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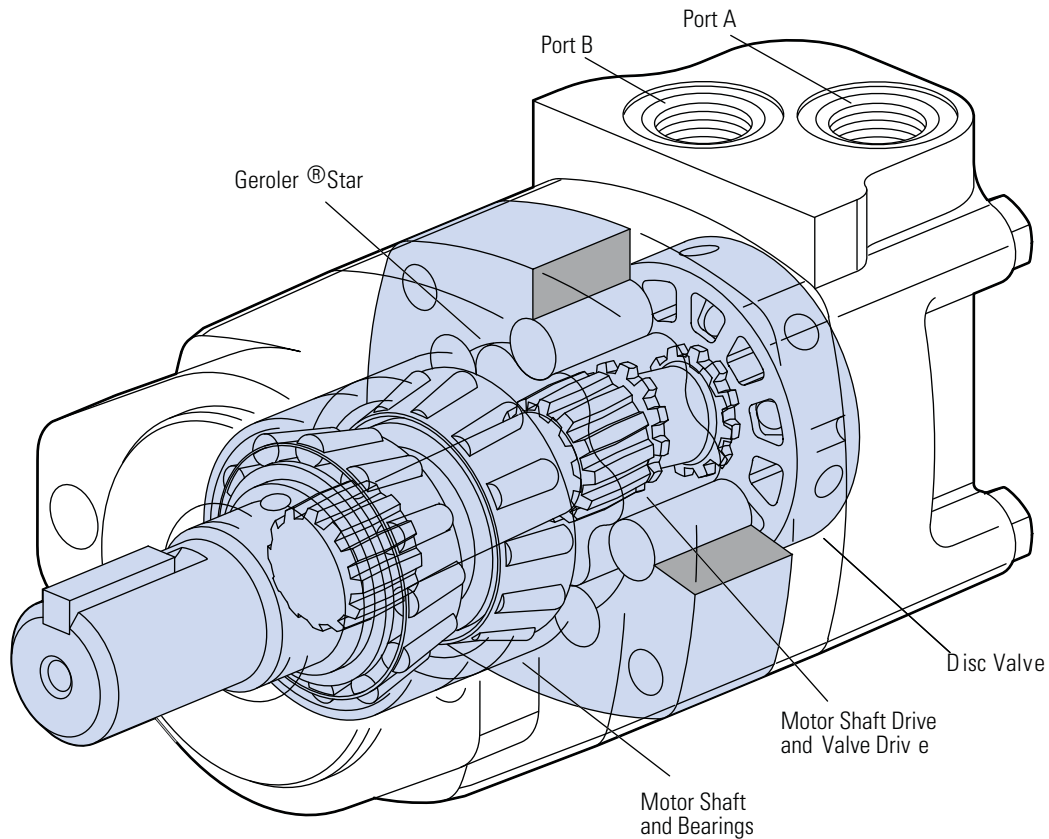
# Disc Valve Hydraulic Motors

## Highlights

### Product Description

In the late 1950's the original low speed, high torque hydraulic motor was developed from a pump Geroter element consisting of an internal gear ring and a mating gear or star. While attaching the internal gear ring to the housing as a non moving part, oil was ported to pressurize and turn the internal star in an orbit around a center point. This slow turning star coupled with a splined drive to the output shaft became the Char-Lynn Orbit® motor.

A few years after this original Char-Lynn Orbit motor was introduced another original motor concept went into production. This motor had rolls incorporated into the internal gear ring, this element was identified by the name Geroler and is a registered trade name of Eaton Hydraulics. From these early years the Geroler motor has seen many design changes to make these Geroler motors the best the industry has to offer. Examine the simplicity of these Geroler disc valve motors shown below. Also examine all the following pages for high value Char-Lynn disc valve motors from Eaton Hydraulics.



# Features, Benefits, and Applications

## Features

Char-Lynn Hydraulic motors provide design flexibility. All disc valve motors are available with various configurations consisting of:

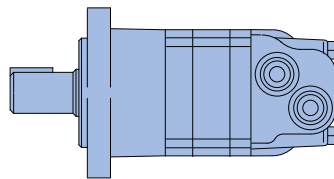
- Displacement (Geroler size)
- Output Shaft
- No Shaft and Bearing Assembly (Bearingless Motor)
- Port Configuration
- Mounting Flange
- Other Special Features

## Benefits

- Lowest pressure drop motor in the industry
- Widest range of options
- The most experienced manufacturer of LSHT motors

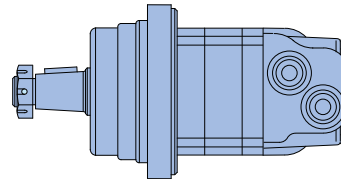
## Applications

- Swing motor
- Brush Cutters & mowers
- Harvesting equipment
- Directional boring
- Turf equipment
- Skid Steer loaders
- Fairway mowers
- Harvesters
- Mowing
- Snow removal
- Sprayers
- Trencher
- Wood products
- Grinders and mixers
- Forestry equipment
- Irrigation reels



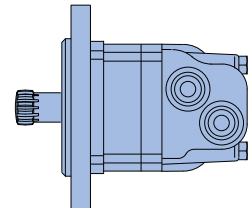
### Standard Motor

The standard motor mounting flange is located as close to the output shaft as possible. This type of mounting supports the motor close to the shaft load. This mounting flange is also compatible with many standard gear boxes.



### Wheel Motor

The wheel motor mounting flange is located near the center of the motor which permits part or all of the motor to be located inside the wheel or roller hub. In traction drive applications, loads can be positioned over the motor bearings for best bearing life. This wheel motor mounting flange provides design flexibility in many applications.



### Bearingless Motor

The bearingless motor has the same drive components as the standard and wheel motors (with the exception that the motor is assembled without the output shaft, bearings and bearing housing). The bearingless motor is especially suited for applications such as gear boxes, winch drives, reel and roll drives. Bearingless motor applications must be designed with a bearing supported internal spline to mate with the bearingless motor drive. Product designs using these hydraulic motors provide considerable cost savings.

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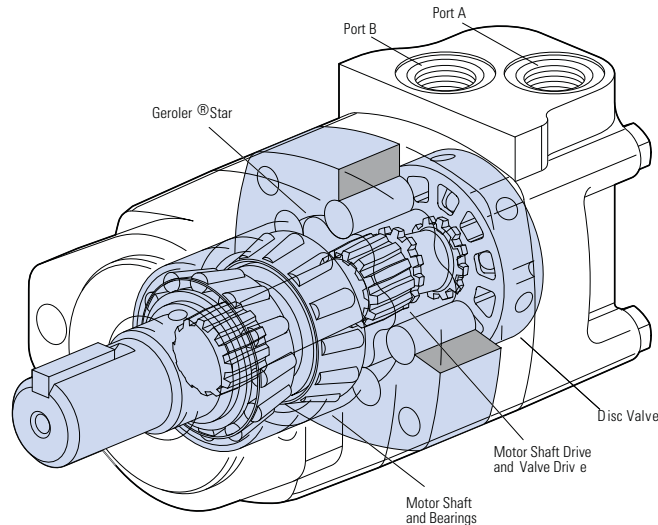
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# 2000 Series

## Highlights



### Features

- Three zone design for longer life and true bi-directionality.
- Bearings that meet the highest standards of the industry
- Options to optimize performance in every application
- Integrated cross-over relief valve option

### Benefits

- Easy to design in a system
- Reliability and performance in tough application
- Compact design of the integrated cross-over relief valve option

### Applications

- Skid Steer Attachments
- Swing Motor
- Brush Cutters & Mowers
- Harvesting Equipment
- Directional Boring any place pressure relief protection is optimal for system or motor performance and life
- Turf equipment

### Description

The popular 2000 Series provides torque up to 7500 lb-in. This proven design is reliable and durable. Eaton has added options that make the motor more flexible to use in a wide variety of applications. The integral cross-over relief valve is the latest innovation in the 2000 series motors.

### 2000 Series

Geroler Element	10 Displacements
Flow l/min [GPM]	75 [20] Continuous**
	115 [30] Intermittent*
Speed RPM	908 Cont.**
	1042 Inter.*
Pressure bar [PSI]	200 [3000] Cont.**
	300 [4500] Inter.*
Torque Nm [lb-in]	845 [7470] Cont.**
	930 [8225] Inter.*

\*\* Continuous— (Cont.) Continuous rating, motor may be run continuously at these ratings.

\* Intermittent— (Inter.) Intermittent operation, 10% of every minute.



Auger



Boring



Plastic Injection

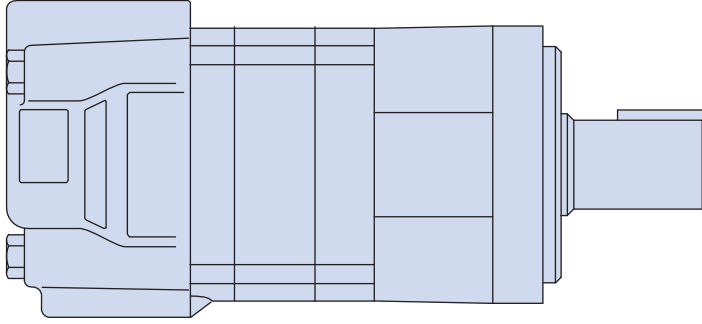


Oil and Gas Equipment

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# 2000 Series

## Specifications



### SPECIFICATION DATA – 2000 SERIES MOTORS

Displ. cm <sup>3</sup> /r [in <sup>3</sup> /r]		80 [4.9]	90 [5.5]	100 [6.2]	130 [8.0]	160 [9.6]	195 [11.9]	245 [14.9]	305 [18.7]	395 [24.0]	490 [29.8]
Max. Speed (RPM)	Continuous	908	836	742	576	477	385	308	246	191	153
	Intermittent	908	1042	924	720	713	577	462	365	287	230
@ Flow											
Flow l/min [GPM]	Continuous	75 [20]	75 [20]	75 [20]	75 [20]	75 [20]	75 [20]	75 [20]	75 [20]	75 [20]	75 [20]
	Intermittent	75 [20]	95 [25]	95 [25]	95 [25]	115 [30]	115 [30]	115 [30]	115 [30]	115 [30]	115 [30]
Torque* Nm [lb-in]	Continuous	235 [2065]	265 [2326]	295 [2630]	385 [3420]	455 [4040]	540 [4780]	660 [5850]	765 [6750]	775 [6840]	845 [7470]
	Intermittent	345 [3035]	390 [3458]	445 [3950]	560 [4970]	570 [5040]	665 [5890]	820 [7250]	885 [7820]	925 [8170]	930 [8225]
Pressure $\Delta$ bar [ $\Delta$ PSI]	Continuous	205 [3000]	205 [3000]	205 [3000]	205 [3000]	205 [3000]	205 [3000]	205 [3000]	205 [3000]	155 [2250]	120 [1750]
	Intermittent	310 [4500]	310 [4500]	310 [4500]	310 [4500]	260 [3750]	260 [3750]	260 [3750]	240 [3500]	170 [2750]	140 [2000]
	Peak	310 [4500]	310 [4500]	310 [4500]	310 [4500]	310 [4500]	310 [4500]	310 [4500]	310 [4500]	205 [3250]	170 [2500]
Weight kg [lb]	Standard or Wheel Mount	9.3 [20.5]	9.3 [20.5]	9.5 [21.0]	9.8 [21.5]	10.0 [22.0]	10.4 [23.0]	10.9 [24.0]	11.3 [25.0]	11.8 [26.0]	12.2 [27.0]
	Bearingless	7.3 [16.0]	7.3 [16.0]	7.5 [16.5]	7.7 [17.0]	7.9 [17.5]	8.4 [18.5]	8.8 [18.5]	9.3 [20.5]	9.8 [21.5]	10.2 [22.5]

Maximum Case Pressure: See case pressure seal limitation graph.

\*See shaft torque ratings for limitations.

#### Note:

To assure best motor life, run motor for approximately one hour at 30% of rated pressure before application to full load. Be sure motor is filled with fluid prior to any load applications.

#### Maximum Inlet Pressure:

310 bar [4500 PSI]  
Do not exceed  $\Delta$  pressure rating (see chart above).

#### Maximum Return Pressure:

310 bar [4500 PSI] with case drain line installed.  
Do not exceed  $\Delta$  pressure rating (see chart above).

#### $\Delta$ bar [ $\Delta$ PSI] :

The true pressure difference between inlet port and outlet port

#### Continuous Rating:

Motor may be run continuously at these ratings

#### Intermittent Operation:

10% of every minute

#### Peak Operation:

1% of every minute

#### Recommended Fluids:

Premium quality, anti-wear type hydraulic oil with a viscosity of not less than 70 SUS at operating temperature.

#### Recommended System Operating Temp.:

-34°C to 82°C [-30°F to 180°F]

#### Recommended Filtration:

per ISO Cleanliness Code, 4406: 20/18/13

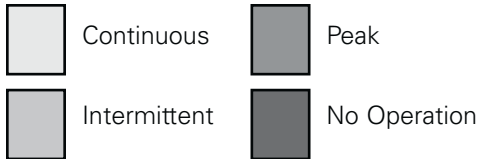


# 2000 Series

## Performance Data

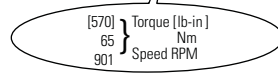
Motors run with high efficiency in all areas designated with a number for torque and speed. For best motor life select a motor to run with a torque and speed range shown in the light shaded area.

Performance data is typical at 120 SUS. Actual data may vary slightly from unit to unit in production.



