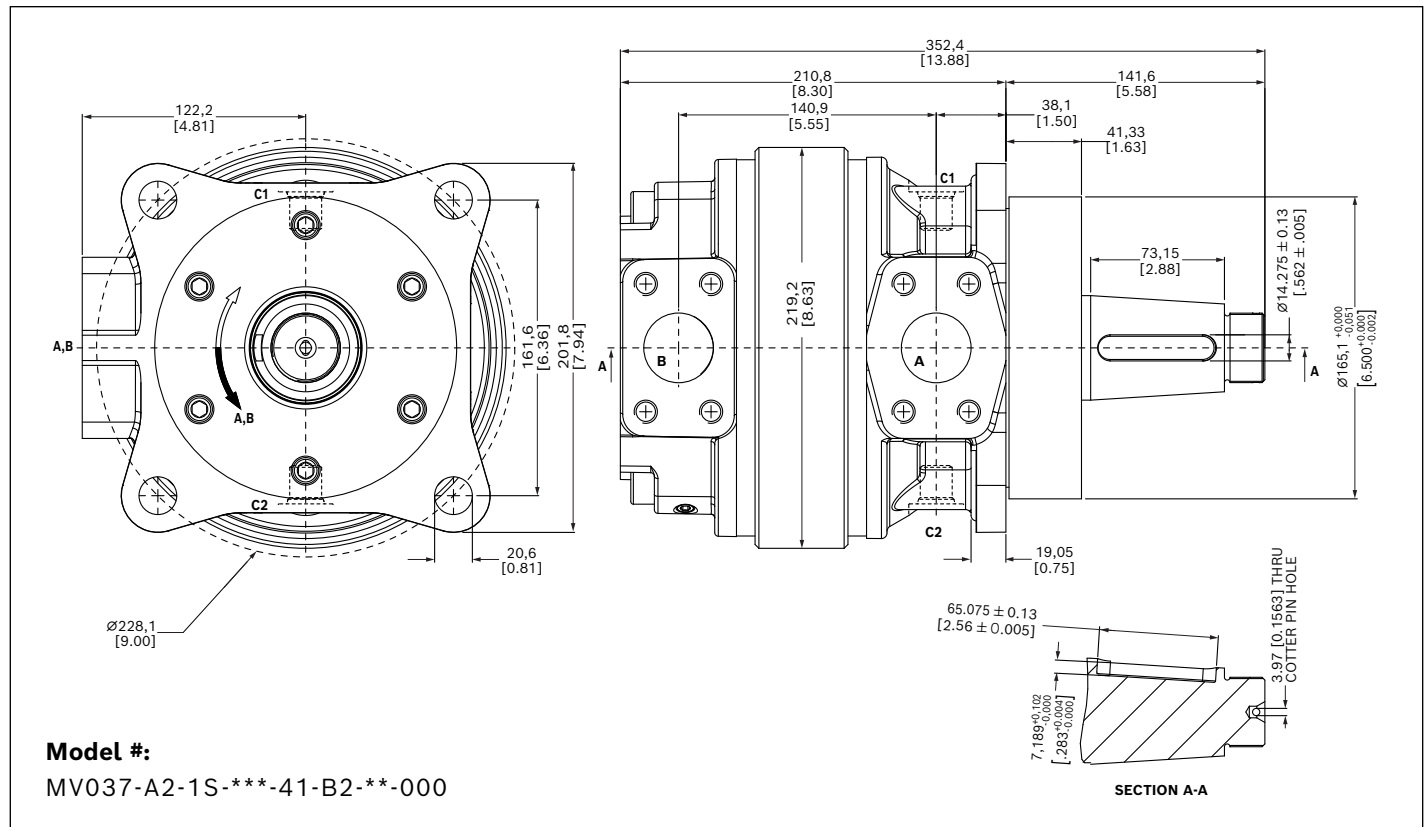


Combined Load at 3000 HRS L10 Bearing Life



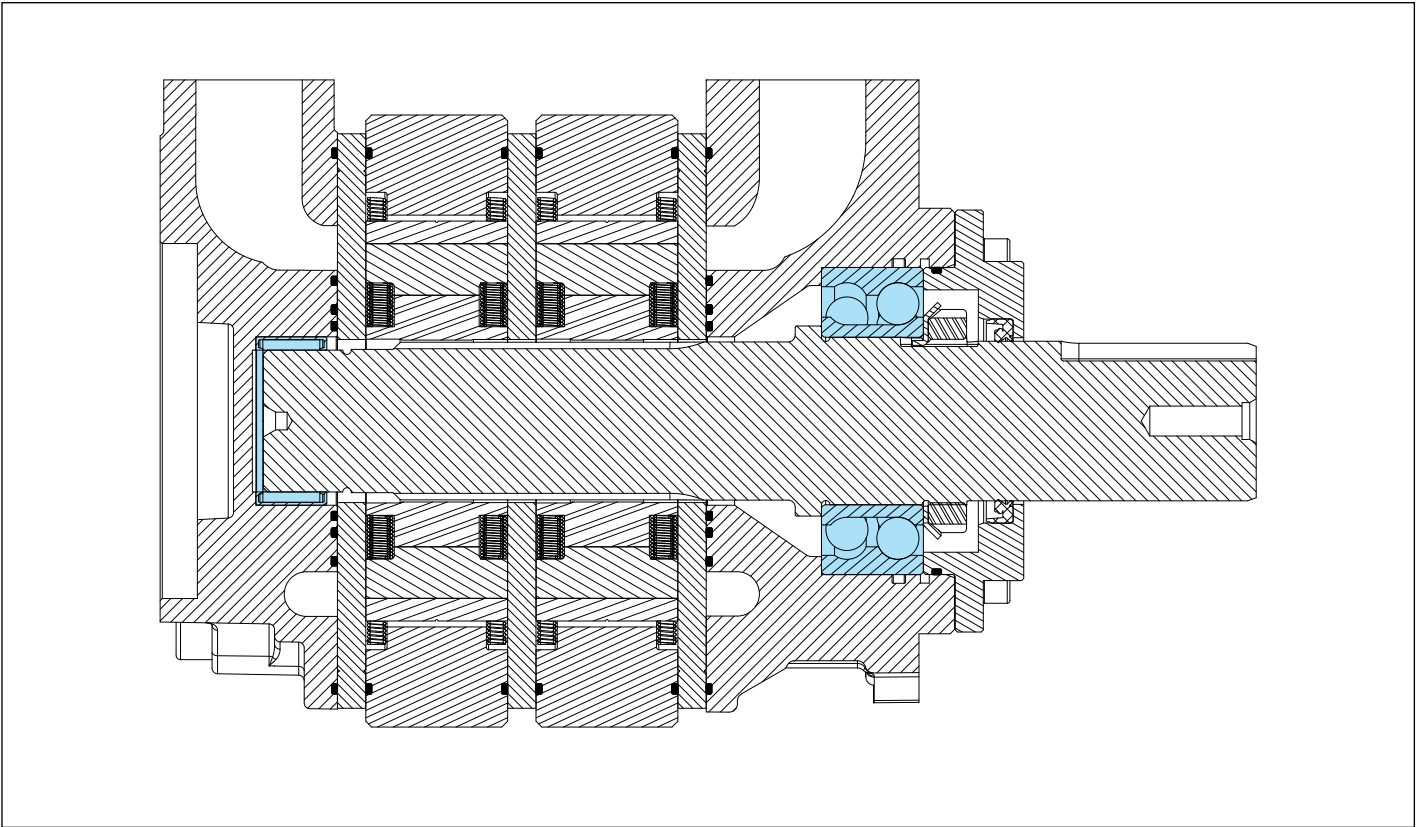
* Radial load located at center of effective output of the shaft.

