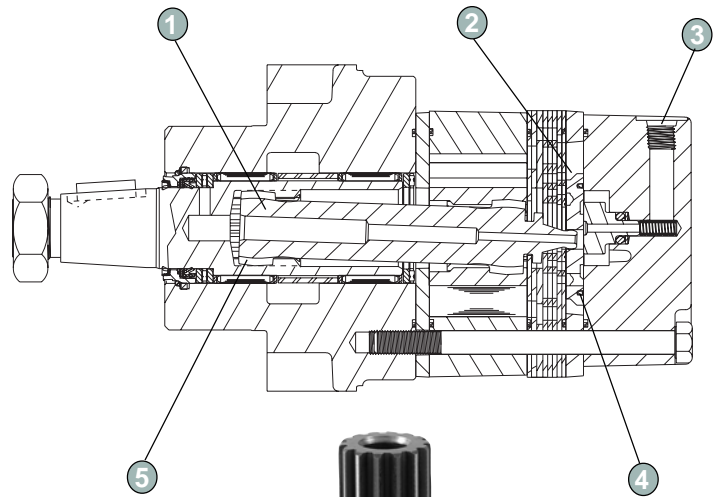


FEATURES

- ① **Heavy-Duty Drive Link** is up to 30% stronger than competitive designs for longer life.
- ② **Three-Zone Orbiting Valve** precisely meters oil to produce exceptional volumetric efficiency.
- ③ **Standard Case Drain** increases shaft seal life by reducing pressure on seal.
- ④ **Rubber Energized Steel Face Seal** does not extrude or melt under high pressure or high temperature.
- ⑤ **Forced Drive Link Lubrication** reduces wear and promotes longer life from motor.



The HB Series motor is the leader in its class, offering high efficiency and durability. The three-zone orbiting valve, laminated manifold and Roller Stator® motor work harmoniously to produce high overall efficiencies over a wide range of operating conditions. The standard case drain increases shaft seal life by reducing internal pressures experienced by the seal. Case oil leakage is also directed across all driveline components, increasing motor life. An internal drain option is also available. At the heart of the motor is a heavy-duty driveline, offering 30% more torque capacity than competitive designs. These features make the HB Series motor the preferred choice for applications requiring peak efficiency for continuous operation.

SPECIFICATIONS

Code	Displacement (in ³ /rev)	Max. Speed (RPM) - 1)Cont 2)Inter.		Max. Flow (GPM) - 1)Cont 2)Inter.		Max. Torque (lb-in) - 1)Cont 2)Inter.		Max. Pressure (PSI) - 1)Cont 2)Inter. 3)Peak		
		1	2	1	2	1	2	1	2	3
050	3.2	680	830	10	12	1200	1400	3000	3500	4000
080	4.6	700	950	14	17	1700	1975	3000	3500	4000
090	5.4	680	840	16	20	2000	2400	3000	3500	4000
110	6.8	680	850	20	25	2650	3100	3000	3500	4000
125	7.7	580	740	20	25	3000	3500	3000	3500	4000
160	10.0	460	580	20	25	3975	4550	3000	3500	4000
200	12.5	370	460	20	25	5050	5800	3000	3500	4000
250	15.5	290	370	20	25	6250	7100	3000	3500	4000
300	17.9	250	320	20	25	7200	8250	3000	3500	4000
400	24.9	180	230	20	25	8400	9050	2500	2750	3000

PERFORMANCE

200 12.5 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Max. Inter.	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	314 (35)	734 (83)	1581 (179)	2365 (267)	3121 (353)	3921 (443)	4469 (505)	5120 (579)			10
1 (4)	325 (37)	721 (81)	1642 (186)	2536 (287)	2665 (301)	4004 (452)	4777 (540)	5406 (611)			19
2 (8)	349 (39)	790 (89)	1759 (199)	2610 (295)	3412 (386)	4185 (473)	4904 (554)	5687 (643)			37
4 (15)	338 (38)	766 (87)	1689 (191)	2586 (292)	3417 (386)	4252 (480)	5077 (574)	5849 (661)			74
6 (23)		742 (84)	1635 (185)	2542 (287)	3380 (382)	4247 (480)	5046 (570)	5817 (657)			111
8 (30)			1556 (176)	2468 (279)	3327 (376)	4243 (479)	5051 (571)	5827 (658)			148
10 (38)			1471 (166)	2374 (268)	3256 (368)	4131 (467)	4923 (556)	5761 (651)			185
12 (45)			1361 (154)	2275 (257)	3185 (360)	4069 (460)	4939 (558)	5751 (650)			222
14 (53)			1304 (147)	2165 (245)	3141 (355)	3906 (441)	4773 (539)	5666 (640)			259
16 (61)			1089 (123)	2083 (235)	2949 (333)	3797 (429)	4628 (523)	5519 (624)			296
18 (68)			993 (112)	1943 (220)	2669 (302)	3665 (414)	4659 (527)	5451 (616)			333
20 (76)				1745 (197)	2740 (310)	3499 (395)	4353 (492)	5273 (596)			370
22 (83)				1525 (172)	2496 (282)	3420 (386)	4252 (480)				407
24 (91)				1390 (157)	2341 (265)	3269 (369)	4005 (453)				444
25 (95)				1229 (139)	2234 (252)	3087 (349)	3955 (447)				462
Theo. Torque	498 (56)	995 (112)	1990 (225)	2986 (337)	3981 (450)	4976 (562)	5971 (675)	6967 (787)			

Areas within white represent maximum motor efficiencies.

DO NOT operate at maximum pressure and maximum flow simultaneously.

Torque, lb-in (Nm)
Speed, RPM

250 15.5 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Max. Inter.	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	381 (43)	924 (104)	1955 (221)	3001 (339)	3974 (449)	4872 (551)					8
1 (4)	439 (50)	1014 (115)	2128 (240)	3196 (361)	4128 (466)	5080 (574)	5907 (668)				15
2 (8)	455 (51)	1014 (115)	2167 (245)	3262 (369)	4236 (479)	5342 (604)	6303 (712)	7082 (800)			30
4 (15)	428 (48)	930 (105)	2145 (242)	3286 (371)	4363 (493)	5480 (619)	6555 (741)	7496 (847)			60
6 (23)	368 (42)	969 (110)	2069 (234)	3252 (367)	4313 (487)	5542 (626)	6611 (747)	7492 (847)			90
8 (30)		818 (92)	1978 (223)	3159 (357)	4332 (490)	5508 (622)	6587 (744)	7490 (846)			120
10 (38)		712 (80)	1849 (209)	3025 (342)	4176 (472)	5353 (605)	6345 (717)	7472 (844)			150
12 (45)		149	148	147	141	129	114	104			179
14 (53)			1757 (199)	2915 (329)	4022 (455)	5142 (581)	6225 (703)	7375 (833)			209
16 (61)			1610 (182)	2743 (310)	3919 (443)	5017 (567)	6296 (711)	7227 (817)			239
18 (68)			1456 (164)	2603 (294)	3873 (438)	4886 (552)	5960 (674)	7114 (804)			269
20 (76)			238	235	233	227	205	191			299
22 (83)			1285 (145)	2393 (270)	3560 (402)	4694 (530)	5846 (661)	6939 (784)			328
24 (91)			268	266	263	259	245	222			358
25 (95)			1083 (122)	2256 (255)	3359 (380)	4519 (511)	5547 (627)	6697 (757)			373
Theo. Torque	617 (70)	1234 (139)	2468 (279)	3702 (418)	4936 (558)	6170 (697)	7404 (837)	8639 (976)			

Tested at 129°F with an oil viscosity of 213 SUS

Note: Performance data is typical. Performance of production units varies slightly from one motor to another.