80 cm<sup>3</sup>/r [4.9 in<sup>3</sup>/r]  
ΔPressure Bar [PSI]

	[500]	[1000]	[1500]	[2000]	[2500]	[3000]	[3500]	[4000]	[4500]
	35	70	105	140	170	205	240	275	310
[.25]	[210]	[420]							
.95	25 3	45 1							
[.5]	[250]	[500]	[740]						
1.9	30 17	50 8	85 3						
[1]	[330]	[670]	[990]	[1300]	[1550]	[1800]	[1950]	[2110]	
3.8	35 44	75 40	110 37	145 34	175 28	205 22	220 14	240 2	
[2]	[330]	[670]	[995]	[1310]	[1580]	[1840]	[2100]	[2365]	[2630]
7.5	35 90	75 85	110 81	150 78	180 72	210 65	235 57	265 49	295 42
[4]	[325]	[670]	[1005]	[1330]	[1620]	[1920]	[2200]	[2480]	[2765]
15	35 182	75 176	115 170	150 166	185 159	215 152	250 140	280 128	310 117
[6]	[320]	[665]	[1010]	[1340]	[1655]	[1975]	[2270]	[2570]	[2880]
23	35 273	75 267	115 259	150 254	185 246	215 238	255 223	290 207	325 192
[8]	[310]	[660]	[1015]	[1345]	[1685]	[2020]	[2330]	[2640]	[2960]
30	35 365	75 375	115 349	150 341	190 333	230 325	265 306	300 286	335 266
[10]	[300]	[650]	[1010]	[1350]	[1700]	[2050]	[2370]	[2690]	[3010]
38	35 456	75 448	115 439	155 429	190 420	230 411	270 388	305 364	340 341
[12]	[285]	[640]	[1005]	[1350]	[1705]	[2065]	[2390]	[2715]	[3035]
45	30 547	70 537	115 530	155 516	195 507	235 497	270 470	305 442	345 415
[14]	[270]	[625]	[990]	[1340]	[1705]	[2065]	[2395]	[2720]	[3030]
53	30 638	70 629	110 622	150 603	195 593	235 584	270 553	305 521	340 490
[16]	[255]	[610]	[975]	[1330]	[1690]	[2055]	[2385]	[2700]	[2995]
61	30 729	70 720	110 714	150 689	190 679	230 670	270 635	305 599	340 564
[18]	[230]	[590]	[955]	[1310]	[1680]	[2025]	[2355]	[2660]	[2935]
68	25 818	65 810	110 795	150 775	190 765	230 756	265 717	300 677	330 638
[20]	[210]	[570]	[930]	[1290]	[1645]	[1985]	[2305]	[2600]	[2845]
76	25 908	65 901	105 880	145 861	185 851	225 842	260 799	295 755	320 712



90 cm<sup>3</sup>/r [5.5 in<sup>3</sup>/r]  
ΔPressure Bar [PSI]





	[250]	[500]	[1000]	[1500]	[2000]	[2500]	[3000]	[3500]	[4000]	[4500]
	15	35	70	105	140	170	205	240	275	310
[.25]	[124]	[233]	[471]							
.95	14 5	26 2	53 1							
[.5]	[133]	[273]	[555]	[832]						
1.9	15 15	31 13	63 6	94 2						
[1]	[151]	[358]	[744]	[1091]	[1424]	[1697]	[1952]	[2189]	[2368]	
3.8	17 39	40 39	84 35	123 32	161 28	192 21	221 13	247 12	268 2	
[2]	[151]	[358]	[744]	[1099]	[1439]	[1737]	[2015]	[2293]	[2570]	[2855]
7.5	17 82	40 80	84 76	124 72	163 68	196 61	228 50	259 38	290 29	323 20
[4]	[151]	[350]	[899]	[1113]	[1473]	[1800]	[2132]	[2454]	[2775]	[3100]
15	17 167	40 163	102 158	126 152	166 148	203 139	241 126	277 115	314 102	350 90
[6]	[142]	[348]	[736]	[613]	[1492]	[1851]	[2208]	[2552]	[2898]	[3249]
23	16 250	39 245	83 240	69 233	169 227	209 218	249 203	288 191	327 176	367 161
[8]	[133]	[338]	[729]	[1128]	[1509]	[1890]	[2269]	[2635]	[3000]	[3367]
30	15 35	38 328	82 329	127 314	170 306	214 295	256 281	298 266	339 249	380 231
[10]	[124]	[331]	[724]	[1130]	[1521]	[1912]	[2309]	[2670]	[3036]	[3398]
38	14 418	37 410	82 404	128 395	172 385	216 373	261 361	302 342	343 322	384 302
[12]	[106]	[315]	[714]	[1127]	[1525]	[1924]	[2326]	[2704]	[3082]	[3458]
45	12 502	36 493	81 485	127 477	172 464	217 451	263 441	306 417	348 394	391 372
[14]	[98]	[298]	[706]	[1115]	[1525]	[1924]	[2326]	[2707]	[3080]	[3450]
53	11 585	34 575	80 567	126 559	172 543	217 529	263 521	306 493	348 467	390 431
[16]	[80]	[285]	[688]	[1107]	[1510]	[1907]	[2311]	[2697]	[3070]	[3432]
61	9 670	32 658	78 650	125 641	171 622	215 607	261 610	305 568	347 541	388 513
[18]	[62]	[262]	[673]	[1087]	[1490]	[1892]	[2281]	[2662]	[3030]	[3381]
68	7 753	30 740	76 732	123 719	168 701	214 685	258 680	301 643	342 613	382 583
[20]	[53]	[242]	[644]	[1045]	[1447]	[1850]	[2246]	[2617]	[2988]	[3301]
76	6 836	27 822	73 814	118 796	163 780	209 765	254 748	296 719	338 686	373 653
[22]	[35]	[231]	[639]	[1047]	[1437]	[1836]	[2218]	[2599]	[2981]	
83	4 920	26 916	72 907	118 895	162 876	207 854	251 749	294 803	337 774	
[24]	[18]	[204]	[612]	[1011]	[1366]	[1792]	[2182]	[2573]	[2963]	
91	2 1003	23 1000	69 991	114 978	154 960	202 940	247 918	291 882	335 850	
[25]		[195]	[594]	[994]	[1384]	[1765]	[2173]	[2564]		
95		22 1042	67 1033	112 1020	156 1003	199 984	246 954	290 921		

# 2000 Series

## Performance Data

Motors run with high efficiency in all areas designated with a number for torque and speed. For best motor life select a motor to run with a torque and speed range shown in the light shaded area.

Performance data is typical at 120 SUS. Actual data may vary slightly from unit to unit in production.

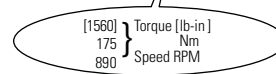
	Continuous		Peak
	Intermittent		No Operation

**100 c3m/r [6.3/2r] in**  
**ΔPressure Bar [PSI]**

	[250] 15	[500] 35	[1000] 70	[1500] 105	[2000] 140	[2500] 170	[3000] 205	[3500] 240	[4000] 275	[4500] 310
[.25] .95	[140] 15 4	[260] 30 2								
[.5] 1.9	[150] 15 13	[300] 35 9	[620] 70 5	[940] 105 2						
[1] 3.8	[170] 20 35	[390] 45 34	[830] 95 31	[1210] 135 28	[1570] 175 23	[1870] 210 15	[2130] 240 6			
[2] 7.5	[170] 20 73	[390] 45 71	[830] 95 68	[1220] 140 63	[1590] 180 59	[1920] 215 51	[2220] 250 38	[2520] 285 24	[2810] 315 14	[3120] 355 4
[4] 15	[170] 20 148	[380] 45 145	[820] 90 141	[1240] 140 136	[1640] 185 131	[2010] 225 121	[2380] 270 104	[2750] 310 94	[3120] 355 80	[3490] 395 69
[6] 23	[160] 20 222	[380] 45 219	[820] 90 215	[1260] 140 209	[1670] 190 202	[2080] 235 192	[2480] 280 172	[2880] 325 163	[3280] 370 149	[3680] 415 134
[8] 30	[150] 15 297	[370] 40 294	[810] 90 288	[1260] 140 281	[1700] 190 273	[2130] 240 261	[2560] 290 243	[2990] 340 231	[3420] 385 216	[3840] 435 200
[10] 38	[140] 15 371	[368] 40 367	[810] 90 362	[1270] 145 354	[1720] 195 344	[2160] 245 330	[2610] 295 316	[3020] 340 300	[3440] 390 283	[3850] 435 266
[12] 45	[120] 15 445	[350] 40 442	[800] 90 436	[1270] 145 427	[1730] 195 415	[2180] 245 399	[2630] 295 389	[3070] 345 369	[3510] 395 350	[3950] 445 332
[14] 53	[110] 10 519	[330] 35 516	[800] 90 509	[1260] 140 500	[1740] 195 486	[2180] 245 469	[2630] 295 463	[3070] 345 437	[3500] 395 417	[3940] 445 378
[16] 61	[90] 10 594	[320] 35 591	[780] 90 583	[1260] 140 573	[1720] 195 558	[2160] 245 540	[2610] 295 537	[3060] 345 506	[3500] 395 485	[3940] 445 463
[18] 68	[70] 10 668	[300] 35 665	[770] 85 657	[1240] 140 646	[1700] 190 630	[2140] 240 611	[2580] 290 609	[3020] 340 574	[3460] 390 552	[3900] 440 529
[20] 76	[60] 5 742	[280] 30 739	[730] 80 731	[1180] 135 715	[1630] 185 703	[2090] 235 684	[2550] 290 662	[2980] 335 643	[3440] 390 619	[3830] 435 595
[22] 83	[40] 5 816	[260] 30 813	[720] 80 805	[1180] 135 794	[1620] 185 777	[2070] 235 758	[2500] 280 749	[2930] 330 712	[3360] 380 687	
[24] 91	[20] 1.0 890	[230] 230 887	[690] 80 879	[1140] 130 868	[1540] 175 852	[2020] 230 834	[2460] 280 814	[2900] 330 782	[3340] 375 754	
[25] 95		[220] 25 924	[670] 75 916	[1120] 125 905	[1560] 175 890	[1990] 225 873	[2450] 275 846	[2890] 325 817		

**130 c3m/r [8.3/0r] in**  
**ΔPressure Bar [PSI]**

	[250] 15	[500] 35	[1000] 70	[1500] 105	[2000] 140	[2500] 170	[3000] 205	[3500] 240	[4000] 275	[4500] 310
[.25] .95	[170] 20 3									
[.5] 1.9	[190] 20 12	[410] 45 8	[870] 100 2							
[1] 3.8	[230] 25 28	[510] 60 27	[1070] 120 23	[1580] 180 19	[2050] 230 16	[2520] 285 13	[2920] 330 9	[3310] 375 3		
[2] 7.5	[230] 25 56	[510] 60 56	[1080] 120 53	[1600] 180 47	[2090] 235 42	[2580] 290 39	[2930] 330 36	[3320] 375 28	[3640] 410 21	[3990] 450 13
[4] 15	[220] 25 114	[500] 55 113	[1080] 120 111	[1620] 185 104	[2150] 245 97	[2660] 300 92	[3100] 350 92	[3540] 400 85	[3980] 450 77	[4420] 500 70
[6] 23	[220] 25 172	[490] 55 171	[1080] 120 169	[1640] 185 161	[2190] 245 153	[2740] 310 149	[3260] 370 146	[3770] 425 132	[4280] 485 118	[4800] 540 104
[8] 30	[200] 25 230	[480] 55 224	[1080] 120 222	[1650] 185 219	[2220] 250 210	[2780] 315 204	[3310] 375 201	[3840] 435 192	[4360] 495 184	[4890] 550 175
[10] 38	[180] 20 287	[470] 55 286	[1070] 120 282	[1650] 185 276	[2230] 250 269	[2800] 315 261	[3420] 385 255	[3940] 445 243	[4450] 505 231	[4970] 560 219
[12] 45	[160] 20 345	[460] 50 344	[1060] 120 338	[1640] 185 333	[2230] 250 327	[2800] 315 317	[3350] 380 307	[3910] 440 295	[4440] 500 284	[4960] 560 272
[14] 53	[150] 15 403	[440] 50 402	[1030] 115 395	[1620] 185 391	[2220] 250 385	[3000] 340 373	[3350] 380 360	[3910] 440 348	[4440] 500 336	
[16] 61	[130] 15 461	[420] 45 460	[1010] 115 452	[1600] 180 447	[2200] 250 443	[2780] 315 430	[3330] 375 411	[3890] 440 397	[4440] 500 384	
[18] 68	[110] 10 518	[400] 45 517	[990] 110 509	[1580] 180 504	[2160] 245 500	[2750] 310 484	[3300] 375 471	[3860] 435 456	[4410] 500 440	
[20] 76	[90] 10 576	[380] 45 575	[960] 110 568	[1550] 175 560	[2130] 240 551	[2710] 305 539	[3280] 370 524	[3840] 435 508		
[22] 83	[60] 5 634	[350] 40 633	[940] 105 624	[1520] 170 619	[2100] 235 604	[2680] 305 597	[3250] 365 579	[3820] 430 560		
[24] 91	[40] 5 692	[325] 35 691	[920] 105 682	[1490] 170 676	[2070] 235 665	[2650] 300 651	[3220] 365 633	[3780] 425 616		
[25] 95	[20] 1.0 720	[310] 35 719	[900] 100 712	[1480] 165 705	[2050] 230 692	[2630] 295 679	[3200] 360 682	[3700] 420 656		





# 2000 Series

## Performance Data

Motors run with high efficiency in all areas designated with a number for torque and speed. For best motor life select a motor to run with a torque and speed range shown in the light shaded area.

Performance data is typical at 120 SUS. Actual data may vary slightly from unit to unit in production.

	Continuous		Peak
	Intermittent		No Operation

160 c3m/r [9.3/6r ]in  
ΔPressure Bar [PSI]

	[250]	[500]	[1000]	[1500]	[2000]	[2500]	[3000]	[3500]	[3750]
	15	35	70	105	140	170	205	240	260
[.25]	[200]								
.95	25								
[.5]	[240]	[490]	[990]	[1570]	[2140]				
1.9	25	55	110	175	240				
[1]	[280]	[590]	[1170]	[1730]	[2290]	[2830]	[3330]	[3820]	[4070]
3.8	30	65	130	195	260	320	375	430	460
[2]	[300]	[610]	[1210]	[1790]	[2350]	[2920]	[3480]	[4050]	[4330]
7.5	35	70	135	200	265	330	395	460	490
[4]	[320]	[630]	[1260]	[1890]	[2530]	[3170]	[3820]	[4460]	[4780]
15	35	70	140	215	285	360	430	505	540
[6]	[320]	[650]	[1300]	[1960]	[2620]	[3280]	[3940]	[4600]	[4930]
23	35	75	145	220	295	370	445	520	560
[8]	[310]	[650]	[1330]	[2010]	[2670]	[3330]	[4000]	[4660]	[4990]
30	35	75	150	225	300	375	450	525	565
[10]	[290]	[640]	[1340]	[2030]	[2690]	[3350]	[4020]	[4680]	[5030]
38	35	70	150	230	305	380	455	530	570
[12]	[270]	[620]	[1320]	[2030]	[2700]	[3370]	[4040]	[4710]	[5040]
45	30	70	150	230	305	380	455	530	570
[14]	[240]	[650]	[1300]	[2020]	[2690]	[3360]	[4030]	[4700]	
53	25	65	145	230	305	380	455	530	
[16]	[220]	[570]	[1270]	[1980]	[2660]	[3330]	[4010]	[4680]	
61	25	65	145	225	300	375	450	525	
[18]	[190]	[540]	[1240]	[1960]	[2640]	[3320]	[3990]		
68	20	60	140	220	300	375	450		
[20]	[170]	[510]	[1210]	[1920]	[2600]	[3270]	[3940]		
76	20	60	135	215	300	375	445		
[22]	[150]	[480]	[1170]	[1880]	[2560]	[3230]	[3900]		
83	15	55	130	210	295	370	445		
[24]	[120]	[450]	[1150]	[1860]	[2570]	[3260]	[3900]		
91	15	50	130	210	290	370	440		
[25]	[90]	[440]	[1140]	[1840]	[2560]	[3230]	[3880]		
95	10	50	130	210	290	365	440		
[30]		[330]	[1040]	[1750]	[2470]	[3140]	[3800]		
114		35	120	200	280	355	430		
		713	706	696	682	672	658		

Flow LPM [GPM]

C-1

195 c3m/r [11.3/9r ]in  
ΔPressure Bar [PSI]