Unit dimensions – Code 61 Motor (B2 Bearing)

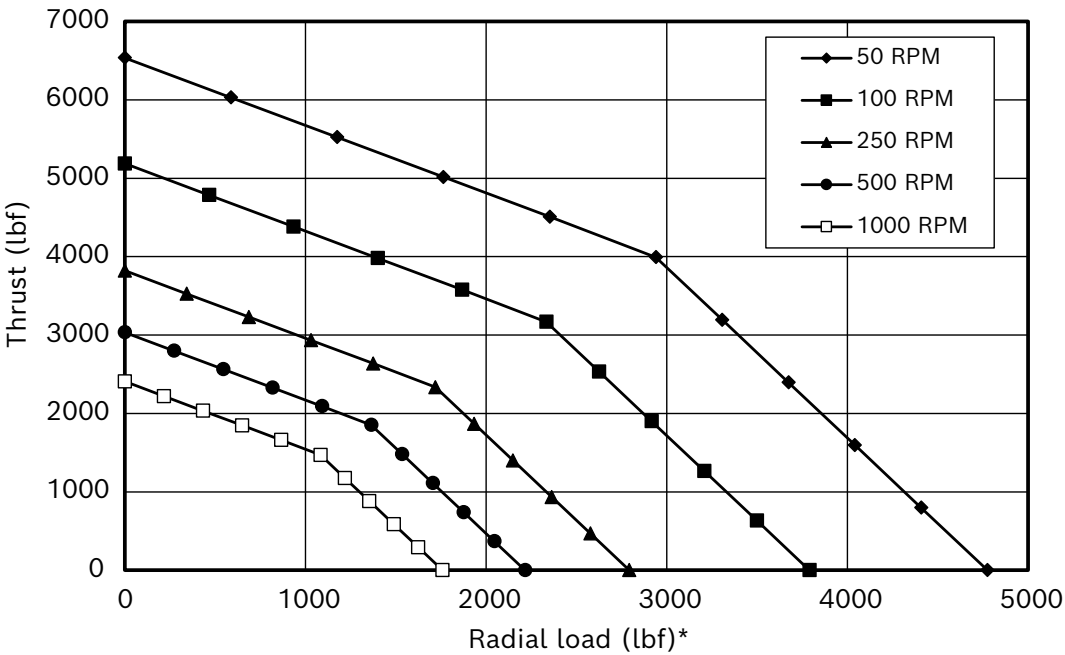


Technical data

Bearing data – Code 62 Motor (B3 Bearing)



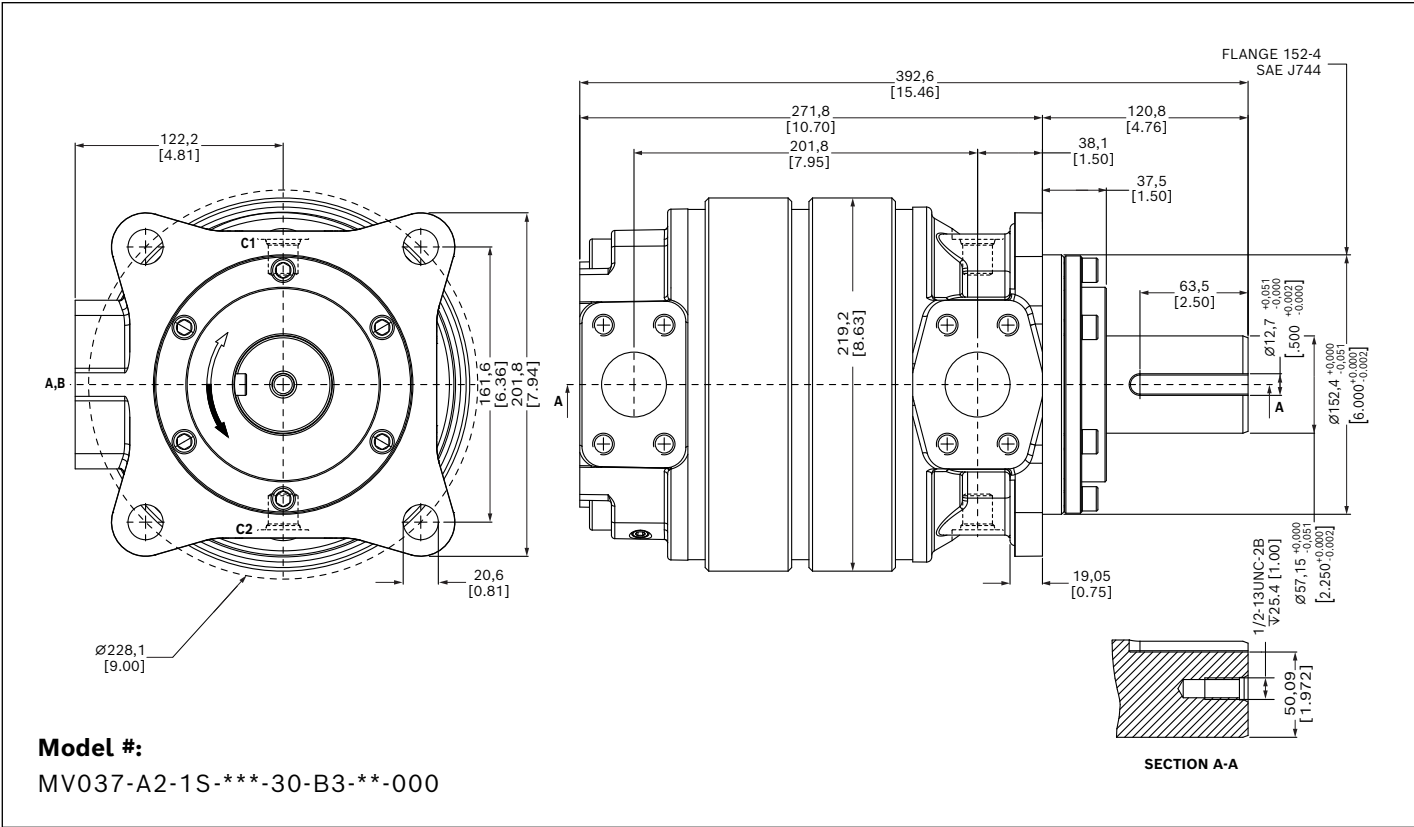
Combined Load at 3000 HRS L10 Bearing Life