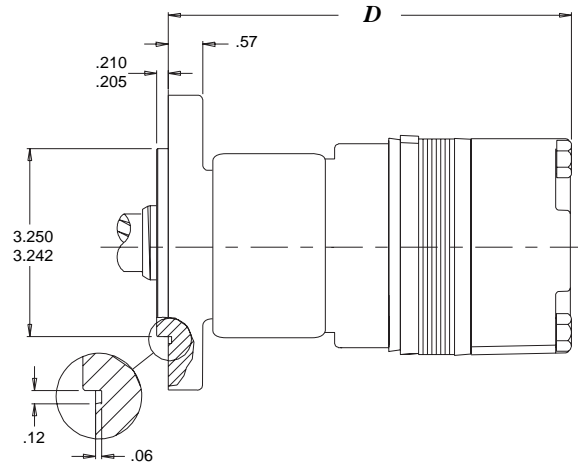
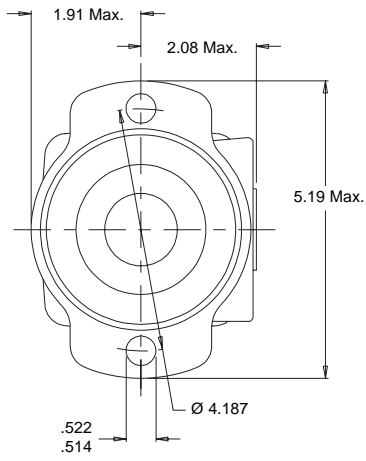
300

HOUSINGS SAE A FLANGE



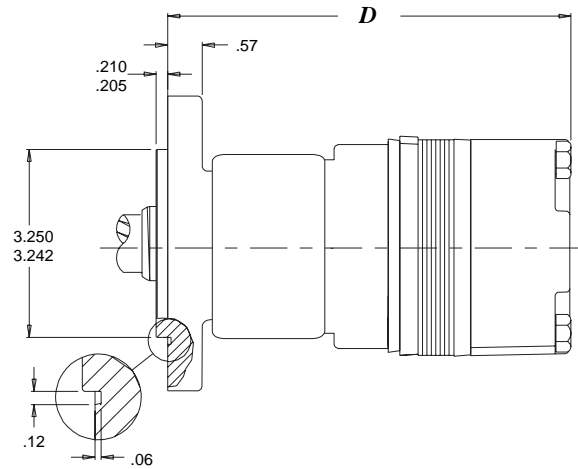
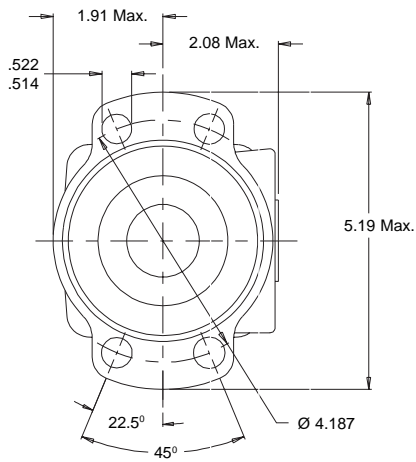
A0 2-Hole with End Ports

A7 2-Hole with Side Ports



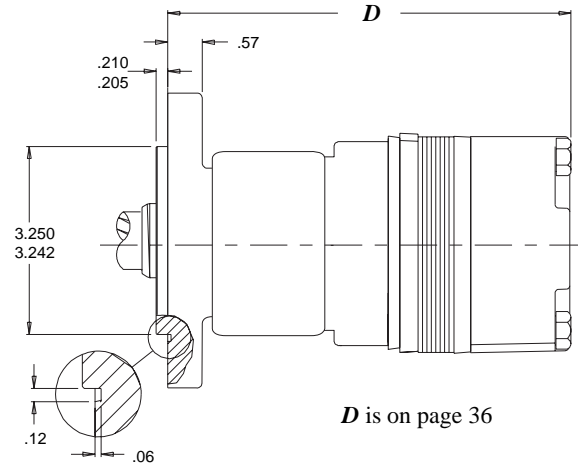
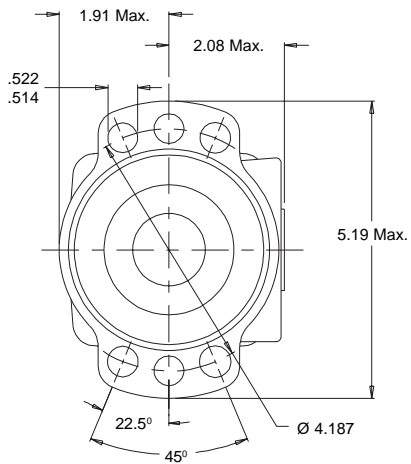
A2 4-Hole with End Ports

A8 4-Hole with Side Ports



A4 6-Hole with End Ports

A9 6-Hole with Side Ports

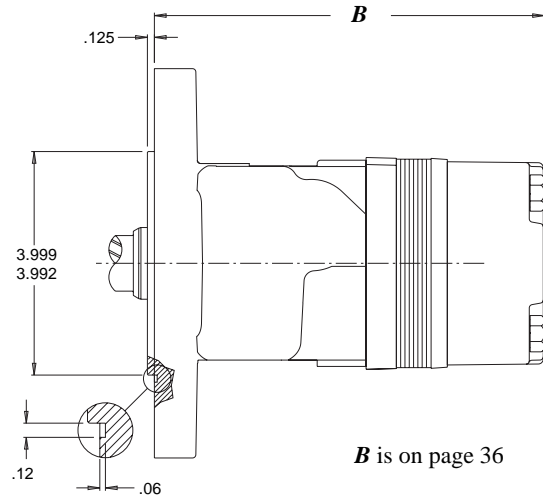
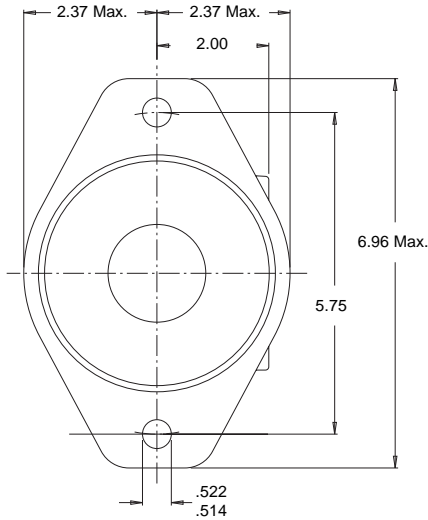


D is on page 36

SAE B FLANGE

B0 2-Hole with End Ports

B7 2-Hole with Side Ports

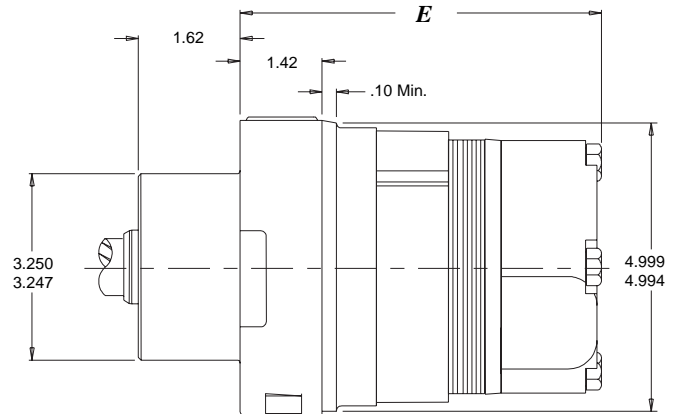
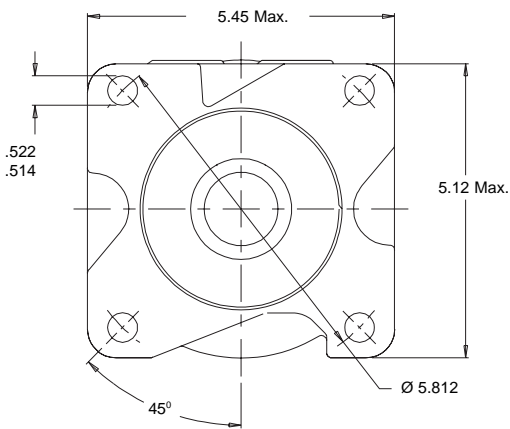