	[250]	[500]	[750]	[1000]	[1250]	[1500]	[1750]	[2000]	[2250]	[2500]	[2750]	[3000]	[3250]	[3500]	[3750]
	155	35	50	70	85	105	120	140	155	170	190	205	225	240	260
[.25]	[240]	[590]													
.95	25	65													
[.5]	[290]	[640]	[990]	[1340]											
1.9	35	70	110	150											
[1]	[380]	[730]	[1100]	[1430]	[1790]	[2120]	[2450]	[2720]	[2990]	[3260]	[3540]	[3810]	[4080]	[4350]	[4620]
3.8	45	80	125	160	200	200	275	305	340	370	400	430	460	490	520
[2]	[390]	[755]	[1135]	[1470]	[1860]	[2195]	[2535]	[2880]	[3120]	[3680]	[4090]	[4500]	[4800]	[5100]	[5400]
7.5	45	85	130	165	210	250	285	325	355	415	460	510	540	575	610
[4]	[405]	[795]	[1185]	[1540]	[1970]	[2310]	[2675]	[3040]	[3420]	[3790]	[4160]	[4520]	[4890]	[5260]	[5630]
15	45	90	135	175	225	260	300	345	385	430	470	510	550	595	635
[6]	[405]	[815]	[1220]	[1590]	[2035]	[2395]	[2780]	[3170]	[3560]	[3940]	[4320]	[4700]	[5070]	[5450]	[5830]
23	45	90	140	180	230	270	315	360	400	445	490	530	570	615	660
[8]	[400]	[820]	[1230]	[1625]	[2065]	[2450]	[2850]	[3260]	[3670]	[4040]	[4410]	[4780]	[5150]	[5520]	[5890]
30	45	90	140	185	235	275	320	370	415	455	500	540	580	625	665
[10]	[380]	[810]	[1230]	[1645]	[2095]	[2480]	[2895]	[3310]	[3730]	[4100]	[4470]	[4840]	[5210]	[5590]	
38	45	95	140	185	235	280	325	375	420	465	505	545	590	630	
[12]	[355]	[790]	[1215]	[1650]	[2100]	[2485]	[2915]	[3340]	[3760]	[4120]	[4480]	[4850]			
45	40	90	135	185	235	280	330	375	425	465	505	550			
[14]	[320]	[765]	[1190]	[1645]	[2090]	[2475]	[2915]	[3350]	[3770]	[4130]	[4480]	[4860]			
53	35	85	135	185	235	280	330	380	425	465	505	550			
[16]	[290]	[730]	[1160]	[1625]	[2070]	[2455]	[2900]	[3340]	[3760]	[4130]	[4490]	[4860]			
61	30	80	130	185	235	275	330	375	425	465	505	550			
[18]	[290]	[690]	[1120]	[1590]	[2035]	[2420]	[2870]	[3310]	[3730]	[4100]	[4480]				
68	30	80	125	180	230	270	325	375	420	465	505				
[20]	[210]	[650]	[1080]	[1550]	[1995]	[2380]	[2830]	[3270]	[3690]	[4070]	[4450]				
76	25	75	120	175	225	270	320	370	415	460	500				
[22]	[170]	[610]	[1040]	[1500]	[1955]	[2340]	[2785]	[3220]	[3640]	[4050]					
83	20	70	120	170	220	265	315	365	410	460					
[24]	[135]	[570]	[1000]	[1440]	[1910]	[2300]	[2710]	[3150]	[3580]	[3980]					
91	15	65	115	165	215	260	310	360	405	450					
[25]	[120]	[550]	[980]	[1410]	[1890]	[2280]	[2750]	[3150]	[3570]	[3960]					
95	15	60	110	160	215	260	315	365	405	445					
[30]		[420]	[860]	[1290]	[1700]	[2120]	[2530]	[2940]	[3400]						
114		45	95	145	190	240	285	330	385						
		577	575	571	567	562	556	550	542						





330 } Torque [lb-in]  
35 } Nm  
713 } Speed RPM

# 2000 Series

## Performance Data

Motors run with high efficiency in all areas designated with a number for torque and speed. For best motor life select a motor to run with a torque and speed range shown in the light shaded area.

Performance data is typical at 120 SUS. Actual data may vary slightly from unit to unit in production.

	Continuous		Peak
	Intermittent		No Operation

245 c3m/r [14.3/9r] in

ΔPressure Bar [PSI]

	[250]	[500]	[750]	[1000]	[1250]	[1500]	[1750]	[2000]	[2250]	[2500]	[2750]	[3000]	[3250]	[3500]	[3750]
	155	35	50	70	85	105	120	140	155	170	190	205	225	240	260
[.5]	[410]	[850]													
1.9	45	95													
[1]	[450]	[930]	[1420]	[1850]	[2320]	[2780]	[3250]	[3650]	[4100]	[4540]	[4980]	[5430]	[5870]	[6310]	[6950]
3.8	50	105	160	210	260	315	365	410	465	515	560	615	665	715	785
[2]	[460]	[960]	[1460]	[1900]	[2400]	[2860]	[3340]	[3780]	[4320]	[4770]	[5210]	[5660]	[6110]	[6570]	[6950]
7.5	50	110	165	215	270	325	375	425	490	540	590	640	690	740	820
[4]	[470]	[1000]	[1540]	[1980]	[2510]	[3010]	[3480]	[3980]	[4450]	[4910]	[5380]	[5850]	[6320]	[6780]	[7250]
15	55	115	175	225	285	340	395	450	505	555	610	660	715	765	820
[6]	[460]	[1020]	[1550]	[2040]	[2580]	[3110]	[3590]	[4120]	[4580]	[5050]	[5520]	[5980]	[6440]	[6910]	[780
23	50	115	175	230	290	350	405	465	515	570	625	675	730	780	850
[8]	[460]	[1010]	[1560]	[2080]	[2630]	[3170]	[3670]	[4210]	[4680]	[5160]	[5630]	[6110]	[6590]		
30	50	115	175	235	295	360	415	475	530	585	635	690	745		
[10]	[440]	[1000]	[1550]	[2110]	[2650]	[3200]	[3730]	[4250]	[4730]	[5210]	[5720]	[6230]			
38	50	115	175	240	300	360	420	480	535	590	645	705			
[12]	[410]	[960]	[1530]	[2100]	[2640]	[3190]	[3760]	[4260]	[4740]	[5220]	[5730]				
45	45	110	175	235	300	360	425	480	535	600	645				
[14]	[380]	[910]	[1500]	[2080]	[2600]	[3160]	[3760]	[4230]	[4710]	[5190]					
53	40	105	170	235	295	355	425	480	530	585					
[16]	[340]	[860]	[1460]	[2040]	[2570]	[3120]	[3740]	[4180]	[4660]	[5140]					
61	40	95	165	230	290	355	425	470	525	580					
[18]	[290]	[810]	[1420]	[2000]	[2520]	[3060]	[3700]	[4130]	[4610]	[5090]					
68	30	90	160	225	285	345	420	465	520	575					
[20]	[250]	[800]	[1350]	[1910]	[2460]	[3010]	[3630]	[4110]	[4610]						
76	30	90	155	215	280	340	410	465	520	588					
[22]	[200]	[710]	[1300]	[1870]	[2390]	[2940]	[3560]	[4010]	[4510]						
83	25	80	145	210	270	330	400	455	510	578					
[24]	[150]	[670]	[1240]	[1790]	[2330]	[2880]	[3460]	[3960]	[4460]						
91	15	75	140	200	265	325	390	445	505	575					
[25]	[120]	[660]	[1210]	[1750]	[2300]	[2860]	[3410]	[3950]	[4470]						
95	15	75	135	200	260	325	385	445	505	575					
[30]	[50]	[1080]	[1620]	[2120]	[2720]	[3260]	[3790]								
114	60	120	185	245	305	370	430								
	462	460	458	456	453	450	447								

305 c3m/r [18.3/7r] in

ΔPressure Bar [PSI]

	[250]	[500]	[750]	[1000]	[1250]	[1500]	[1750]	[2000]	[2250]	[2500]	[2750]	[3000]	[3250]	[3500]
	155	35	50	70	85	105	120	140	155	170	190	205	225	240
[.5]	[500]	[1050]												
1.9	55	120												
[1]	[610]	[1180]	[1750]	[2330]	[2870]	[3440]	[3930]	[4410]	[4900]	[5380]				
3.8	70	135	200	260	325	390	445	500	555	610				
[2]	[620]	[1210]	[1800]	[2400]	[2970]	[3510]	[4050]	[4600]	[5140]	[5680]	[6220]	[6750]	[7290]	[7820]
7.5	70	135	205	270	335	395	460	520	580	640	705	765	825	885
[4]	[680]	[1250]	[1880]	[2500]	[3120]	[3690]	[4260]	[4840]	[5410]	[5980]	[6550]	[7120]	[7690]	
15	75	140	210	280	355	415	480	545	610	675	740	805	870	
[6]	[620]	[1270]	[1920]	[2560]	[3230]	[3810]	[4390]	[4970]	[5560]	[6130]	[6710]	[7290]		
23	70	145	215	290	365	430	495	560	630	695	760	825		
[8]	[600]	[1270]	[1940]	[2600]	[3290]	[3880]	[4470]	[5070]	[5660]	[6250]	[6840]			
30	70	145	220	295	370	440	505	575	640	705	775			
[10]	[570]	[1250]	[1940]	[2610]	[3310]	[3920]	[4530]	[5150]	[5760]	[6370]				
38	65	140	220	295	375	440	510	580	650	720				
[12]	[530]	[1220]	[1920]	[2600]	[3300]	[3920]	[4530]	[5150]	[5760]	[6370]				
45	60	140	215	295	375	440	510	580	650	720				
[14]	[480]	[1180]	[1870]	[2560]	[3260]	[3900]	[4510]	[5120]	[5730]					
53	55	135	210	290	370	440	510	580	645					
[16]	[430]	[1120]	[1820]	[2500]	[3210]	[3870]	[4480]	[5080]	[5690]					
61	50	125	205	280	365	440	505	575	645					
[18]	[370]	[1060]	[1760]	[2440]	[3140]	[3800]	[4420]	[5050]						
68	40	120	200	275	355	440	500	570						
[20]	[320]	[980]	[1680]	[2360]	[3050]	[3710]	[4370]	[5020]						
76	35	110	190	265	345	420	495	565						
[22]	[240]	[920]	[1620]	[2300]	[2990]	[3560]	[4190]	[4820]						
83	25	105	185	260	340	400	475	545						
[24]	[180]	[870]	[1550]	[2240]	[2920]	[3420]	[4020]	[4630]						
91	20	100	175	255	330	385	455	525						
[25]	[150]	[840]	[1520]	[2200]	[2890]	[3340]	[3930]	[4520]						
95	15	95	170	250	325	375	445	510						
[30]	[680]	[1360]	[2040]	[2720]	[3140]	[3810]								
114	75	155	230	305	355	430								
	365	362	360	357	356	352								

[3260] } Torque [lb-in]  
370 } Nm  
450 } Speed RPM

# 2000 Series

## Performance Data

Motors run with high efficiency in all areas designated with a number for torque and speed. For best motor life select a motor to run with a torque and speed range shown in the light shaded area.

Performance data is typical at 120 SUS. Actual data may vary slightly from unit to unit in production.

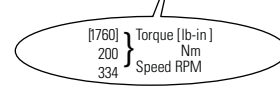
	Continuous		Peak
	Intermittent		No Operation

**490 c3m/r [29.3/8r jin]**  
**ΔPressure Bar [PSI]**

	[250]	[500]	[750]	[1000]	[1250]	[1500]	[1750]	[2000]
	155	35	50	70	85	105	120	140
[.5]	[670]	[1600]						
1.9	75 2	180 1						
[1]	[920]	[2000]	[2990]	[3900]	[4880]			
3.8	105 7	225 6	340 5	440 4	550 2			
[2]	[950]	[2060]	[3110]	[4080]	[5110]	[6320]		
7.5	105 14	235 13	350 12	460 10	575 9	715 7		
[4]	[980]	[2130]	[3230]	[4270]	[5350]	[6370]	[7380]	[7980]
15	110 30	240 29	365 28	480 27	605 26	720 24	835 22	900 20
[6]	[980]	[2120]	[3230]	[4300]	[5370]	[6420]	[7470]	[8225]
23	110 45	240 44	365 43	485 42	605 41	725 39	845 37	930 35
[8]	[980]	[2110]	[3220]	[4330]	[5400]	[6470]	[7550]	
30	110 61	240 60	365 59	490 58	610 57	730 55	855 52	
[10]	[920]	[2050]	[3170]	[4300]	[5390]	[6460]	[7550]	
38	105 76	230 75	360 74	485 73	610 72	730 70	855 68	
[12]	[860]	[1990]	[3120]	[4260]	[5370]	[6460]	[7560]	
45	95 91	225 90	355 90	480 89	605 87	730 85	855 84	
[14]	[790]	[1930]	[3055]	[4185]	[5300]	[6400]		
53	90 106	220 105	345 105	475 104	600 102	725 100		
[16]	[720]	[1870]	[2990]	[4110]	[5230]	[6340]		
61	80 122	210 121	340 120	465 119	590 118	715 116		
[18]	[630]	[1770]	[2890]	[4020]	[5140]	[6260]		
68	70 137	200 136	325 135	455 134	580 133	705 131		
[20]	[550]	[1670]	[2800]	[3940]	[5060]	[6180]		
76	60 153	190 152	315 151	445 150	570 149	700 146		
[22]	[450]	[1570]	[2700]	[3830]	[4960]	[6070]		
83	50 168	175 168	305 167	435 165	560 164	685 161		
[24]	[360]	[1480]	[2600]	[3730]	[4860]	[5970]		
91	40 184	165 184	295 183	420 181	550 179	675 177		
[26]	[270]	[1390]	[2510]	[3640]	[4770]			
98	30 199	155 195	285 194	410 192	540 190			
[28]		[1260]	[2370]	[3520]	[4630]			
106		140 212	270 211	400 209	525 207			
[30]		[1130]	[2240]	[3400]	[4500]			
114		125 230	255 229	385 227	510 224			