* Radial load located at center of effective output of the shaft.

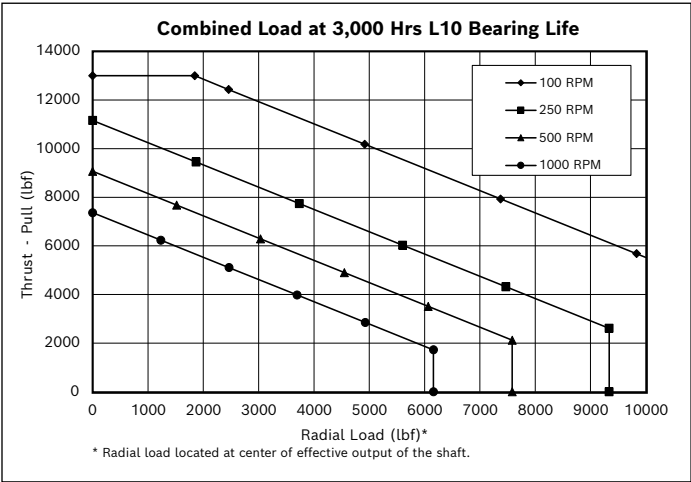
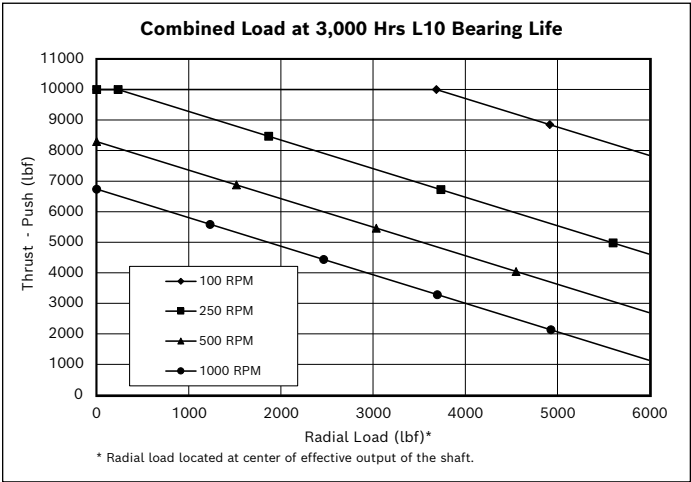
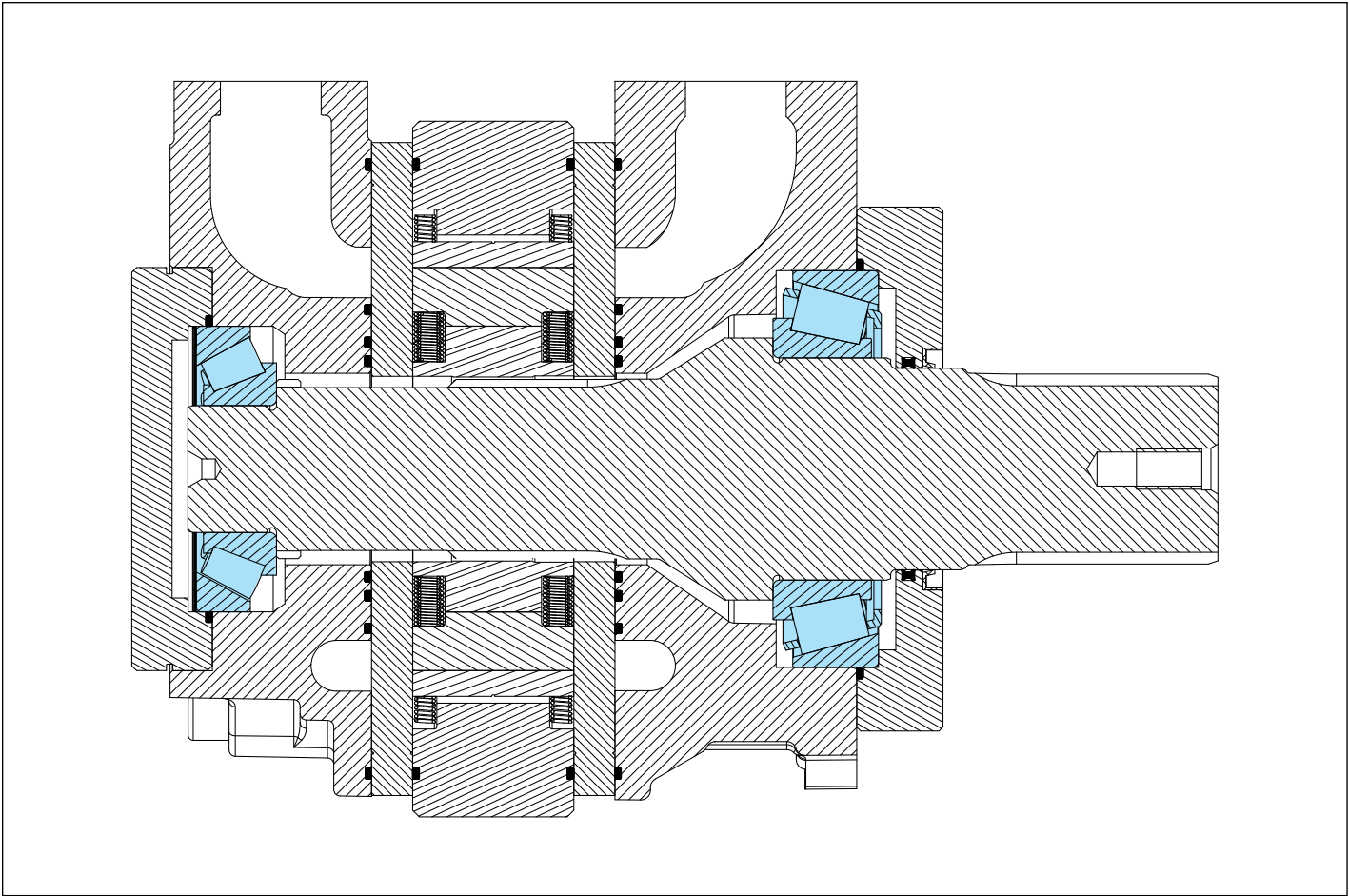
Technical data