B is on page 36

WHEEL MOUNT

W2 4-Hole with End Ports

W8 4-Hole with Side Ports

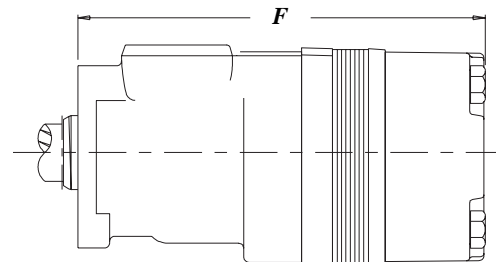
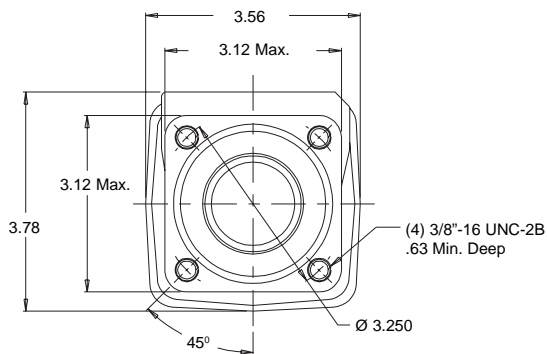


E is on page 37

4-HOLE SQUARE MOUNT

F2 4-Hole with End Ports

F8 4-Hole with Side Ports



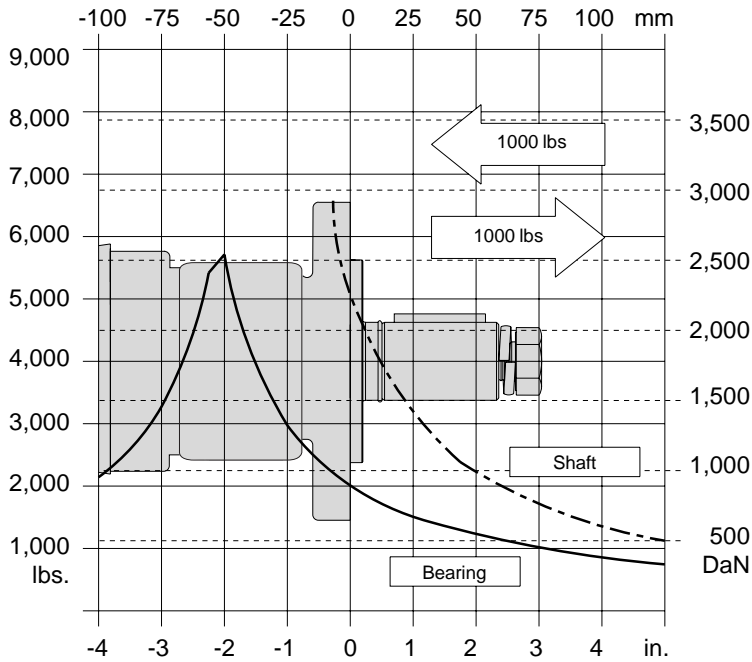
F is on page 37

300

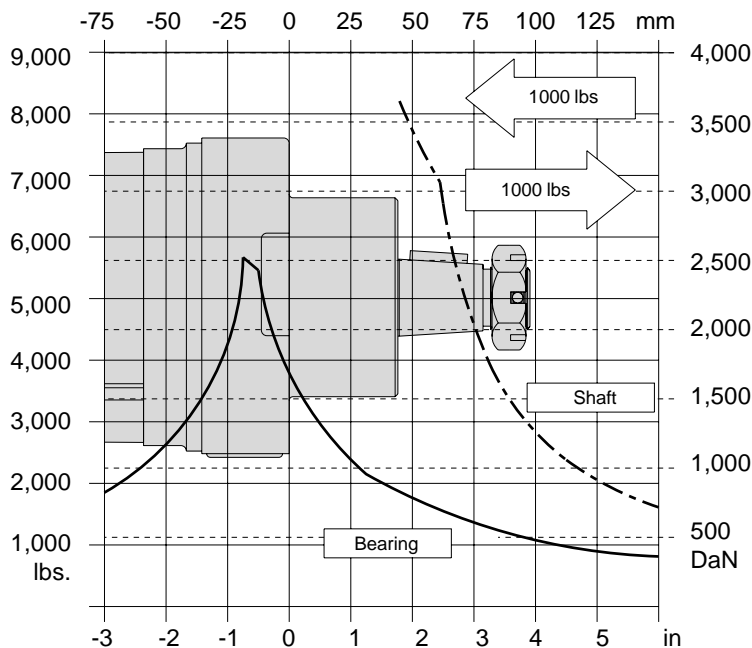
TECHNICAL ALLOWABLE BEARING AND SHAFT LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 24.

SAE A & B FLANGE



WHEEL MOUNT



LENGTH AND WEIGHT TABLES

SAE "A" Flange

Code	D in	Weight lbs
050	7.68	19.5
080	7.82	20.0
090	7.90	20.2
110	8.04	20.7
125	8.14	21.0
160	8.36	21.7
200	8.61	22.5
250	8.91	23.4
300	9.15	24.3
400	9.86	26.4

SAE "B" Flange

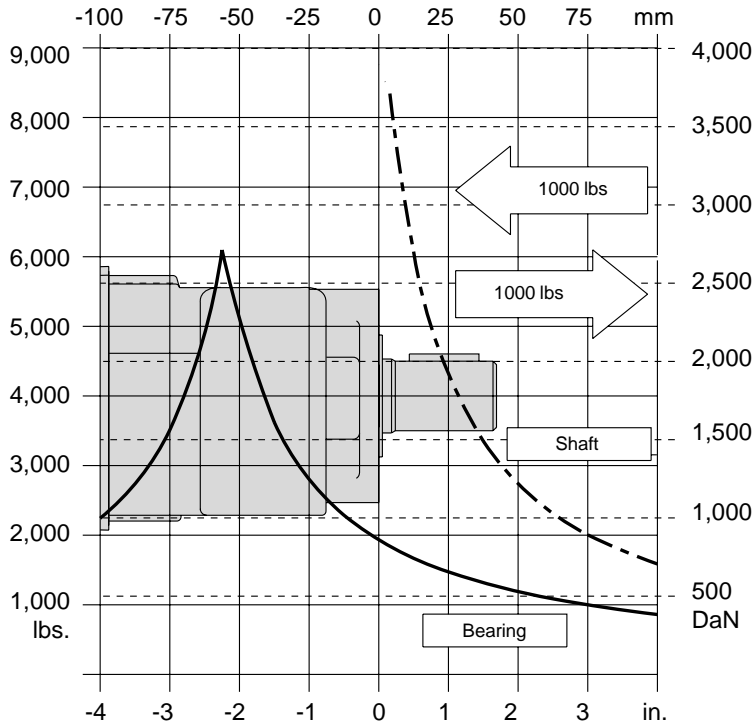
Code	B in	Weight lbs
050	7.68	22.2
080	7.82	22.7
090	7.90	22.9
110	8.04	23.4
125	8.14	23.7
160	8.36	24.4
200	8.61	25.2
250	8.91	26.1
300	9.15	27.0
400	9.86	29.1

*HB motor weights vary ± 2 lbs depending upon motor configuration.
Subtract .71 in. from dimension for motors with side ports 5, 6, & 7 and end ports 1 & 2*

ALLOWABLE BEARING AND SHAFT LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 24.