**395 c3m/r [24.3/0r jin]**  
**ΔPressure Bar [PSI]**

	[250]	[500]	[750]	[1000]	[1250]	[1500]	[1750]	[2000]	[2250]	[2500]	[2750]
	155	35	50	70	85	105	120	140	155	170	190
[.5]	[560]	[1310]									
1.9	65 4	150 3									
[1]	[770]	[1540]	[2290]	[3080]	[3780]	[4480]	[5170]	[5880]	[6580]	[7270]	[7980]
3.8	85 9	175 9	260 9	350 8	430 8	505 7	585 7	665 6	745 5	820 4	900 3
[2]	[790]	[1580]	[2360]	[3180]	[3930]	[4680]	[5430]	[6180]	[6840]	[7500]	[8170]
7.5	90 18	180 18	265 18	360 17	445 17	530 16	615 15	700 14	775 13	845 11	925 10
[4]	[810]	[1660]	[2480]	[3320]	[4130]	[4940]	[5740]	[6550]	[7230]	[7880]	
15	90 37	190 37	280 37	375 36	465 36	560 35	650 34	740 33	815 31	890 28	
[6]	[820]	[1700]	[2550]	[3420]	[4250]	[5080]	[5920]	[6750]	[7420]	[8000]	
23	90 57	190 56	290 56	385 55	480 54	575 52	670 50	765 49	840 47	905 45	
[8]	[820]	[1700]	[2580]	[3460]	[4300]	[5130]	[5960]	[6800]			
30	90 76	190 75	290 75	390 74	485 73	580 71	675 69	770 68			
[10]	[800]	[1700]	[2590]	[3480]	[4320]	[5160]	[6000]	[6840]			
38	90 95	190 94	295 94	395 93	490 92	585 90	680 88	775 86			
[12]	[770]	[1680]	[2570]	[3470]	[4310]	[5150]	[5990]	[6830]			
45	85 114	190 113	290 113	390 112	485 111	580 109	675 106	770 103			
[14]	[740]	[1640]	[2530]	[3430]	[4280]	[5120]	[5960]				
53	85 133	185 132	285 132	390 131	485 129	580 127	675 124				
[16]	[690]	[1590]	[2480]	[3370]	[4220]	[5060]	[5910]				
61	80 153	180 152	280 152	380 150	475 149	570 146	670 144				
[18]	[640]	[1530]	[2420]	[3310]	[4160]	[5010]	[5870]				
68	70 172	170 171	275 171	375 170	470 169	565 167	665 164				
[20]	[580]	[1470]	[2370]	[3260]	[4110]	[4960]	[5820]				
76	65 191	165 190	270 190	370 189	465 188	560 186	660 184				
[22]	[510]	[1390]	[2290]	[3170]	[4030]	[4880]					
83	60 210	155 209	260 209	360 208	455 207	550 206					
[24]	[440]	[1330]	[2220]	[3100]	[3950]	[4800]					
91	50 230	150 229	250 228	350 227	445 225	540 224					
[26]	[350]	[1240]	[2130]	[3020]	[3880]	[4730]					
98	40 249	140 248	240 247	340 246	440 244	535 242					
[28]	[270]	[1150]	[2050]	[2930]	[3790]	[4650]					
106	30 268	130 267	230 265	330 264	430 261	525 259					
[30]	[180]	[1060]	[1960]	[2850]	[3710]	[4570]					
114	20 287	120 286	220 284	320 283	420 281	515 277					
[35]		[840]	[1760]	[2640]	[3480]						
132		95 335	200 334	300 333	395 332						



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# 2000 Series

## Dimensions

### Standard Mount

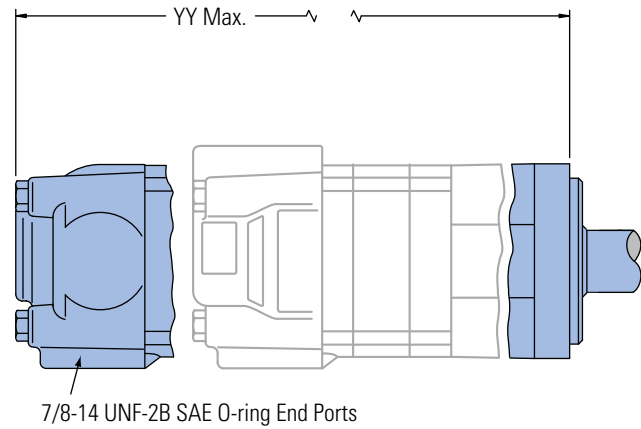
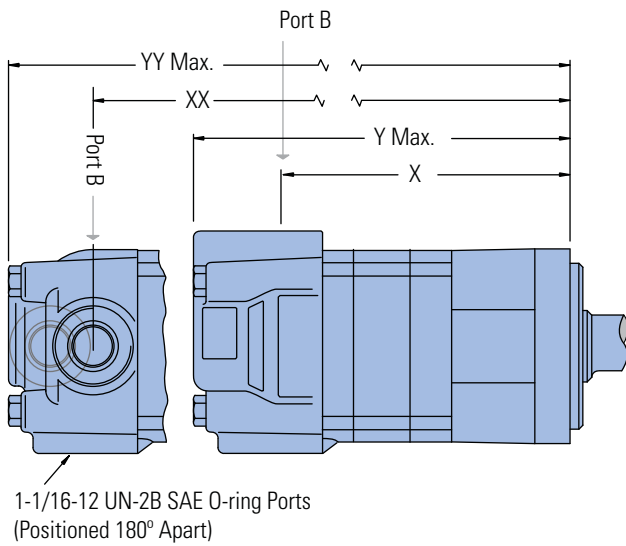
## Ports

- 7/8 -14 UNF-2B SAE O-ring Staggered Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- 1 1/16 -12 UN-2B SAE O-ring Ports (Positioned 180° Apart) (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- 7/8 -14 UNF-2B SAE O-ring End Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- G 1/2 (BSP) Staggered Ports (2)
- G 1/4 (BSP) Case Drain Port (1) or
- Manifold Mount
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1)

## Standard Rotation Viewed from Shaft End

- Port A Pressurized — CW
- Port B Pressurized — CCW

## Standard Mount



### STANDARD MOUNT MOTOR DIMENSIONS

Displacement cm <sup>3</sup> /r [in <sup>3</sup> /r]	X mm [inch]	Y mm [inch]	XX mm [inch]	YY mm [inch]
80 [4.9]	136,9 [5.39]	184,2 [7.25]	139,2 [5.48]	185,4 [7.30]
100 [6.2]	141,5 [5.57]	189,0 [7.44]	143,8 [5.66]	190,3 [7.49]
130 [8.0]	147,9 [5.83]	195,4 [7.69]	150,2 [5.92]	196,6 [7.74]
160 [9.6]	147,9 [5.83]	195,4 [7.69]	150,2 [5.92]	196,6 [7.74]
195 [11.9]	154,7 [6.09]	202,2 [7.96]	157,0 [6.18]	203,2 [8.00]
245 [14.9]	163,7 [6.45]	211,1 [8.31]	166,0 [6.54]	212,4 [8.36]
305 [18.7]	175,1 [6.90]	222,3 [8.75]	177,4 [6.99]	223,5 [8.80]
395 [24.0]	191,0 [7.52]	238,6 [9.39]	193,3 [7.61]	239,8 [9.44]
490 [29.8]	208,4 [8.21]	255,8 [10.07]	210,7 [8.30]	270,1 [10.12]

# 2000 Series

## Dimensions

Standard Mount with  
Integral Relief Valve

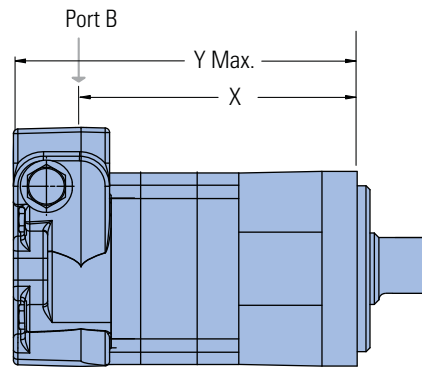
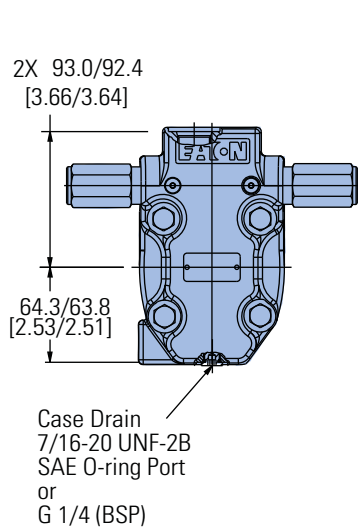
## Ports

7/8 -14 UNF-2B SAE O-ring Staggered Ports (2)  
7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or  
G 1/2 (BSP) Staggered Ports (2)  
G 1/4 (BSP) Case Drain Port (1)

## Standard Rotation Viewed from Shaft End

Port A Pressurized — CW  
Port B Pressurized — CCW

## Standard Mount with Integral Relief Valve



## STANDARD MOUNT MOTOR DIMENSIONS

Displacement cm <sup>3</sup> /r [in <sup>3</sup> /r]	X mm [inch]	Y mm [inch]
80 [4.9]	137,0 [5.40]	184,5 [7.26]
100 [6.2]	141,6 [5.58]	189,0 [7.44]
130 [8.0]	147,9 [5.83]	195,4 [7.69]
160 [9.6]	147,9 [5.83]	195,4 [7.69]
195 [11.9]	154,8 [6.10]	202,2 [7.96]
245 [14.9]	163,7 [6.45]	211,1 [8.31]
305 [18.7]	175,1 [6.90]	222,6 [8.76]
395 [24.0]	191,1 [7.53]	238,6 [9.39]
490 [29.8]	208,4 [8.21]	255,8 [10.07]

C-1

# 2000 Series

## Dimensions

### Wheel Mount

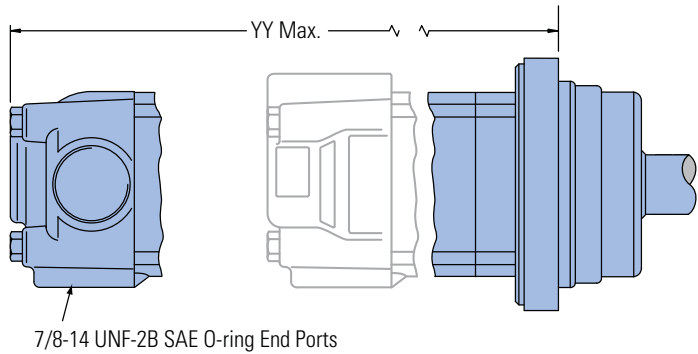
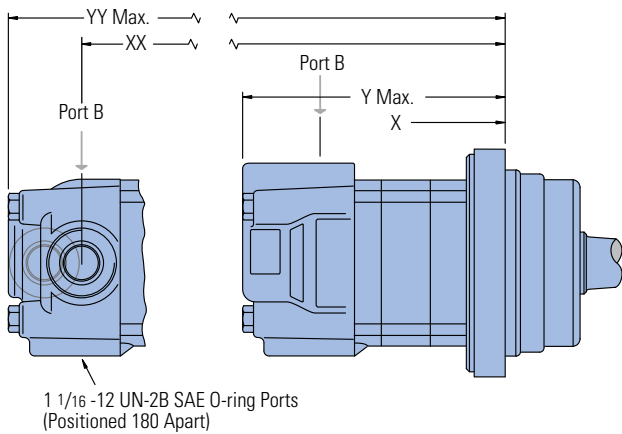
## Ports

- 7/8 -14 UNF-2B SAE O-ring Staggered Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- 1 1/16 -12 UN-2B SAE O-ring Ports (Positioned 180° Apart) (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- 7/8 -14 UNF-2B SAE O-ring End Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- G 1/2 (BSP) Staggered Ports (2)
- G 1/4 (BSP) Case Drain Port (1) or
- Manifold Mount
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1)

## Standard Rotation Viewed from Shaft End

- Port A Pressurized — CW
- Port B Pressurized — CCW

## Wheel Mount



## WHEEL MOUNT MOTOR DIMENSIONS

Displacement	X	Y	XX	YY
cm <sup>3</sup> /r [in <sup>3</sup> /r]	mm [inch]	mm [inch]	mm [inch]	mm [inch]
80 [4.9]	96,8 [3.81]	144,0 [5.67]	99,1 [3,90]	145,3 [5.72]
100 [6.2]	101,3 [3.99]	148,9 [5.86]	103,6 [4.08]	150,2 [5.91]
130 [8.0]	107,8 [4.25]	155,2 [6.11]	110,1 [4.34]	156,5 [6.16]
160 [9.6]	107,8 [4.25]	155,2 [6.11]	110,1 [4.34]	156,5 [6.16]
195 [11.9]	114,6 [4.51]	161,8 [6.37]	116,8 [4.60]	163,1 [6.42]
245 [14.9]	123,5 [4.87]	171,0 [6.73]	125,8 [4.96]	172,3 [6.78]
305 [18.7]	135,0 [5.32]	182,1 [7.17]	137,4 [5.41]	183,4 [7.22]
395 [24.0]	150,9 [5.94]	198,4 [7.81]	153,2 [6.03]	199,7 [7.86]
490 [29.8]	168,2 [6.63]	215,7 [8.49]	170,7 [6.72]	217,0 [8.54]



# 2000 Series

## Dimensions

Wheel Mount with Integral Relief Valve

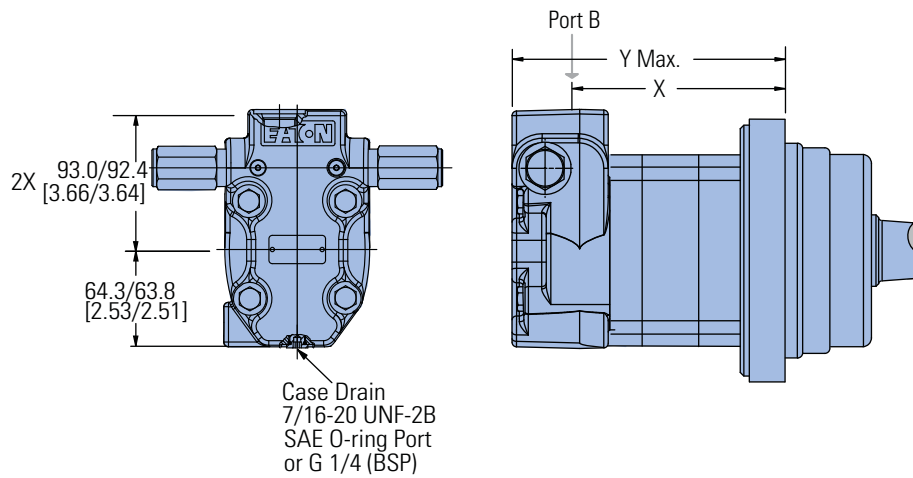
## Ports

- 7/8 -14 UNF-2B SAE O-ring Staggered Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1)
- G 1/2 (BSP) Staggered Ports (2)
- G 1/4 (BSP) Case Drain Port (1)

## Standard Rotation Viewed from Shaft End

- Port A Pressurized — CW
- Port B Pressurized — CCW

## Wheel Mount with Integral Relief Valve



### WHEEL MOUNT MOTOR DIMENSIONS

Displacement cm <sup>3</sup> /r [in <sup>3</sup> /r]	X mm [inch]	Y mm [inch]
80 [4.9]	96,9 [3.82]	144,3 [5.68]
100 [6.2]	101,4 [4.00]	148,9 [5.86]
130 [8.0]	107,8 [4.25]	155,2 [6.11]
160 [9.6]	107,8 [4.25]	155,2 [6.11]
195 [11.9]	114,6 [4.52]	162,1 [6.38]
245 [14.9]	123,5 [4.87]	171,0 [6.73]
305 [18.7]	135,0 [5.32]	182,4 [7.18]
395 [24.0]	151,0 [5.95]	198,4 [7.81]
490 [29.8]	168,2 [6.63]	215,7 [8.49]