Unit dimensions – Code 62 Motor (B3 Bearing)



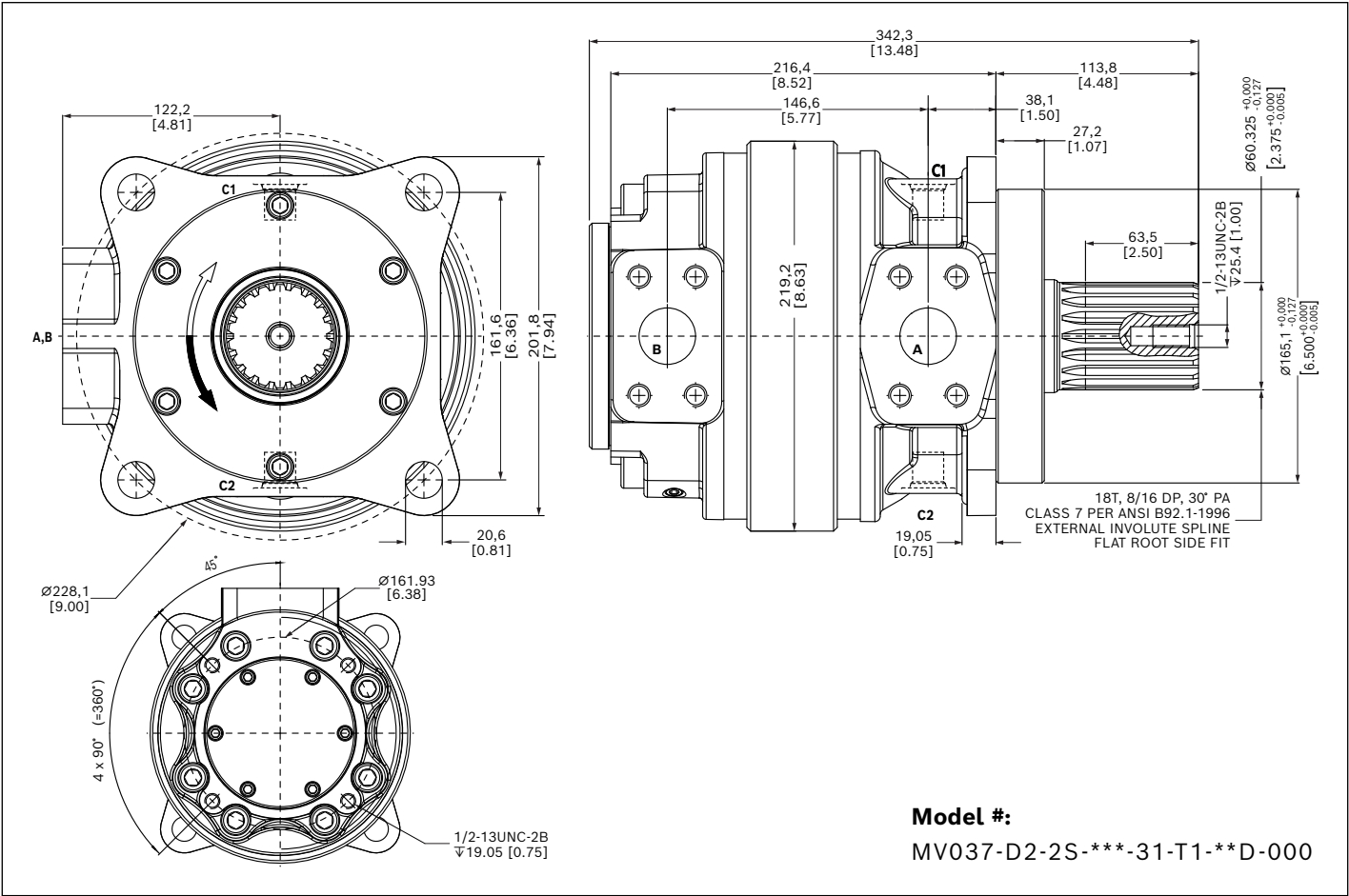
Technical data

Bearing data – Code 62 Motor (T1 Bearing)