4-HOLE



SHAFT LENGTHS

Code	A & B Flange in	Wheel Mount in	4-Hole in
01	1.75	3.21	1.63
02	1.93	3.39	1.81
22	2.58	4.04	2.46
20	2.40	3.87	2.29
23	2.23	3.69	2.11
10	1.93	3.39	1.81
12	2.17	3.63	2.05
21	2.40	3.87	2.29
07	2.46	3.93	2.35
15	1.99	3.45	1.87
08	2.46	3.93	2.35

Shaft Lengths vary \pm .030 in

LENGTH AND WEIGHT TABLES

4-Hole Square Mount		
Code	F in	Weight lbs
050	7.80	18.4
080	7.94	18.9
090	8.02	19.1
110	8.16	19.6
125	8.26	19.9
160	8.48	20.6
200	8.73	21.4
250	9.03	22.3
300	9.27	23.2
400	9.98	25.3

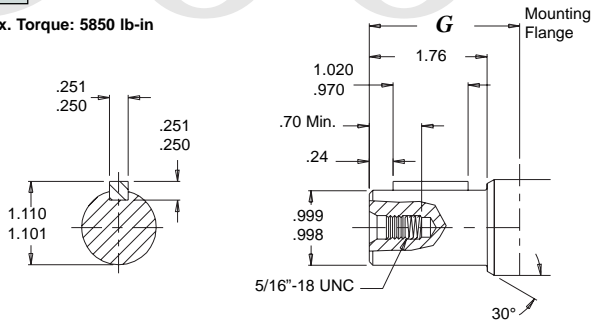
Wheel Mount		
Code	E in	Weight lbs
050	6.22	25.3
080	6.36	25.7
090	6.41	25.9
110	6.55	26.5
125	6.64	26.7
160	6.87	27.4
200	7.12	28.3
250	7.42	29.1
300	7.66	30.0
400	8.37	32.1

*HB motor weights vary \pm 2 lbs depending upon motor configuration.
Subtract .71 in. from dimension for motors with side ports 5, 6, & 7 and end ports 1 & 2*

SHAFTS

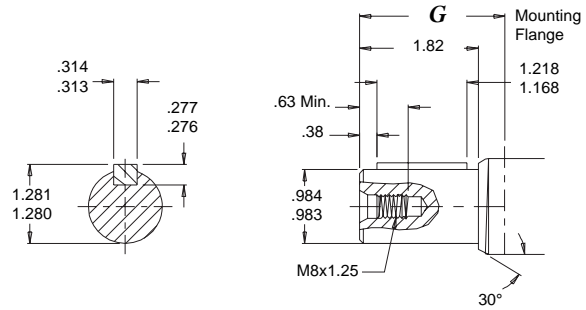
10 1" Straight
***15** 1" Straight Ext.

Max. Torque: 5850 lb-in



12 25mm Straight

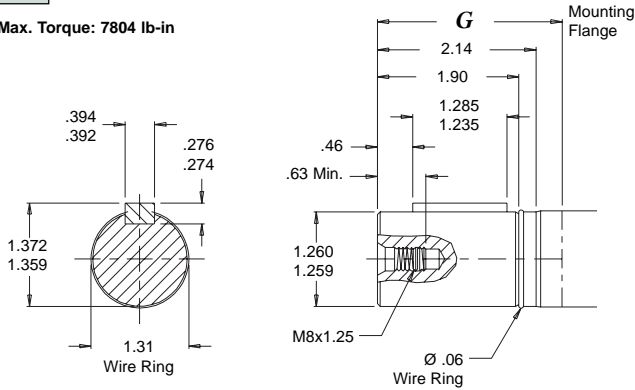
Max. Torque: 5580 lb-in



G is on page 37

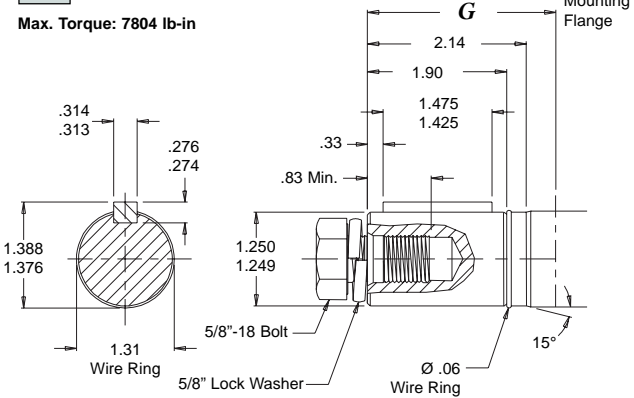
21 32mm Straight
***08** 32mm Straight Ext.

Max. Torque: 7804 lb-in



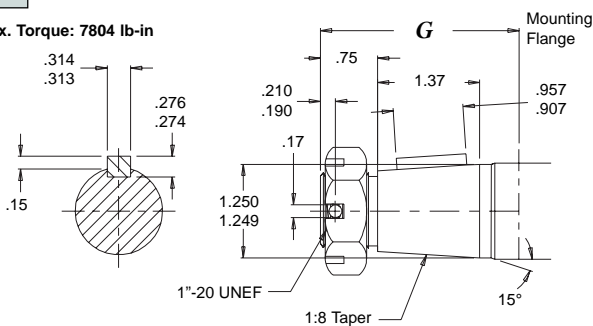
20 1-1/4" Straight
***07** 1-1/4" Straight Ext.

Max. Torque: 7804 lb-in



22 1 1/4" Tapered

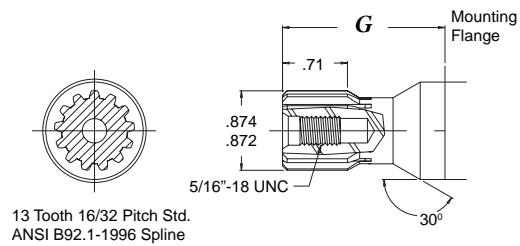
Max. Torque: 7804 lb-in



Note: A slotted nut is standard on this shaft.

01 13 Tooth Spline

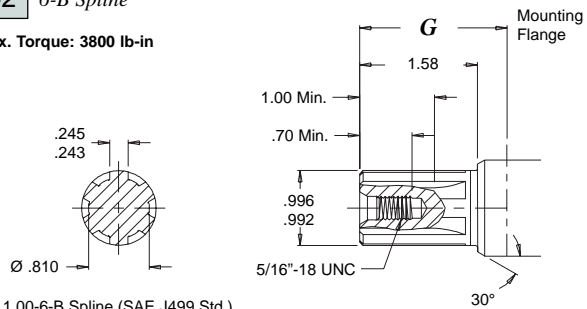
Max. Torque: 1500 lb-in



13 Tooth 16/32 Pitch Std. ANSI B92.1-1996 Spline

02 6-B Spline

Max. Torque: 3800 lb-in

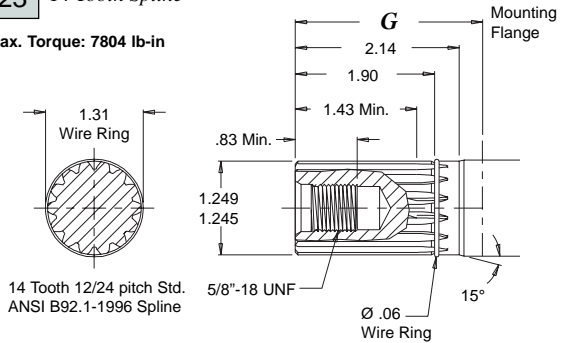


1.00-6-B Spline (SAE J499 Std.)