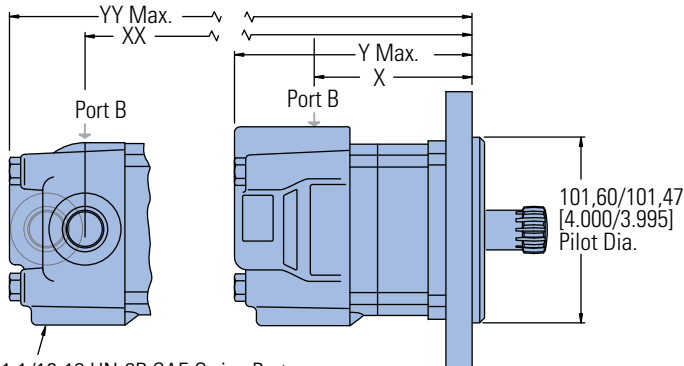
C-1

# 2000 Series

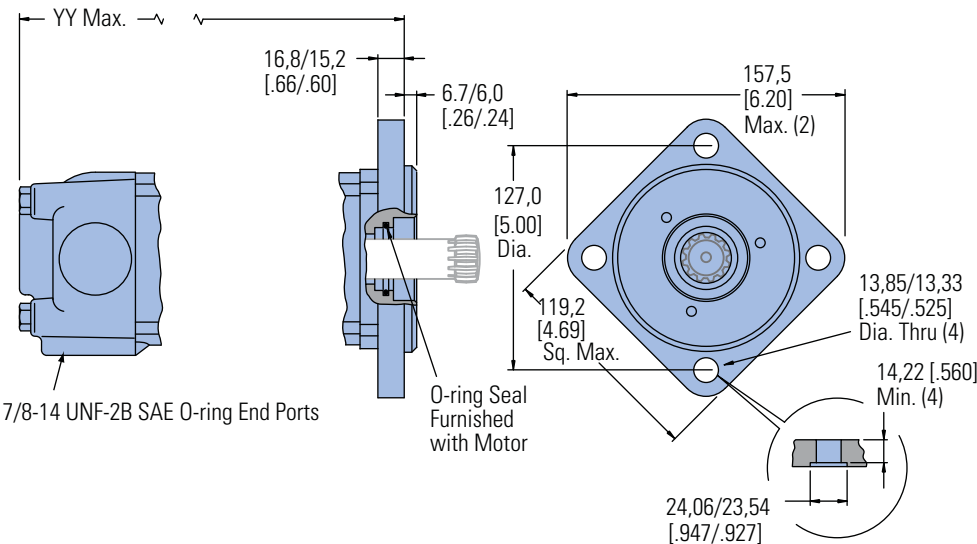
## Dimensions

Bearingless

## Bearingless



1 1/16-12 UN-2B SAE O-ring Ports  
(Positioned 180° Apart)



7/8-14 UNF-2B SAE O-ring End Ports

## Ports

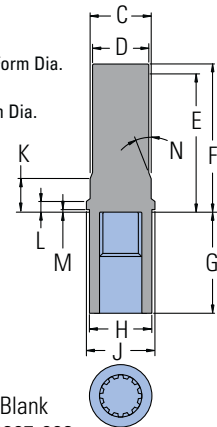
- 7/8 -14 UNF-2B SAE O-ring Staggered Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- 1 1/16 -12 UN-2B SAE O-ring Ports (Positioned 180° Apart) (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- 7/8 -14 UNF-2B SAE O-ring End Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1) or
- G 1/2 (BSP) Staggered Ports (2)
- G 1/4 (BSP) Case Drain Port (1) or
- Manifold Mount
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1)

## Standard Rotation Viewed from Shaft End

- Port A Pressurized — CW
- Port B Pressurized — CCW

## MAT'L

- C 35,86 [1.412] Dia.
- D 34,04 [1.340] Dia.
- E 81,0 [3.19] Min. Full Form Dia.
- F 86,1 [3.39] Max.
- G 62,10 [2.445] Full Form Dia.
- H 38,40 [1.512] Dia.
- J 43,7 [1.72] Dia.
- K 25,91 [1.020]
- L 8,25 [.325]
- M 0,89 [.035]
- N 15°



Mating Coupling Blank  
Eaton Part No. 13307-003

For 2000 Series Bearingless Motor application information contact your Eaton representative (mating coupling blanks available from Eaton Hydraulics).

## Note:

After machining blank, part must be hardened per Eaton specification.

## BEARINGLESS MOTOR DIMENSIONS

Displacement cm <sup>3</sup> /r [in <sup>3</sup> /r]	X mm [inch]	Y mm [inch]	XX mm [inch]	YY mm [inch]
80 [4.9]	79,0 [3.11]	126,5 [4.98]	81,3 [3.20]	127,8 [5.03]
100 [6.2]	83,5 [3.29]	131,4 [5.17]	85,8 [3.38]	132,6 [5.22]
130 [8.0]	89,9 [3.54]	137,7 [5.42]	92,2 [3.63]	139,0 [5.47]
160 [9.6]	89,9 [3.54]	137,7 [5.42]	92,2 [3.63]	139,0 [5.47]
195 [11.9]	96,8 [3.81]	144,3 [5.68]	99,0 [3.90]	145,5 [5.73]
245 [14.9]	105,6 [4.16]	153,5 [6.04]	107,9 [4.25]	154,7 [6.09]
305 [18.7]	117,1 [4.61]	164,6 [6.48]	119,4 [4.70]	165,9 [6.53]
395 [24.0]	133,1 [5.24]	180,9 [7.12]	135,4 [5.33]	182,1 [7.17]
490 [29.8]	150,3 [5.92]	198,2 [7.80]	152,7 [6.01]	199,3 [7.85]

# 2000 Series

## Dimensions

Bearingless with Integral Relief Valve

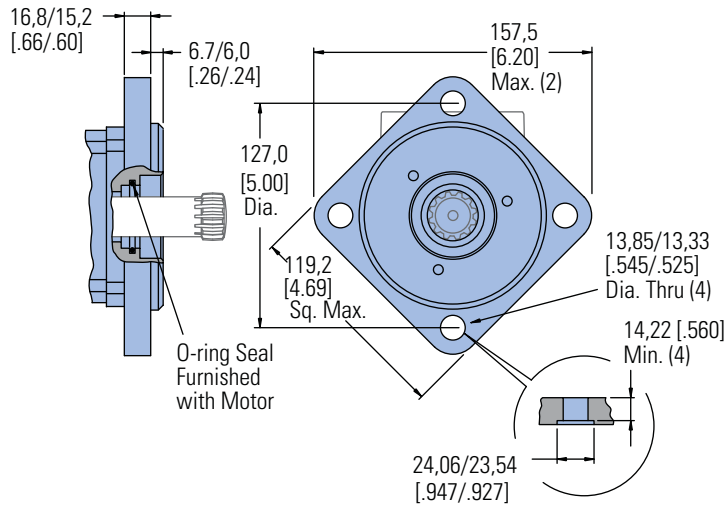
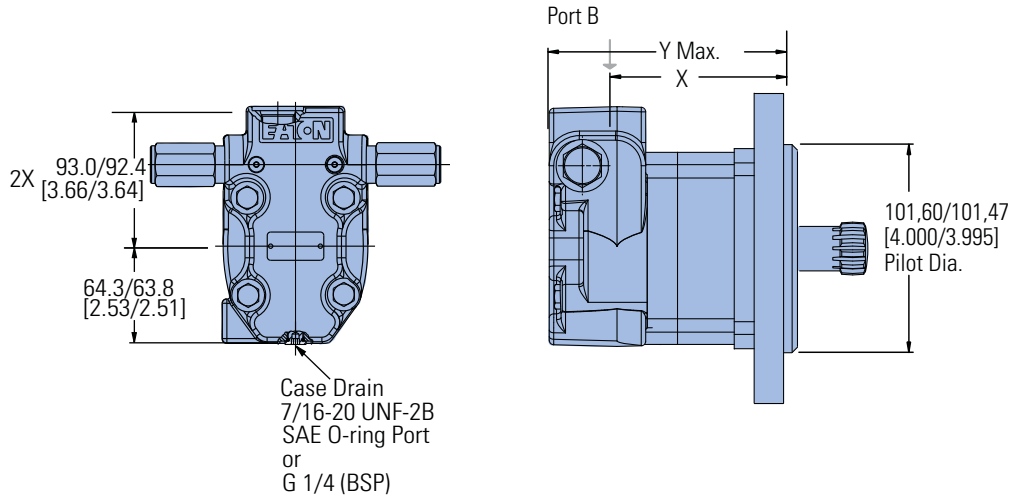
## Ports

- 7/8 -14 UNF-2B SAE O-ring Staggered Ports (2)
- 7/16 -20 UNF-2B SAE O-ring Case Drain Port (1)
- G 1/2 (BSP) Staggered Ports (2)
- G 1/4 (BSP) Case Drain Port (1)

## Standard Rotation Viewed from Shaft End

- Port A Pressurized — CW
- Port B Pressurized — CCW

## Bearingless with Integral Relief Valve



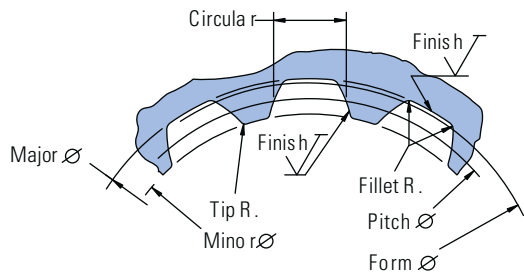
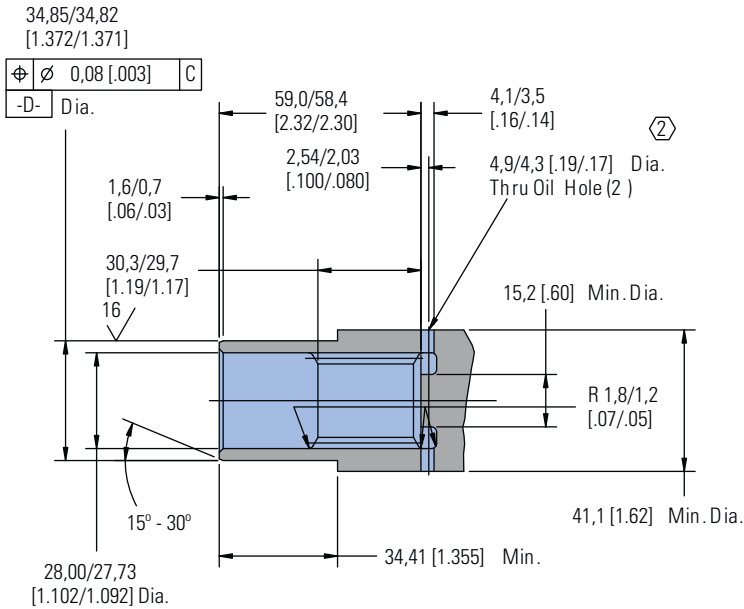
## BEARINGLESS MOTORS DIMENSIONS

Displacement cm <sup>3</sup> /r [in <sup>3</sup> /r]	X mm [inch]	Y mm [inch]
80 [4.9]	79,0 [3.11]	126,8 [4.99]
100 [6.2]	83,5 [3.29]	131,4 [5.17]
130 [8.0]	89,9 [3.54]	137,7 [5.42]
160 [9.6]	89,9 [3.54]	137,7 [5.42]
195 [11.9]	96,8 [3.81]	144,6 [5.69]
245 [14.9]	105,6 [4.16]	153,5 [6.04]
305 [18.7]	117,1 [4.61]	164,9 [6.49]
395 [24.0]	133,1 [5.24]	180,9 [7.12]
490 [29.8]	150,3 [5.92]	198,2 [7.80]

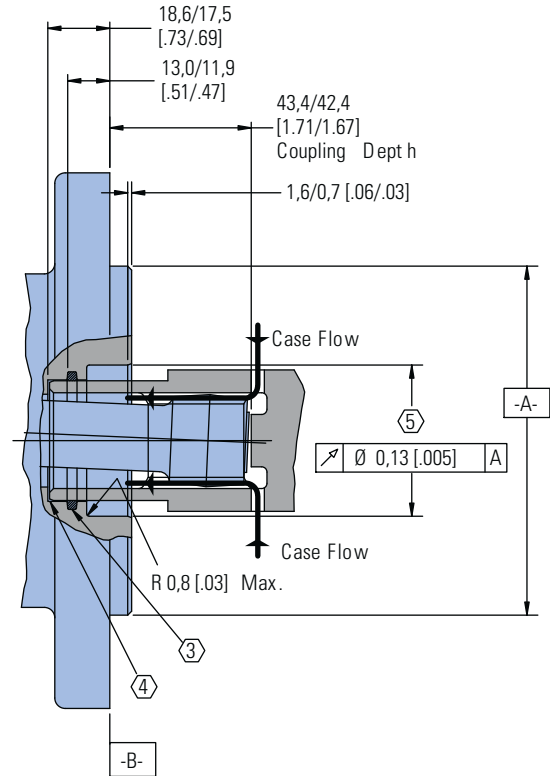
# 2000 Series

## Installation Information

### Bearingless



- ① Internal spline in mating part to be per spline data. Specification material to be ASTM A304, 8620H vacuum degassed alloy steel carbonize to a hardness of 59-62 HRc with case depth (to 50HRc) of 0,076 -1,02 [.030 -0.040]. Dimensions apply after heat treat.
- ② Mating part to have critical dimensions as shown. Oil holes must be provided and open for proper oil circulation.
- ③ Seal to be furnished with motor for proper oil circulation thru splines.
- ④ Some means of maintaining clearance between shaft and mounting flange must be provided.
- ⑤ Counterbore designed to adapt a standard sleeve bearing 35,010 -35,040 [1.3784 -1.3795] I.D. by 44,040 -44,070 [1.7339 -1.7350] O.D. (Oilite Bronze Sleeve Bearing AAM3544-22).