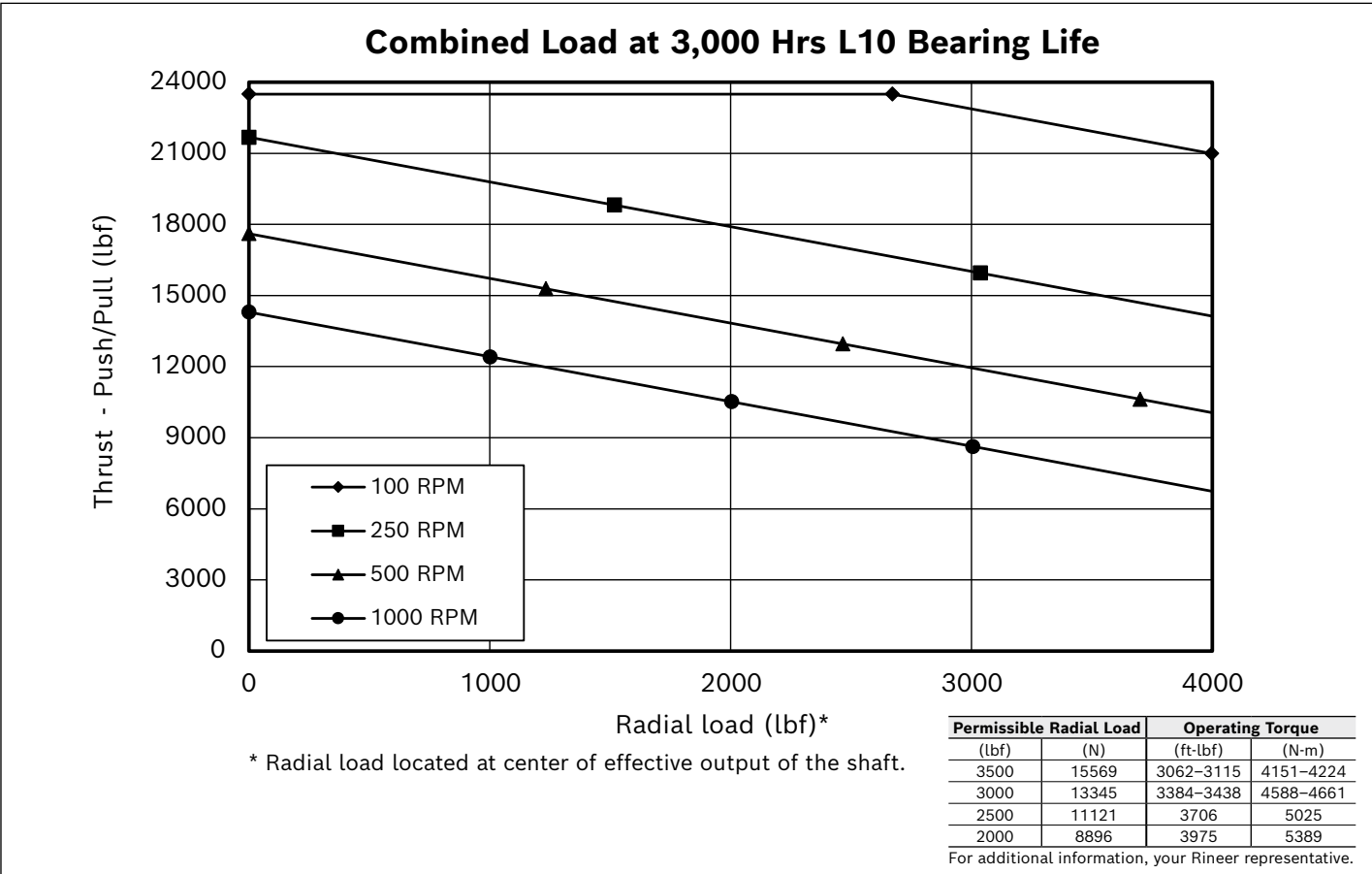
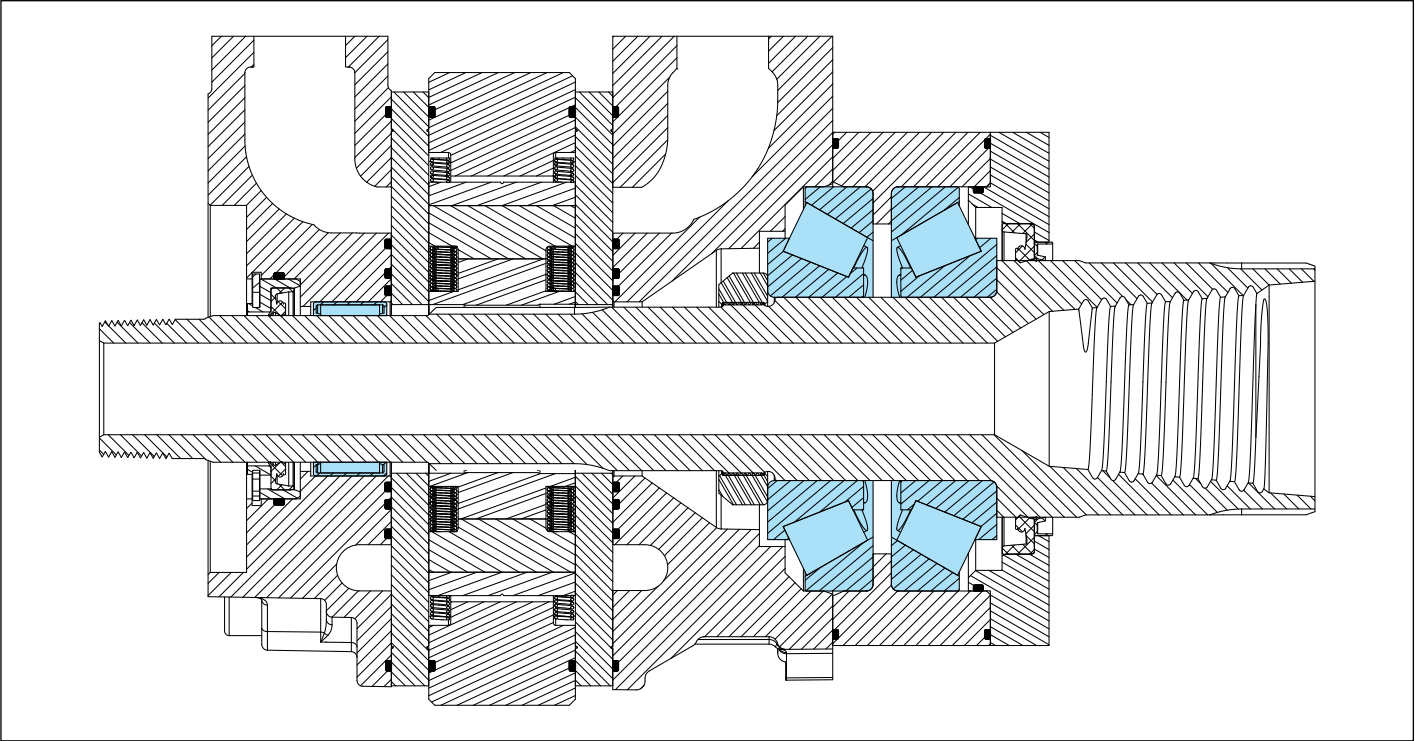
Technical data

Unit dimensions – Code 62 Motor (T1 Bearing)