*Speed Sensor Component

23 14 Tooth Spline

Max. Torque: 7804 lb-in

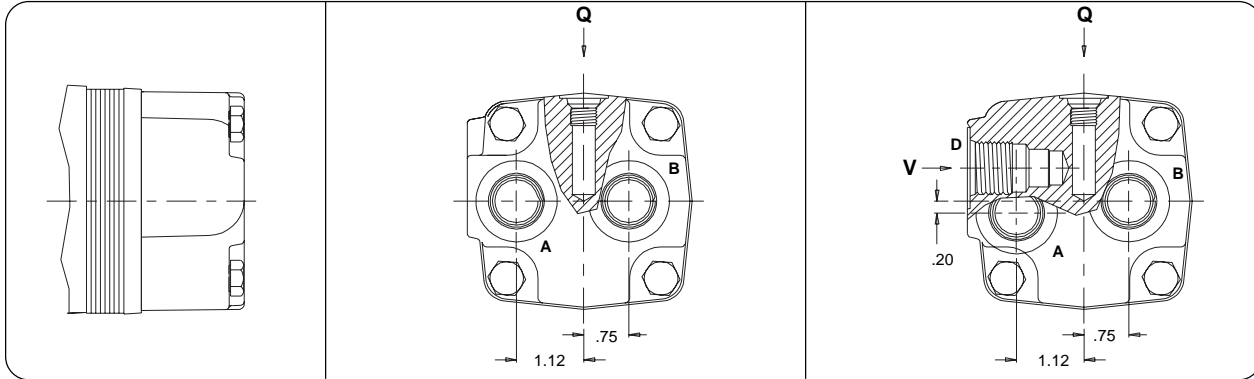


14 Tooth 12/24 pitch Std. ANSI B92.1-1996 Spline

END PORTS

- 2** 1/2" BSPF with 1/4" Drain
- 1** 7/8" O-Ring with 7/16" Drain

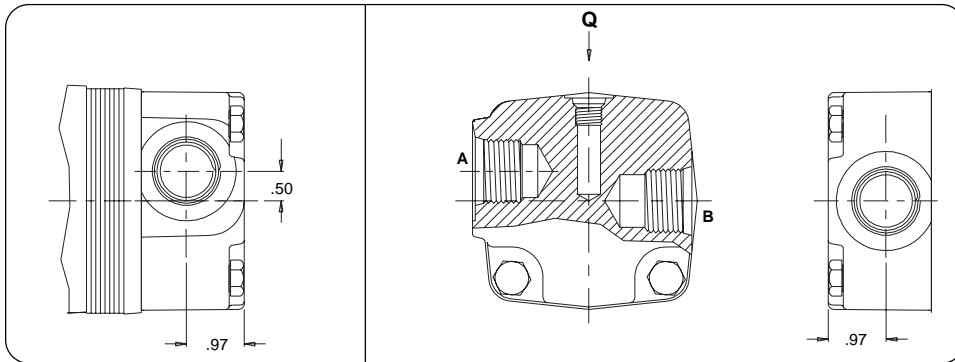
D- 10 Series/2-way Valve Cavity (7/8-14 UNF-2B)



The 1 & 2 porting options can be ordered with an internal drain and/or a relief valve cavity.

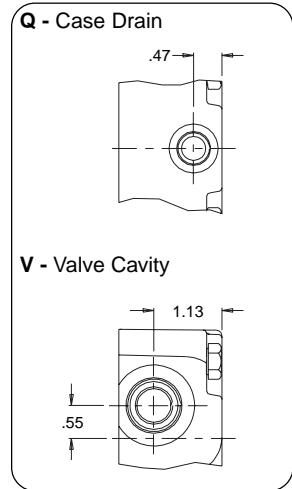
SIDE PORTS

- 6** 1-1/16" O-Ring with 7/16" Drain
- 7** 1/2" BSPF with 1/4" Drain

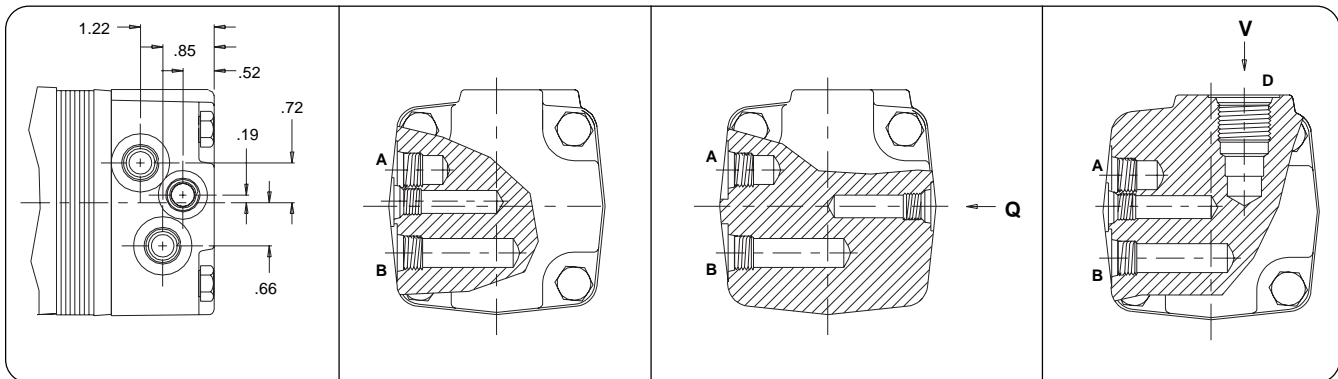


The 6 & 7 porting options can be ordered with an internal drain.

Q and V



- 5** 9/16" O-Ring with 7/16" Drain



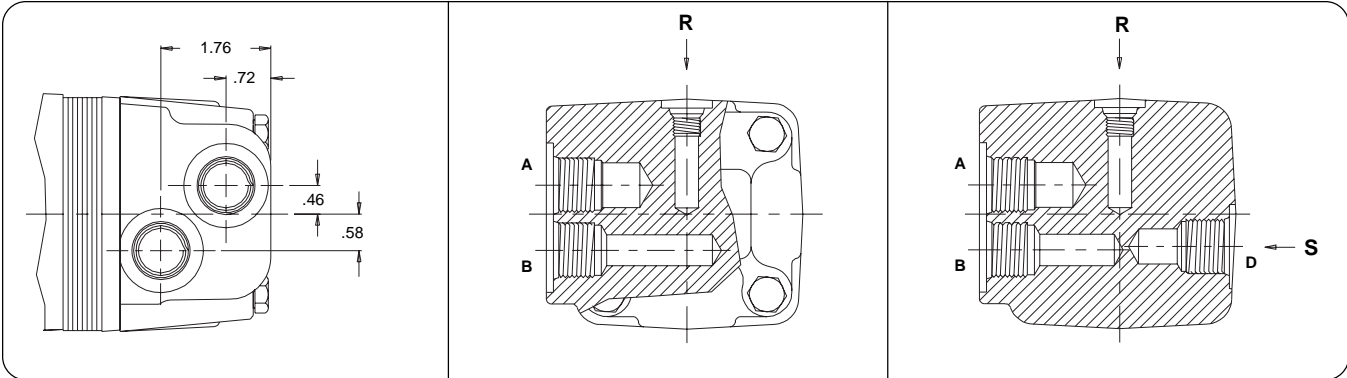
The 5 porting option can be ordered with an internal drain or a relief valve cavity.