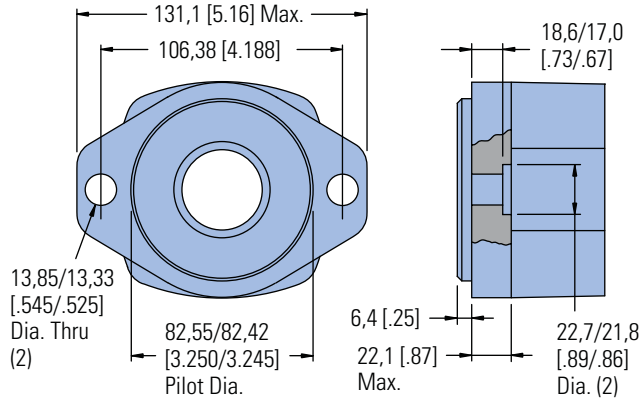
Spline Pitch.....	12/24
Pressure Angle.....	30°
Number of teeth.....	12
Class of Fit.....	Ref. 5
Type of Fit.....	Side
Pitch Diameter.....	Ref. 25,400000 [1.0000000]
Base Diameter.....	Ref. 21,997045 [.8660254] $\text{C} \varnothing 0,21 [0.008]   D$
Major Diameter.....	(27,74 [1.092] Max. 27,59 [1.086] Min.)
Minor Diameter.....	23,097 - 23,224 [.9093 - .9143]
Form Diameter, Min.....	29,93 [1.060]
Fillet Radius.....	0,64 - 0,76 [.025 - .030]
Tip Radius.....	0,25 - 0,38 [.010 - .015]
Finish.....	1,6 (63)
Involute Profile Variation.....	+0,000 -0,025 [+0.000 -0.010]
Total Index Variation.....	0,038 [.0015]
Lead Variation.....	0,013 [.0005]
Circular Space Width:	
Maximum Actual.....	4,318 [1.700]
Minimum Effective.....	4,216 [1.660]
Maximum Effective.....	Ref. 4,270 [1.681]
Minimum Actual.....	Ref. 4,247 [1.672]
Dimension Between Two Pins.....	Ref. 19,020 - 19,190 [.7488 - .7555]
Pin Diameter.....	4,496 [1.770] Pins to Have 3,38 [.133]
	Wide Flat for Root Clearance

# 2000 Series

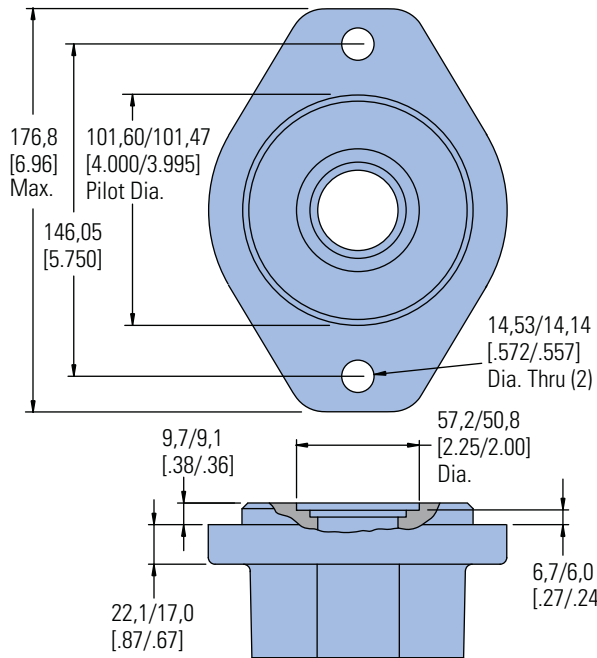
Dimensions

Mounting Options

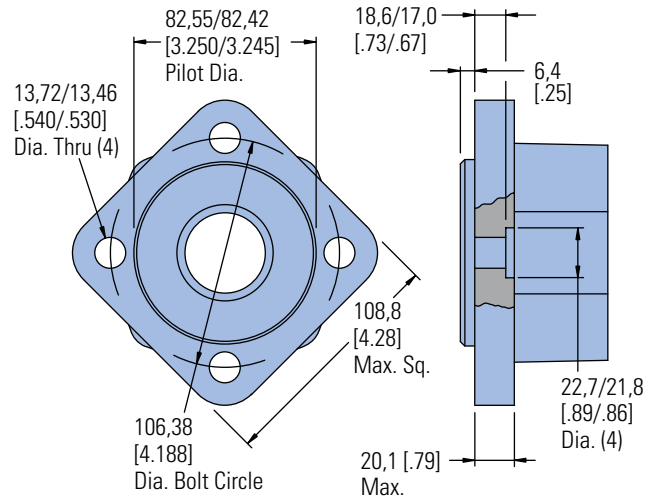
## SAE A – Two Bolt (Standard Motor)



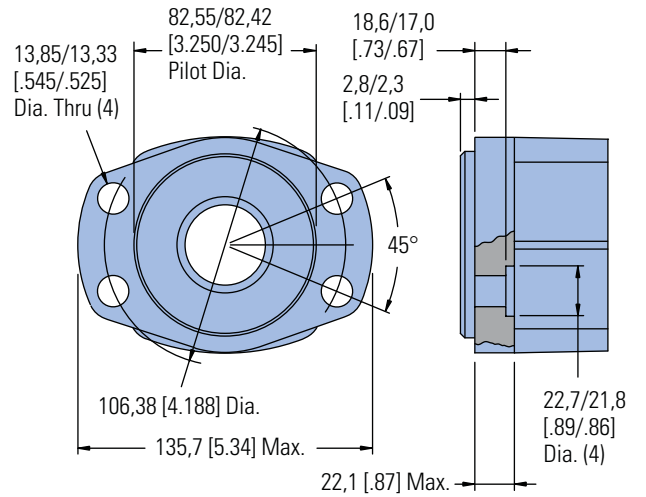
## SAE B – Two Bolt



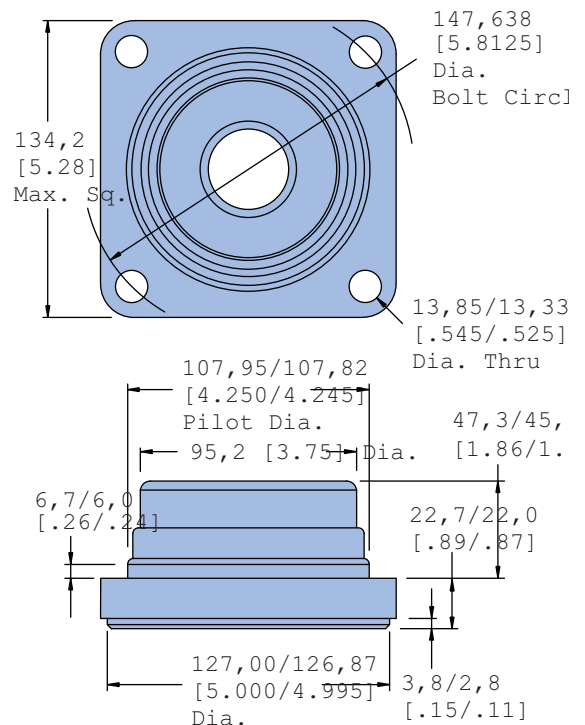
## Four Bolt



## Four Bolt Magneto



## Four Bolt (Wheel Motor)



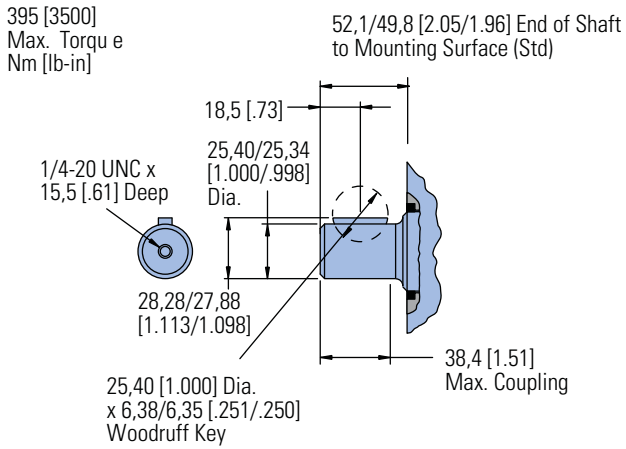
C-1

# 2000 Series

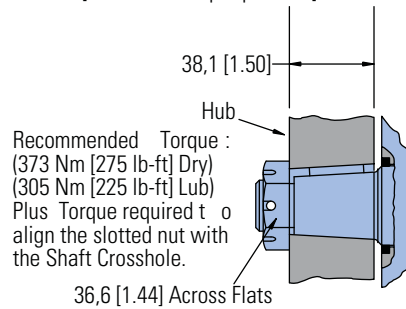
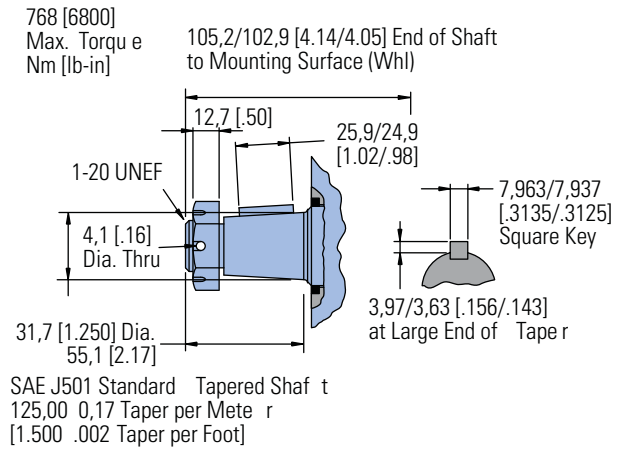
## Dimensions

### Shafts

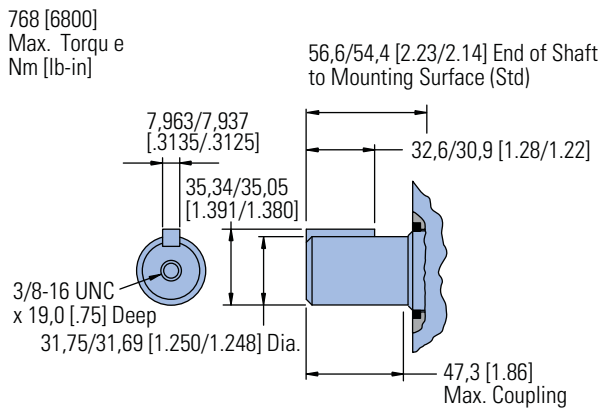
#### 1 Inch Straight



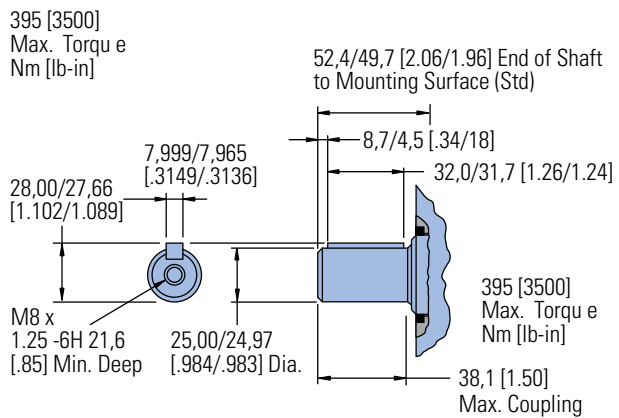
#### 1 1/4 Inch Tapered



#### 1 1/4 Inch Straight



#### 25 mm Straight





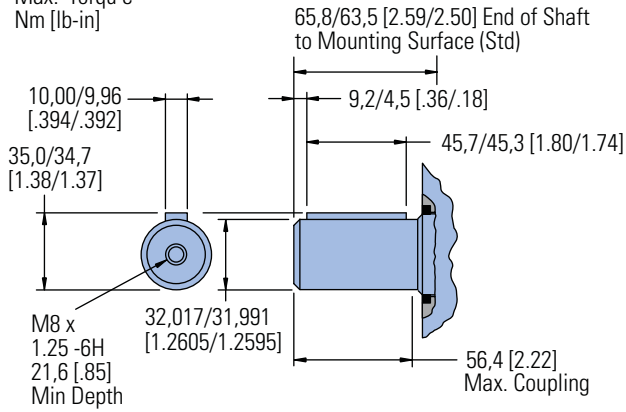
# 2000 Series

## Dimensions

### Shafts

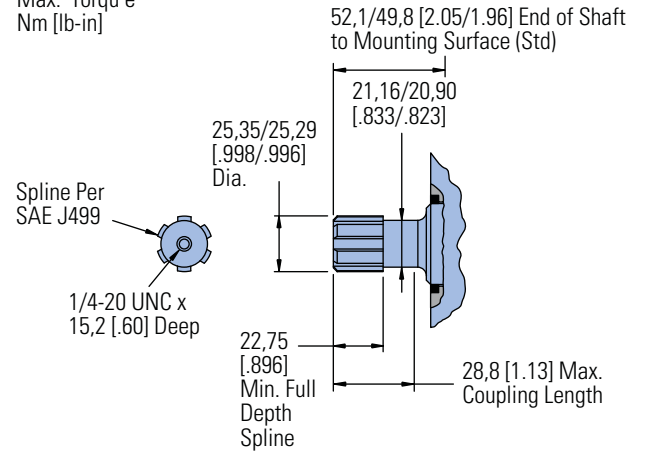
#### 32 mm Straight

768 [6800]  
Max. Torque  
Nm [lb-in]



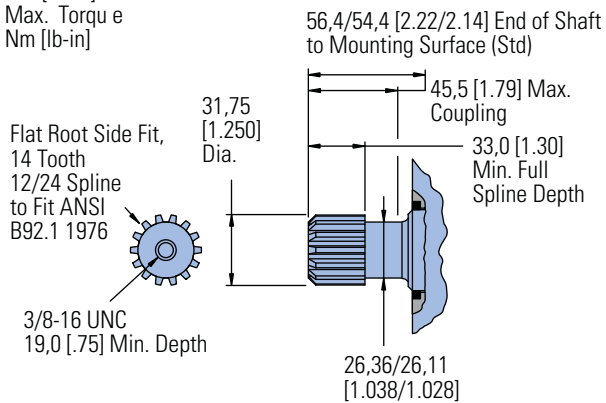
#### SAE 6B Splined

395 [3500]  
Max. Torque  
Nm [lb-in]



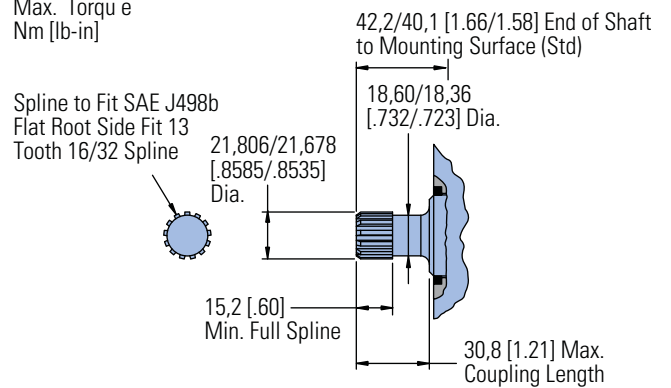
#### 1 1/4 -14 Tooth Splined

768 [6800]  
Max. Torque  
Nm [lb-in]



#### 13 Tooth Splined

141 [1250]  
Max. Torque  
Nm [lb-in]



C-1

# 2000 Series

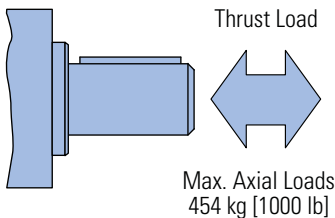
## Shaft Side Load Capacity

These curves indicate the radial load capacity on the motor shaft at various locations with an allowable external thrust load of 454 kg [1000 lb].

### Note:

Case pressure will increase the allowable inward thrust load and decrease the allowable outward thrust load. Case pressure will push outward on the shaft at 61 kg/7 Bar [135 lb/100 PSI].

**Each curve is based on B 10 bearing life (2000**



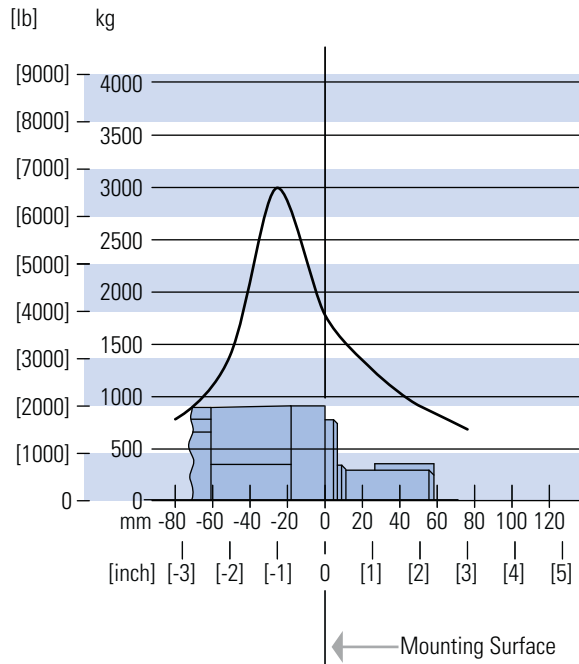
### hours of 12,000,000 shaft revolutions at 100 RPM) at rated output torque.