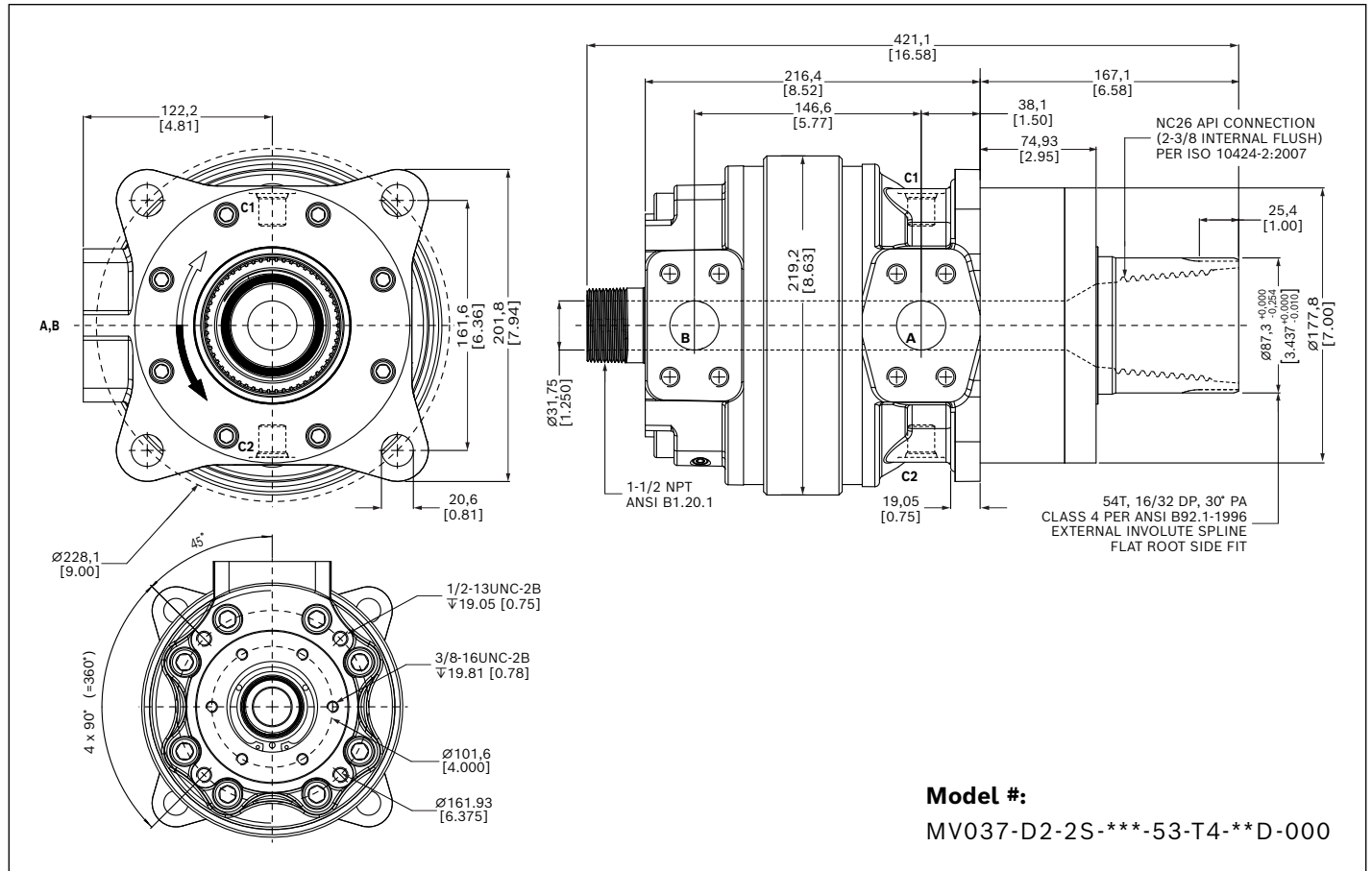
Technical data

Bearing data – Code 62 Motor (T4 Bearing)