300

PORTS SIDE PORTS

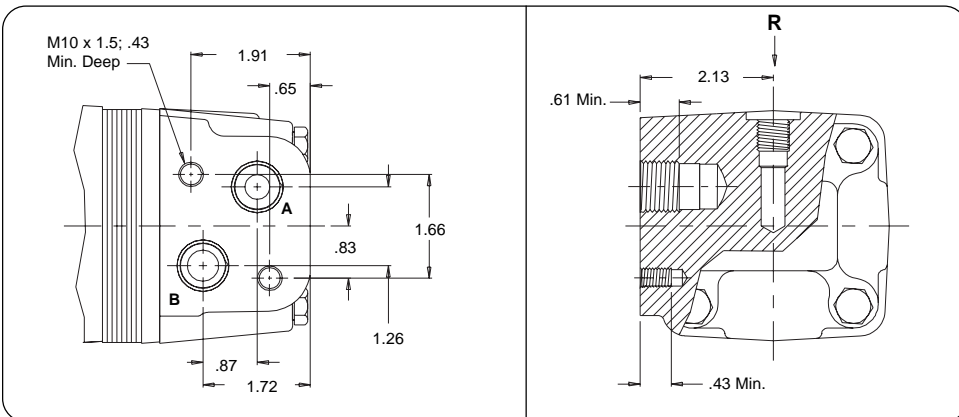
- 2** 1/2" BSP.F with 1/4" Drain
- 1** 7/8" O-Ring with 7/16" Drain

D- 10 Series/2-way Valve Cavity (7/8-14 UNF-2B)



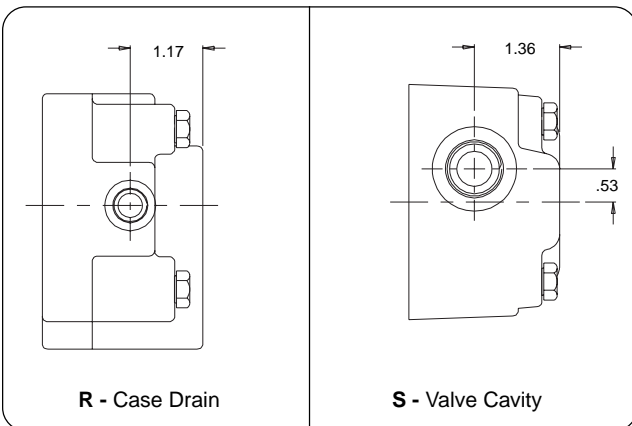
The 1 & 2 porting options can be ordered with an internal drain and/or a relief valve cavity.

- 3** 1/2" BSP.F with 1/4" Drain

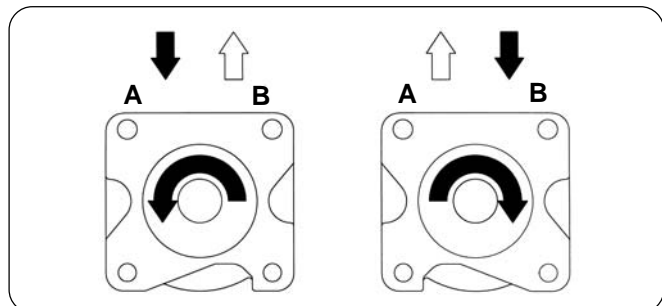


The 3 porting option can be ordered with an internal drain.