To determine radial load at speeds other than 100 RPM, multiply the load values given on the bearing curve by the factors in the chart below.

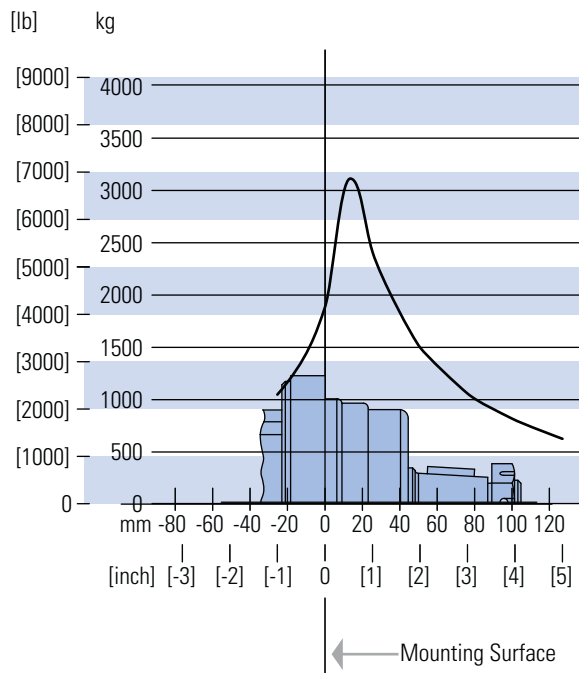
RPM	Multiplication Factor
50	1.23
100	1.00
200	0.81
300	0.72
400	0.66
500	0.62
600	0.58
700	0.56
800	0.54

For 3,000,000 shaft revolutions or 500 hours—Increase these shaft loads 52%.

Standard Motor  
Straight and Splined Shafts



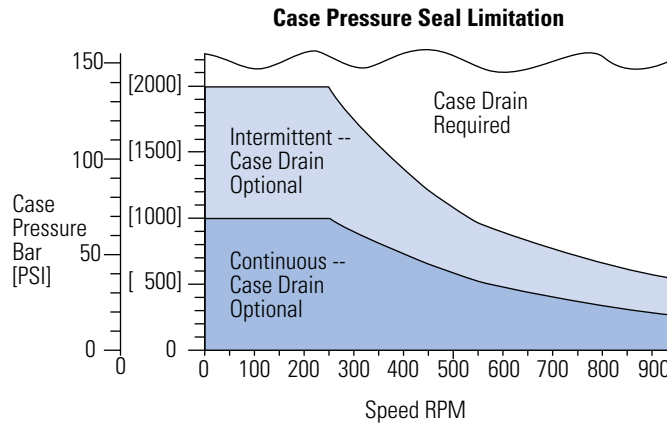
Wheel Motor  
Tapered Shaft



# 2000 Series

## Case Pressure and Case Porting

Char-Lynn 2000 Series motors are durable and have long life as long as the recommended case pressure is not exceeded. Allowable case pressure is highest at low shaft speeds. Consequently, motor life will be shortened if case pressure exceeds these ratings (acceptability may vary with application). Determine if an external case drain is required from the case pressure seal limitation chart.



### Case Porting Advantage

**Contamination Control** — flushing the motor case.

**Cooler Motor** — exiting oil draws motor heat away.

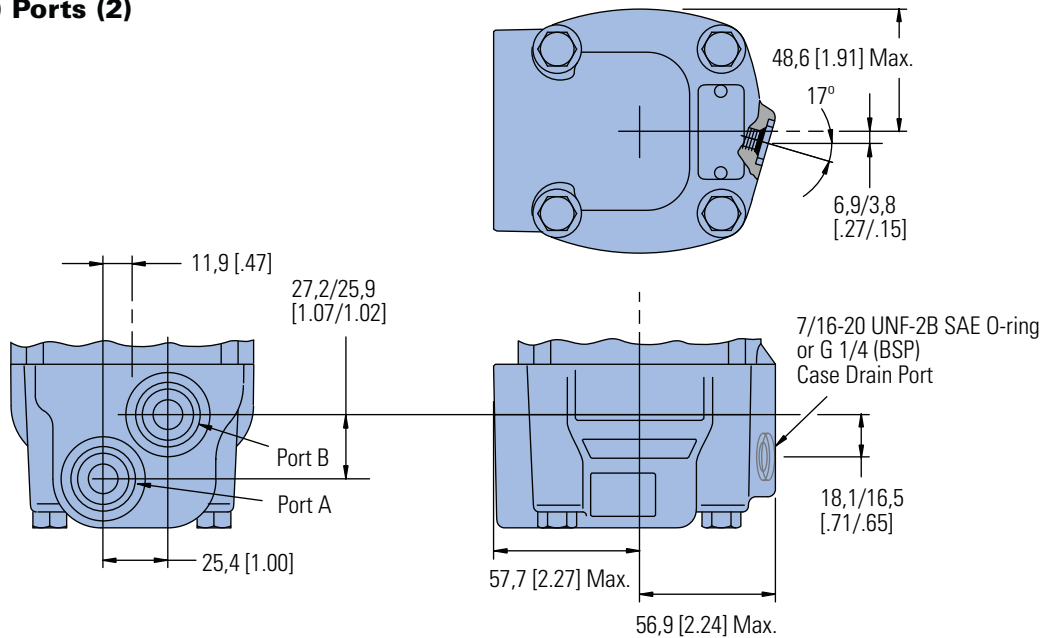
**Extend Motor Seal Life** — maintain low case pressure with a preset restriction in the case drain line.

# 2000 Series

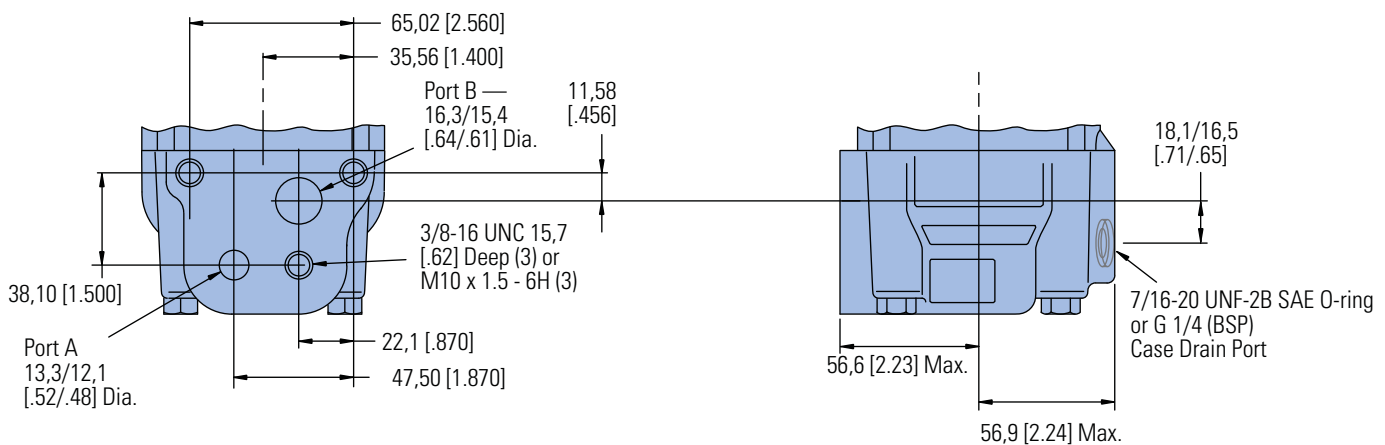
## Dimensions

### Ports

#### 7/8-14 UNF-2B SAE O-ring Ports (2) or G 1/2 (BSP) Ports (2)



#### Manifold Mount

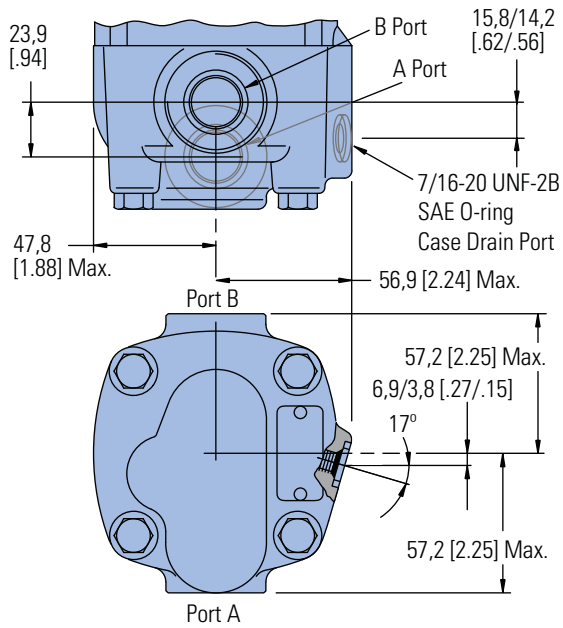


# 2000 Series

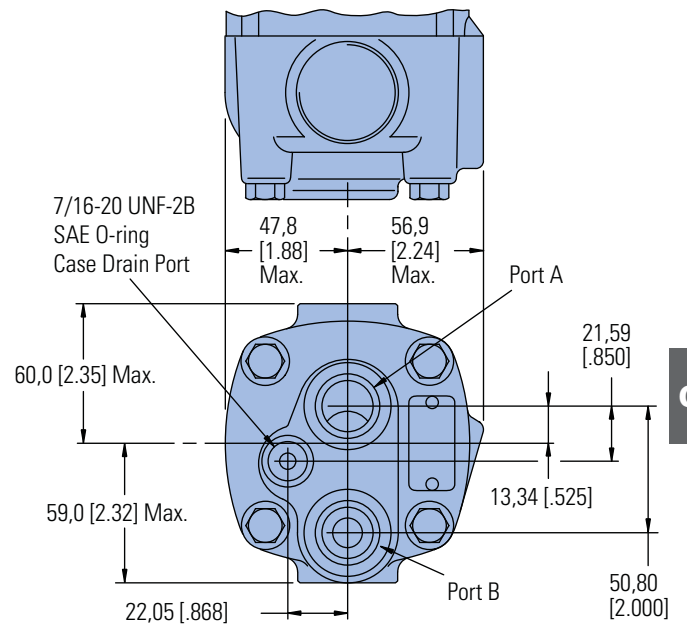
## Dimensions

### Ports

#### 1-1/16-12 UN-2B SAE O-ring Ports (2) Positioned 180° Apart



#### 7/8-14 UNF-2B SAE O-ring End Ports (2)



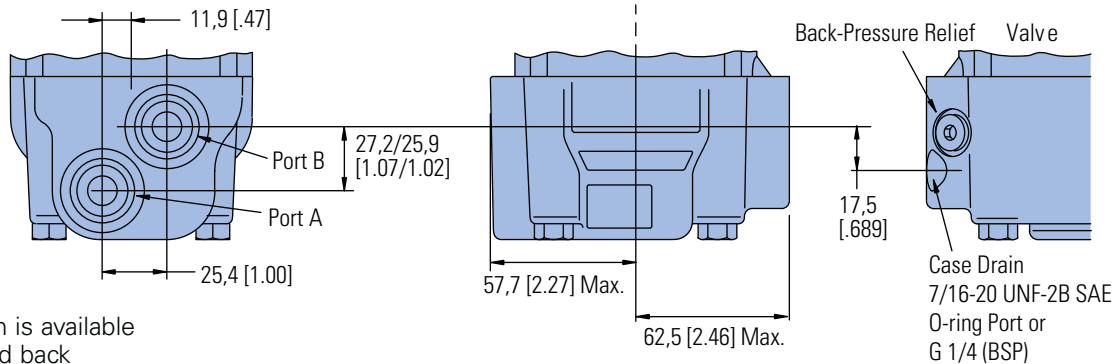
C-1

# 2000 Series

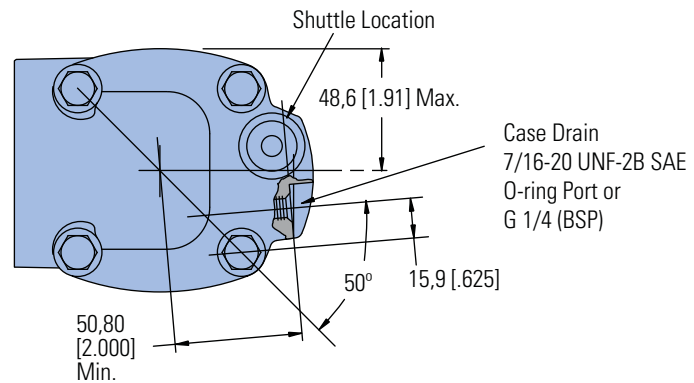
## Dimensions

### Ports with Shuttle

#### 7/8 -14 UNF-2B SAE O-ring Ports (2) or G 1/2 (BSP) Ports (2)

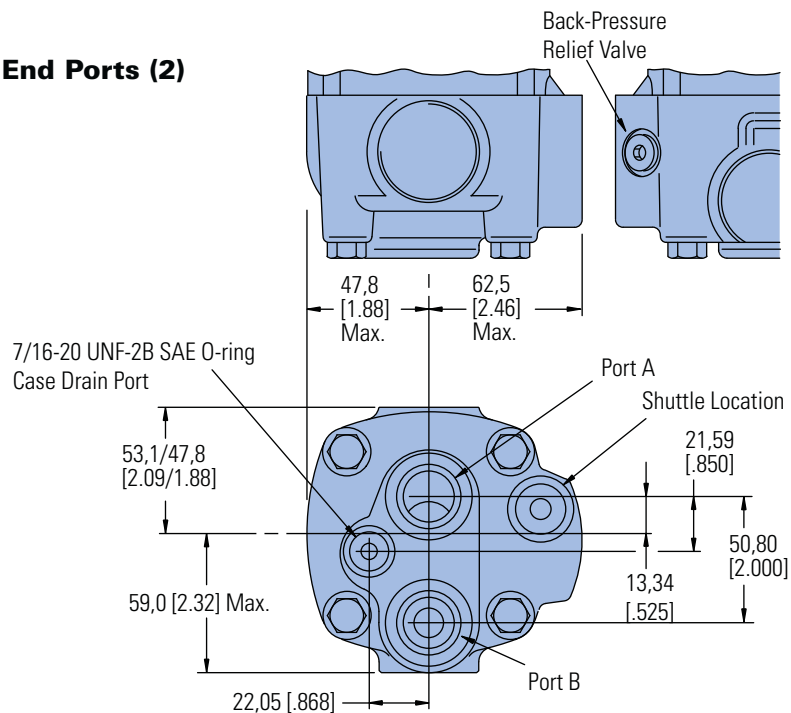


This port option is available with shuttle and back pressure relief valve for closed loop applications.



#### 7/8 -14 UNF-2B SAE O-ring End Ports (2)

This port option is available with shuttle and back pressure relief valve for closed loop applications.





# 2000 Series

## Product Numbers

### Note:

For 2000 Series Motors with a configuration **Not Shown** in the charts below: Use model code number system on the next page to specify product in detail.