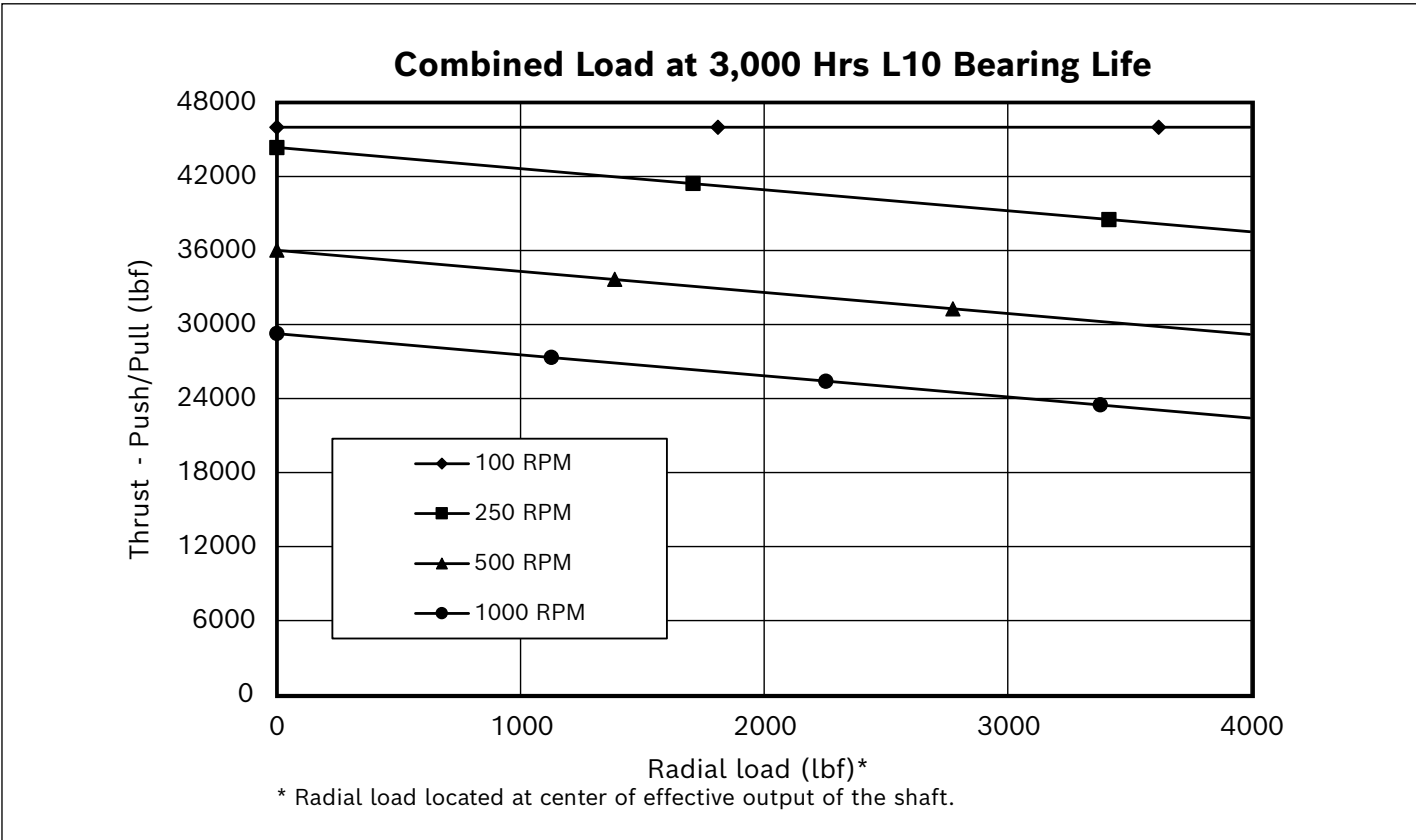
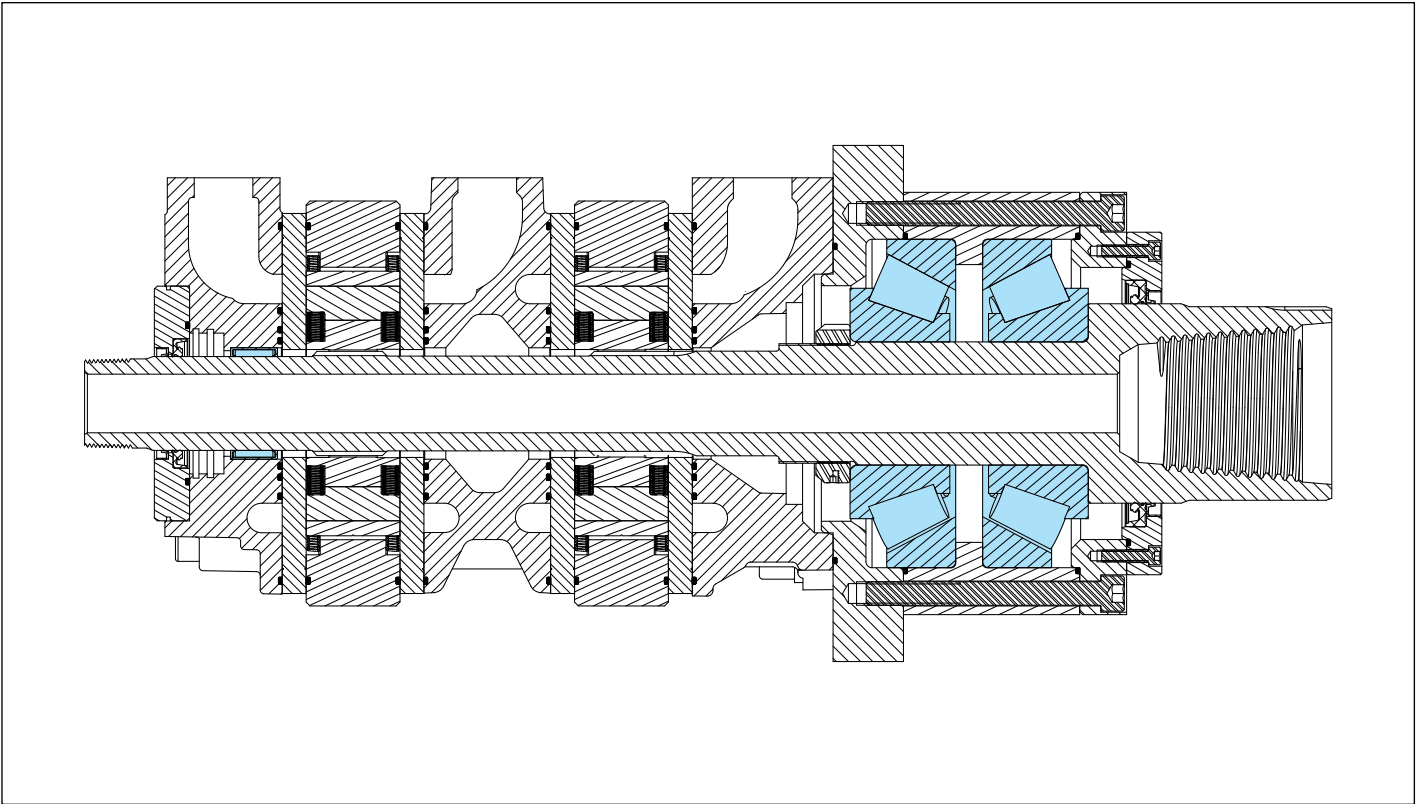
Technical data

Unit dimensions – Code 62 Motor (T4 Bearing)