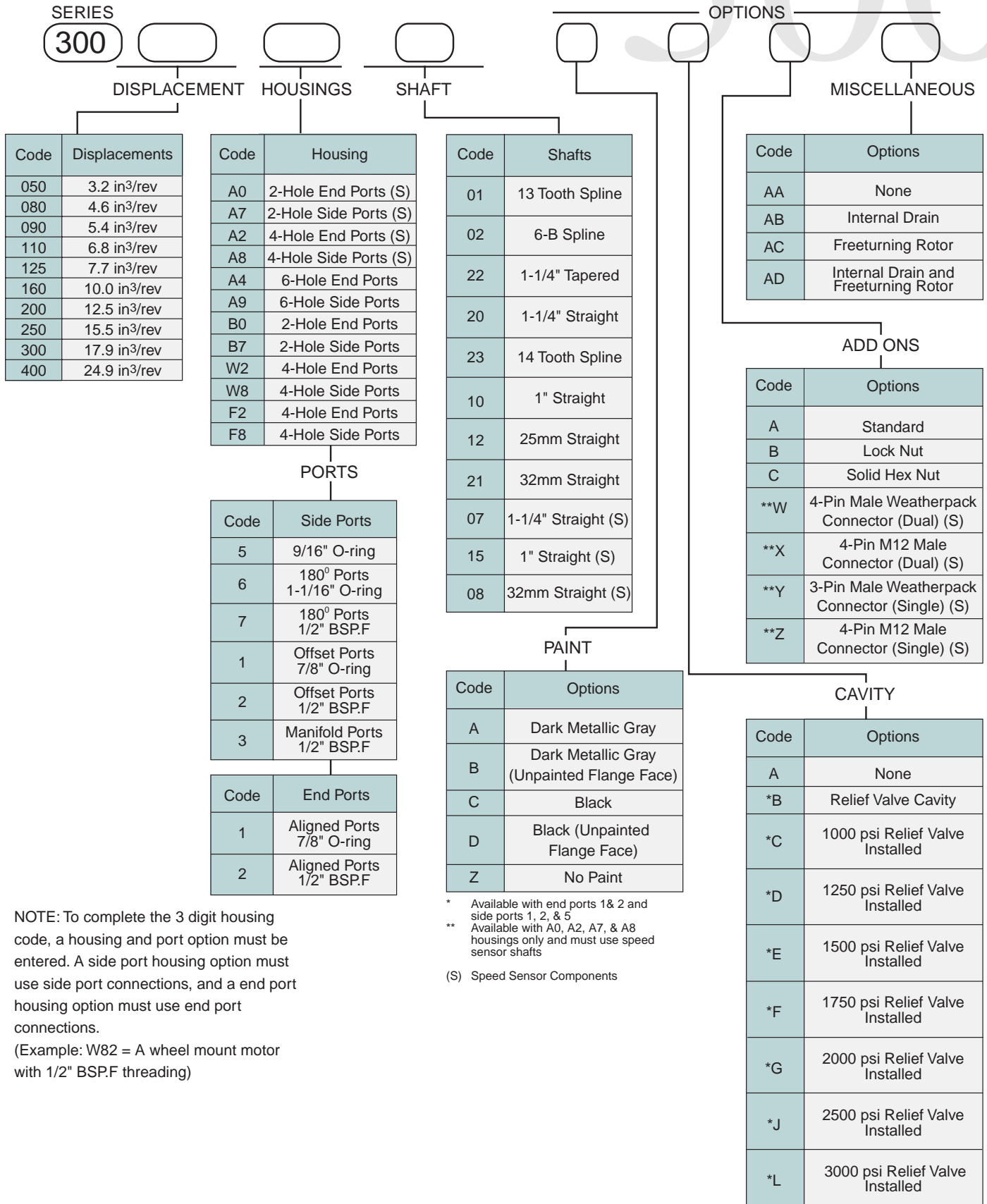
R and S



HB ROTATION SELECTION



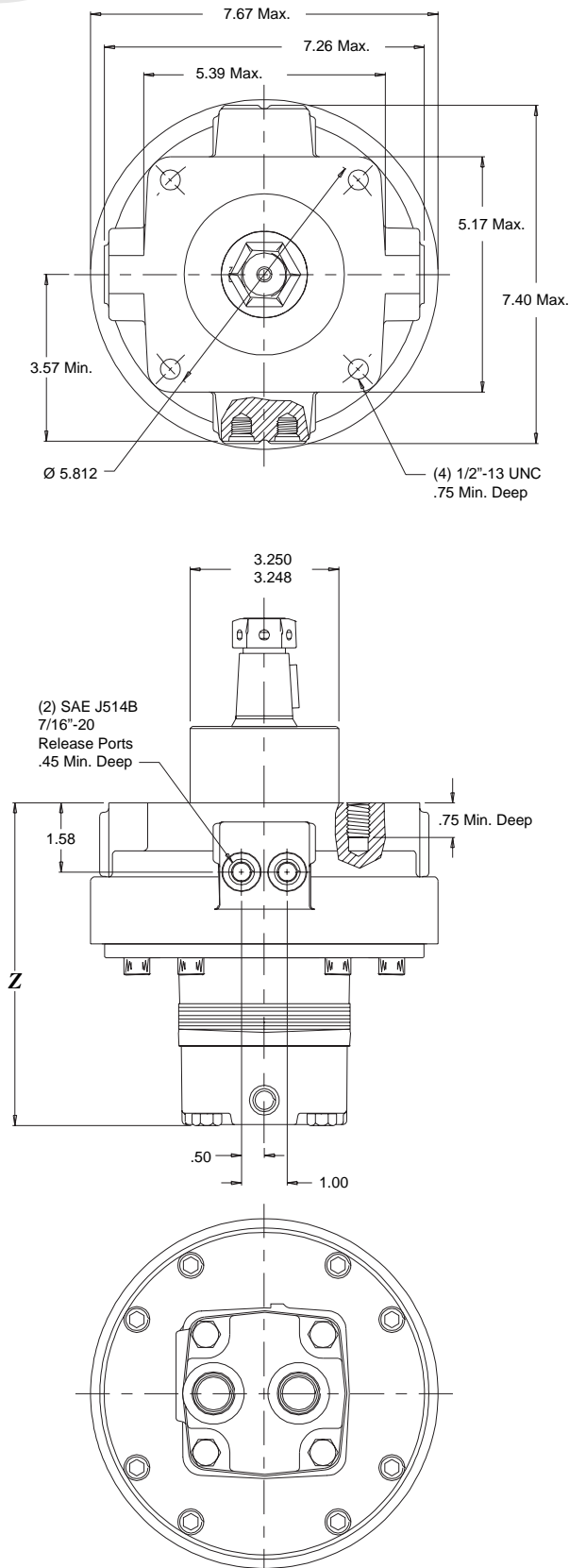
ORDERING INFORMATION



TECHNICAL

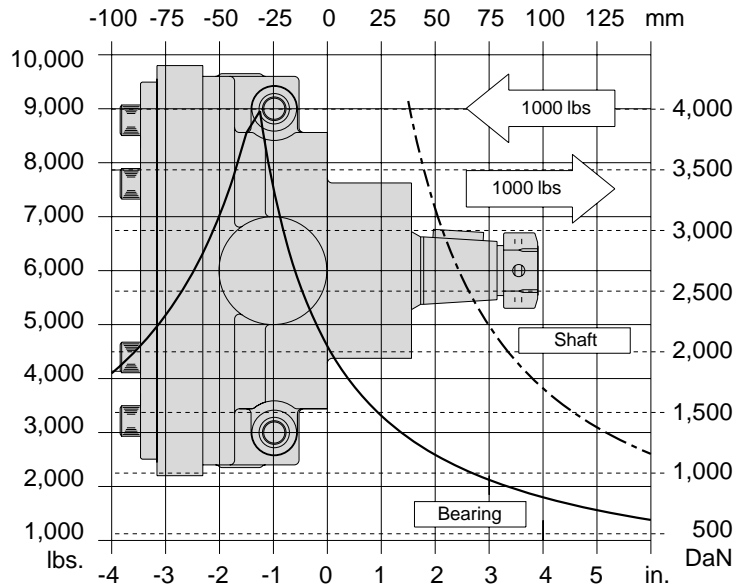
W2 4-Hole with End Ports

W8 4-Hole with Side Ports



ALLOWABLE BEARING AND SHAFT LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 24.



LENGTH AND WEIGHT TABLES

HB Brake

Code	Z in	Weight lbs
050	6.80	42.2
080	6.88	42.7
090	7.02	42.9
110	7.16	43.4
125	7.26	43.7
160	7.48	44.4
200	7.73	45.3
250	8.03	46.1
300	8.27	47.0
400	8.98	49.1

HB motor weights vary ± 2 lbs depending upon motor configuration.
 Subtract .71 in. from dimension for motors with side ports 5, 6, & 7 and end ports 1 & 2

OPERATING RECOMMENDATIONS

CAUTION! - White Hydraulics motors/brakes are intended to operate as static or parking brakes. System circuitry must be designed to bring the load to a stop before applying the brake.

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

To ensure proper operation of the brake, case drain back pressure must be maintained at 500 psi or less. Case drain back pressure above 500 psi can result in erratic operation of the brake. To avoid potential problems with the operation of the brake, a separate case drain line is recommended. Use of the internal drain option is not recommended due to the possibility of return line pressure spikes. A simple schematic of a system utilizing a motor/brake is shown in Figure A below. Although maximum brake release pressure may be used for an application, a 500 psi pressure reducing valve is recommended to promote maximum life for the brake release piston seals. To achieve proper brake release operation, it is necessary to bleed out any trapped air and fill brake release cavity and hoses before all connections are tightened. To facilitate this operation, all motor/brakes feature two release ports. One or both of these ports may be used to release the brake in the unit. Motor/brakes should be configured so that the release ports are near the top of the unit in the installed position. Once all system connections are made, one release port must be opened to atmosphere and the brake release line carefully charged with fluid until all air is removed from the line and motor/brake release cavity. When this has been accomplished the port plug or secondary release line must be reinstalled. In the event of a pump or battery failure, an external pressure source may be connected to the brake release port to release the brake, allowing the machine to be moved.

Typical motor/brake schematic

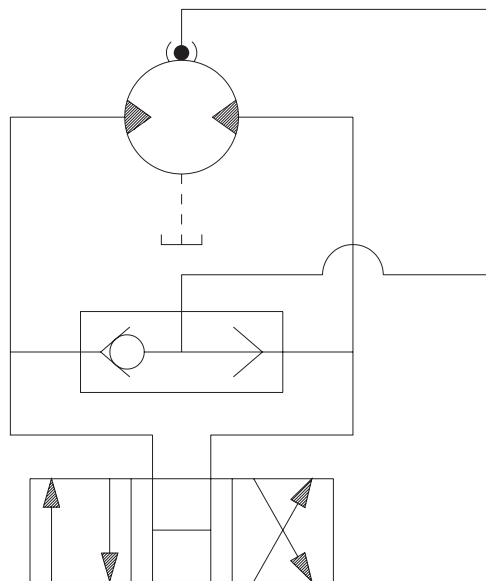


Figure A

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

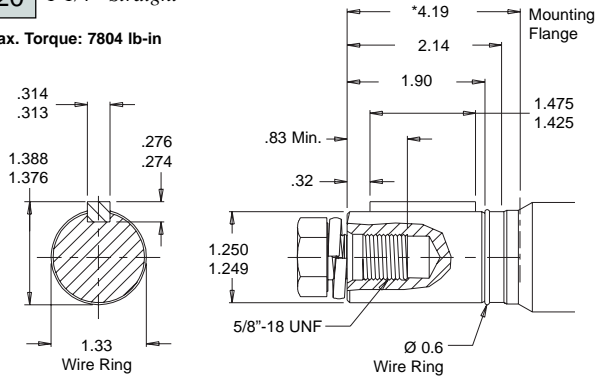
TECHNICAL

Rated brake torque	8000 lb-in
Initial release pressure	300 psi
Full release pressure	450 psi
Maximum release pressure	3000 psi
Release volume	0.8 - 1.0 cu in