Use digit prefix — 104-, 105-, or 106- plus four digit number from charts for complete product number— Example 106-1043.

**Orders will not be accepted without three digit prefix.**

MOUNTING	SHAFT	PORT SIZE	DISPL. cm <sup>3</sup> /r [in <sup>3</sup> /r] / PRODUCT NUMBER									
			80 [4.9]	90* [5.5]	100 [6.2]	130 [8.0]	160 [9.6]	195 [11.9]	245 [14.9]	305 [18.7]	395 [24.0]	490 [29.8]
2 Bolt SAE A Flange	1 Inch Straight	7/8 -14 O-ring Staggered	104-1001	—	-1002	-1003	-1004	-1005	-1006	-1007	-1143	—
		1 1/16 -12 O-ring 180° Apart	104-1037	—	-1038	-1039	-1040	-1041	-1042	-1043	-1044	—
	1 1/4 Inch Straight	7/8 -14 O-ring Staggered	104-1022	—	-1023	-1024	-1025	-1026	-1027	-1028	-1228	-1420
		1 1/16 -12 O-ring 180° Apart	104-1061	—	-1062	-1063	-1064	-1065	-1066	-1067	-1068	-1421
	1 1/4 Inch 14 T Splined	7/8 -14 O-ring Staggered	104-1029	—	-1030	-1031	-1032	-1033	-1034	-1035	-1229	-1422
		1 1/16 -12 O-ring 180° Apart	104-1087	—	-1088	-1089	-1090	-1091	-1092	-1093	-1094	-1423
2 Bolt SAE B Flange	1 1/4 Inch Straight	7/8 -14 O-ring Staggered	104-1200	—	-1201	-1202	-1203	-1204	-1205	-1206	-1207	—
	1 1/4 Inch Involute SAE C Splined	7/8 -14 O-ring Staggered	104-1208	—	-1209	-1210	-1211	-1212	-1213	-1214	-1215	—
	1 Inch SAE 6B Splined	7/8 -14 O-ring Staggered	104-1193	—	-1194	-1195	-1196	-1197	-1198	-1199	—	—
	7/8 Inch SAE B Splined	7/8 -14 O-ring Staggered	104-1216	—	-1217	-1218	-1219	-1220	—	—	—	—
Standard with 4 Bolt Flange	32 mm Straight	G 1/2 (BSP)	104-1384	—	-1385	-1386	-1387	-1388	-1389	-1390	-1391	—
	1 1/4 Inch 14 T Splined	G 1/2 (BSP)	104-1376	—	-1377	-1378	-1379	-1380	-1381	-1382	-1383	—
Wheel Motor	1 1/4 Inch Straight	7/8 -14 O-ring Staggered	105—	—	—	—	—	—	—	—	—	-1148
		1 1/16 -12 O-ring 180° Apart	105—	—	—	—	—	—	—	—	—	-1149
	32 mm Straight	G 1/2 (BSP)	105-1134	—	-1135	-1136	-1137	-1138	-1139	-1140	-1141	—
	1 1/4 Inch Tapered	7/8 -14 O-ring Staggered	105-1001	—	-1002	-1003	-1004	-1005	-1006	-1007	-1060	-1152
		1 1/16 -12 O-ring 180° Apart	105-1071	—	-1072	-1073	-1074	-1075	-1076	-1077	-1078	—
	1 1/4 Inch 14 T Splined	7/8 -14 O-ring Staggered	105-1029	—	-1030	-1031	-1032	-1033	-1034	-1035	-1096	—
1 1/16 -12 O-ring 180° Apart		105-1079	—	-1080	-1081	-1082	-1083	-1084	-1085	-1086	—	
Bearingless	G 1/2 (BSP)	7/8 -14 O-ring Staggered	106-1008	—	-1009	-1010	-1011	-1012	-1013	-1014	-1015	-1047
		G 1/2 (BSP)	106-1038	—	-1039	-1040	-1041	-1042	-1043	-1044	-1045	—

\*New Release

106-1044

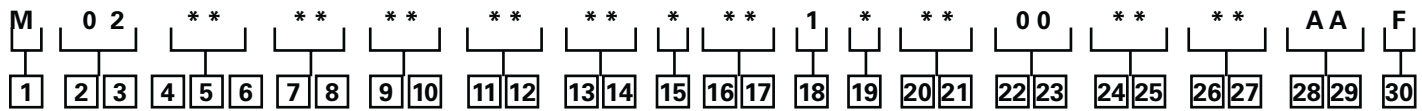
## Motors with Corrosion Protection

MOUNTING	SHAFT	PORT SIZE	DISPL. cm <sup>3</sup> /r [in <sup>3</sup> /r] / PRODUCT NUMBER									
			80 [4.9]	90* [5.5]	100 [6.2]	130 [8.0]	160 [9.6]	195 [11.9]	245 [14.9]	305 [18.7]	395 [24.0]	490 [29.8]
2 Bolt SAE A Flange	1 inch Straight	7/8 -14 O-ring Staggered	104-1528	—	-1529	-1530	-1531	-1532	-1533	-1534	-1519	-1535
	1 1/4 Inch Straight	7/8 -14 O-ring	104-1516	—	-1536	-1537	-1538	-1539	-1452	-1479	-1509	-1489

\*New Release

# 2000 Series

## Model Code



The following 30-digit coding system has been developed to identify all of the configuration options for the 2000 Series motor. Use this model code to specify a motor with the desired features. All 30 digits of the code must be present when ordering. You may want to photocopy the matrix below to ensure that each number is entered in the correct box.

### 1 Product

**M – 2000 Series Motor**

### 2, 3 Product Series

**02 – 2000 Series Motor**

### 4, 5, 6 Displacement cm<sup>3</sup>/r [in<sup>3</sup>/r]

**049 – 80.6 cm<sup>3</sup>/r [4.92]**  
 055 – 90.6 cm<sup>3</sup>/r [5.53 in<sup>3</sup>/r]  
**062 – 101.6 cm<sup>3</sup>/r [6.20 in<sup>3</sup>/r]**  
**080 – 130.6 cm<sup>3</sup>/r [7.97 in<sup>3</sup>/r]**  
**096 – 158.1 cm<sup>3</sup>/r [9.65 in<sup>3</sup>/r]**  
**119 – 194.8 cm<sup>3</sup>/r [11.89 in<sup>3</sup>/r]**  
**149 – 244.3 cm<sup>3</sup>/r [14.91 in<sup>3</sup>/r]**  
**187 – 306.6 cm<sup>3</sup>/r [18.71 in<sup>3</sup>/r]**  
**240 – 393.8 cm<sup>3</sup>/r [24.03 in<sup>3</sup>/r]**  
 298 – 489.0 cm<sup>3</sup>/r [29.84 in<sup>3</sup>/r]

### 7, 8 Mounting Type

**AB – Wheel, 4 Bolt: 108.0 [4.25] Pilot Dia. 13.59 [.535] Dia. Holes on 147.6 [5.81] Dia. Bolt Circle. 127.0 [5.00] Dia. Rear Mount Pilot**

**AC – Standard, 2 Bolt: 82.6 [3.25] Pilot Dia. 13.59 [.535] Dia. Holes on 106.4 [4.19] Dia. Bolt Circle. SAE A**

AD – Bearingless (w/ Leakage Slots), 4 Bolt: 101.6 [4.00] Pilot Dia. 13.59 [5.35] Dia. Holes on 127.0 [5.00] Dia. Bolt Circle

AF – Standard, 2 Bolt: 101.6 [4.00] Pilot Dia. 14.35 [5.65] Dia. Holes on 146.0 [5.75] Dia. Bolt Circle. SAE B

**AH – Standard, 4 Bolt: 82.6 [3.25] Pilot Dia. 13.59 [5.35] Dia. Holes on 106.4 [4.19] Dia. Bolt Circle**

**AJ – Standard (Magneto), 4 Bolt: 82.6 [3.25] Pilot Dia. 13.59 [5.35] Dia. Holes on 106.4 [4.19] Dia. Bolt Circle. 2.79 [1.10] Pilot Length**

AL - Wheel (European), 4 Bolt: 125 [4.92] Pilot Dia. 13.79 [5.43] Dia. Holes on 159.99 [6.299] Dia. Bolt Circle

AP – Wheel, 4 Bolt: 108.0 [4.25] Pilot Dia. 13.59 [5.35] Dia. Holes on 147.6 [5.81] Dia. Bolt Circle. 127.0 [5.00] Dia. Rear Mount Pilot. Spigot Reduced to 88.9 [3.50] Dia. by 25.4 [1.00] Depth.

AZ – Bearingless (w/ Leakage Slots), 4 Bolt: 100.0 [3.94] Pilot Dia. 11.0 [4.3] Dia. Holes on 125.0 [4.92] Dia Bolt Circle (European)

### 9, 10 Output Shaft

**00 – None (Bearingless)**

**01 – 25.40 [1.000] Dia. Straight Shaft with 1/4-20UNC-2B Thread in End, 6.35 [1.250] Wide x 25.40 [1.000] Dia. Woodruff Key**

**02 – 31.75 [1.250] Dia. Straight Shaft with .375-16UNC-2B Thread in End, 7.938 [3.125] Sq x 31.75 [1.250] Straight Key**

**03 – 31.75 [1.250] Dia. .125:1 Tapered Shaft per SAE J501 with/1.000-20 UNEF-2A Threaded Shaft End and Slotted Hex Nut, 7.938 [3.125] Sq x 25.40 [1.0] Straight Key**  
**04 – 31.75 [1.250] Dia. Flat Root Side Fit, 14 Tooth, 12/24 DP 30° Involute Spline w/ .375-16UNC-2B Thread in End, 33.0 [1.30] Min. Full Spline Length**

05 – 25.40 [1.000] Dia. 6B Spline per SAE J499 with .250-20UNC-2B Thread in End, 22.76 [8.96] Min. Full Spline Length

07 – 22.22 [8.75] Dia. Flat Root Side Fit, 13 Tooth, 16/32 DP 30° SAE B Involute Spline, 15.2 [6.0] Min. Full Spline Length

**16 – 32.00 [1.260] Dia. Straight Shaft with M8 x 1.25-6H Thread in End, 9.982 [3.930] W x 7.995 [3.132] H x 45.00 [1.772] L Key**

17 – 31.75 [1.250] Dia. Straight Shaft With 3/8 -16 UNC-2B Thread in End, 7.938 [3.125] Sq x 31.75 [1.250] Straight Key, Corrosion Resistant (Seal area to shaft end)

18 – 31.75 [1.250] Dia. .125:1 Tapered Shaft per SAE J501 with 1.000-20UNEF-2A Threaded Shaft End and Slotted Hex Nut, 7.938 [3.125] Sq x 25.40 [1.000] Straight Key, Corrosion Resistant (Under seal area only)

19 – 25.00 [9.84] Dia. Straight Shaft with M8 x 1.25-6H Thread in End, 7.982 [3.142] W x 6.954 [2.738] H x 31.82 [1.254] L Key

28 – 32.00 [1.260] Dia. 10:1 Tapered Shaft Per ISO R775 with M10 X 1.50-6H Thread in End, 6.00 [2.36] Sq. x 50.00 [1.968] Key

39 – None (Bearingless)

European Spline  
 41 – 35.00 [1.378] Dia. 10:1 Tapered Shaft Per ISO R775 with M20 x 1.5-6g Threaded Shaft End and Slotted Hex Nut, 6.00 [2.36] Sq. X 20.00 [7.87] Key

42 – 35.00 [1.378] Dia. Straight Shaft with M8 x 1.25-6H Thread in End, 9.982 [3.930] W x 7.995 [3.132] H x 45.00 [1.772] L Key

### 11, 12 Ports

**AA – .875-14 UNF-2B SAE O-ring Ports - Staggered Ports**

AB – 12.70 [5.00] and 15.88 [6.25] Dia. Manifold Ports with 3 x .375-16 UNC-2B Port Block Mounting Holes

AC – .875-14 UNF-2B SAE O-ring Ports - Ports Oriented 180° to each other

AE – 12.70 [5.00] And 15.88 [6.25] Dia. Manifold Ports with 3 x M10 x 1.5-6H Port Block Mounting Holes

**AF – 1.0625-12 UN-2B SAE O-ring Ports - Ports Oriented 180° to each other**

**AG – G-1/2 BSP Straight THD Ports - Staggered Ports**

AN – G-1/2 BSP Straight THD Ports - End Ported

AR – .875-14 UNF-2B SAE O-ring Ports - End Ported, Cast Boss Removed

AS – G-1/2 Bsp Straight THD Ports - Staggered Port with 2 x M10 x 1.5-6H Port Block Mounting Holes - European

### 13, 14 Case Flow Options

Shuttles available with port code AA only)

**01 – .4375-20 UNF-2B SAE O-Ring Port**

**02 – G 1/4 BSP Straight THD Port**

09 – Reverse Flow Shuttle Valve w/ G-1/4 BSP Straight THD Port, .062 Dia. Shuttle Flow Orifice

13 – Reverse Flow Shuttle Valve w/ .4375-20 UNF-2B SAE O-Ring Port, .062 Dia. Shuttle Flow Orifice

### 15 Low Pressure Relief

**0 – None**

A – Set at 4.5 bar [65 lbf/in<sup>2</sup>]  
 B – Set at 15.2 bar [220 lbf/in<sup>2</sup>]  
 C – Set at 20.7 bar [300 lbf/in<sup>2</sup>]  
 E – Set at 11.03 bar [160 lbf/in<sup>2</sup>]

### 16, 17 Pressure/Flow Option

Integral Cross-Over Relief Valve:

**00 – None**

30 – Set at 103.4 bar [1500 lbf/in<sup>2</sup>]  
 31 – Set at 120.6 bar [1750 lbf/in<sup>2</sup>]  
 32 – Set at 137.9 bar [2000 lbf/in<sup>2</sup>]  
 33 – Set at 155.1 bar [2250 lbf/in<sup>2</sup>]  
 34 – Set at 172.4 bar [2500 lbf/in<sup>2</sup>]  
 35 – Set at 189.6 bar [2750 lbf/in<sup>2</sup>]  
 36 – Set at 206.8 bar [3000 lbf/in<sup>2</sup>]

### 18 Geroler Option

**1 – Standard**

### 19 Seal Options

**0 – Standard**

1 – Viton  
 2 – Viton Shaft Seal  
 4 – Seal Guard

### 20, 21 Accessories

**00 – None**

AD – M 12 Threaded Connector, Digital Speed Pickup (30 Pulse)  
 AE – M 12 Threaded Connector, Long Body Digital Speed and Direction Pickup (1 = Power Supply, Pin 2 = Output Signal 1, Pin 3 = Common, Pin 4 = Output Signal 2)

### 22, 23 Special Features (Hardware)

**00 – None**

### 24, 25 Special Features (Assembly)

**00 – None**

AB – Reverse Rotation  
 AE – Flange Rotated 45 Degrees

### 26, 27 Paint/Packaging

**AA – No Paint, Indiv. Box**  
**AB – Low Gloss Black Primer, Indiv. Box**

### 28, 29 Customer ID

**AA – None**

### 30 Design Code

**F – Sixth**