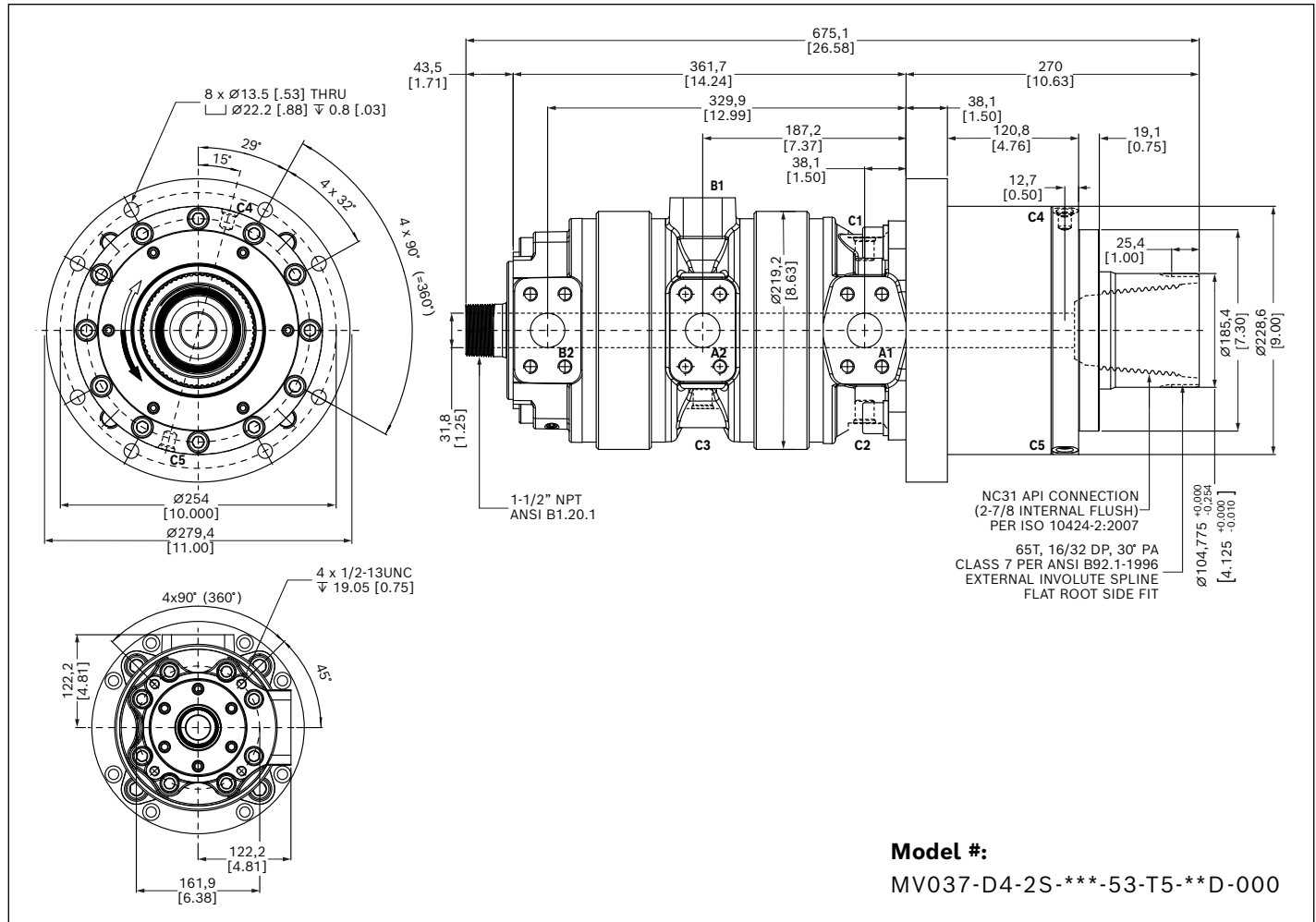
Technical data

Bearing data – Code 62 Motor (T5 Bearing)



Technical data

Unit dimensions – Code 62 Motor (T5 Bearing)

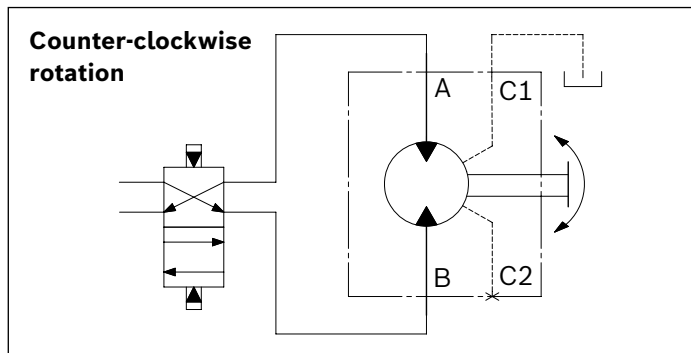
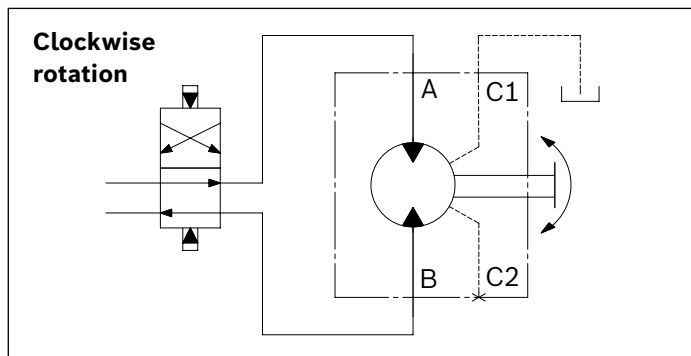


Engineering guidelines

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 the return line flow. Using the “B” port for inlet flow will reverse the direction of the shaft rotation, and the “A” port will become the return line port.

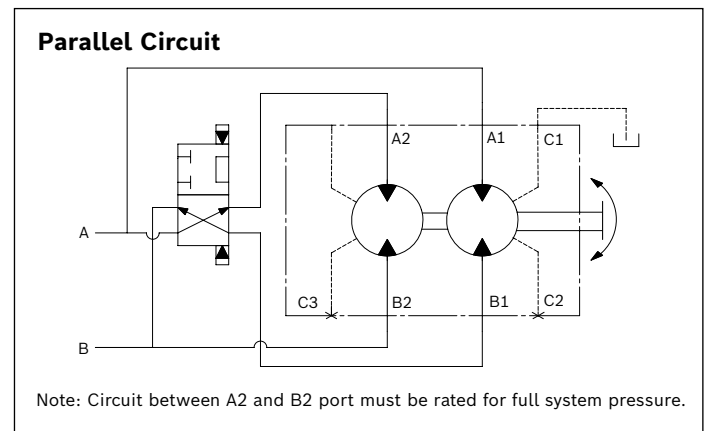
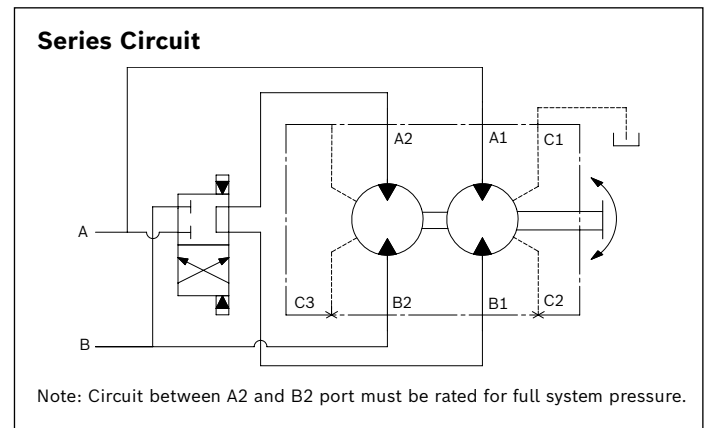


4-port motor circuit

The front housing has a port designated “A1.” The center housing has 2 ports, designated “A2” and “B1”. Port “A2” is on the same plane as port “A1”. Port “B1” is offset from “A2” by 90 degrees. The rear housing has a port designated “B2”, located on the same plane as “A1” and “A2.” The 4-ported motor is capable of single speed operation, and with external valving, two speed operation. Two-speed operation with the 4-port motor can be accomplished using either series, parallel, or logic circuits.

Series/parallel circuit

When using a series/parallel circuit with the 4-port motor, equal displacement rotating groups must be used. See the circuit diagram below for reference only.



Notes

Bosch Rexroth Corp.
Hydraulics
8 Southchase Court
Fountain Inn, SC 29644-9018
U.S.A.
Telephone (864) 967-2777
Facsimile (864) 967-8900
www.boschrexroth-us.com

© All rights reserved Bosch Rexroth Corp. This document, as well as the data, specifications and other information set forth in it, are the exclusive property of Bosch Rexroth Corp. It may not be reproduced or given to third parties with its consent.

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.