SHAFTS

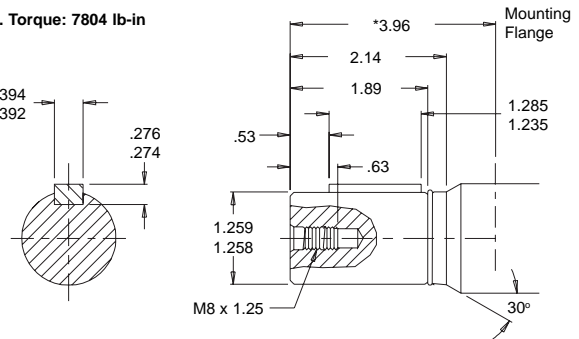
20 1-1/4" Straight

Max. Torque: 7804 lb-in



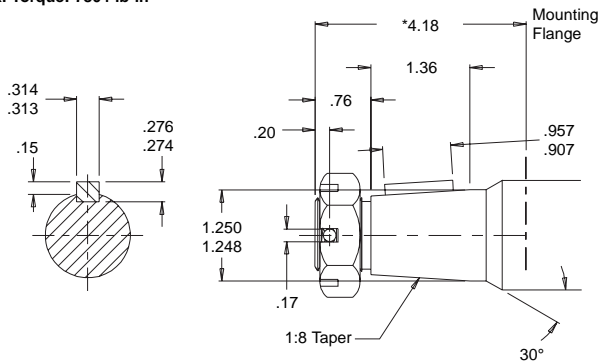
21 32mm Straight

Max. Torque: 7804 lb-in



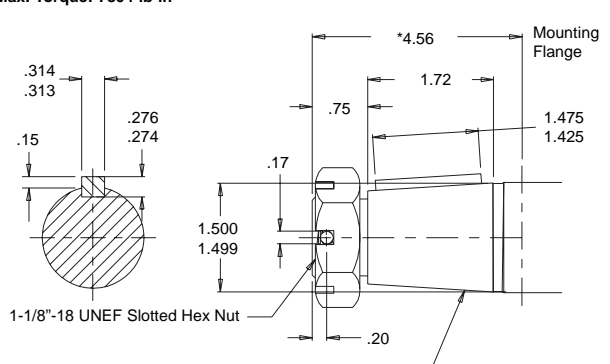
22 1-1/4" Tapered

Max. Torque: 7804 lb-in



31 1-1/2" Tapered

Max. Torque: 7804 lb-in

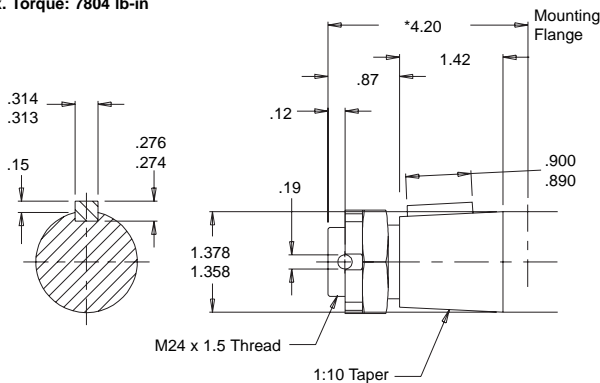


Note: A slotted nut is standard on this shaft.

Note: A slotted nut is standard on this shaft.

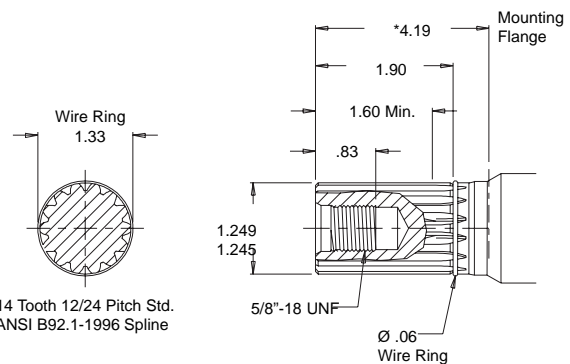
28 35mm Tapered

Max. Torque: 7804 lb-in



23 14 Tooth Spline

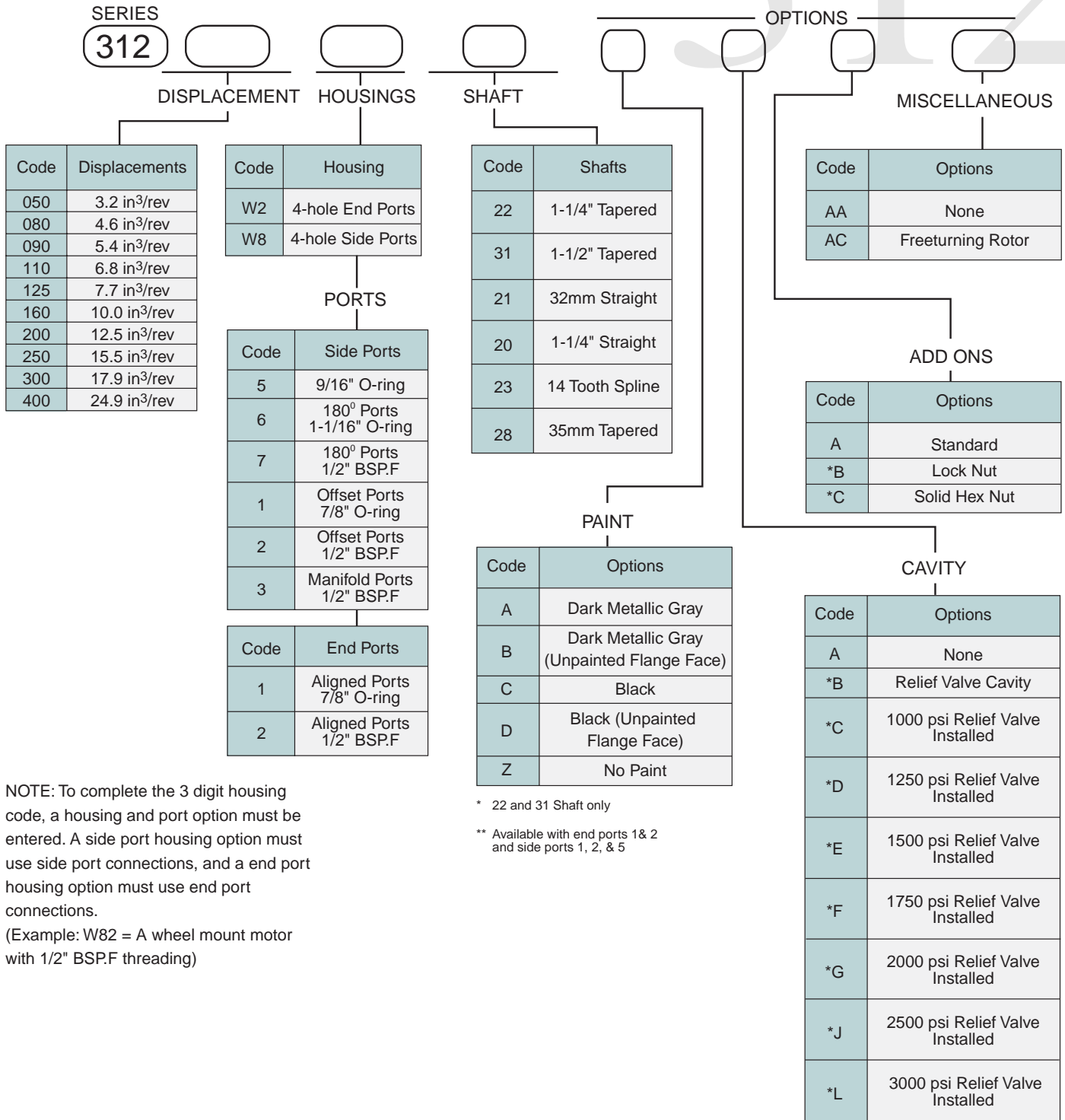
Max. Torque: 7804 lb-in



Note: A slotted nut is standard on this shaft.

*Note: Shaft lengths may vary by ± .030 in

ORDERING INFORMATION



NOTE: To complete the 3 digit housing code, a housing and port option must be entered. A side port housing option must use side port connections, and a end port housing option must use end port connections.
(Example: W82 = A wheel mount motor with 1/2" BSP.F threading)

* 22 and 31 Shaft only

** Available with end ports 1 & 2 and side ports 1, 2, & 5



whitedriveproducts

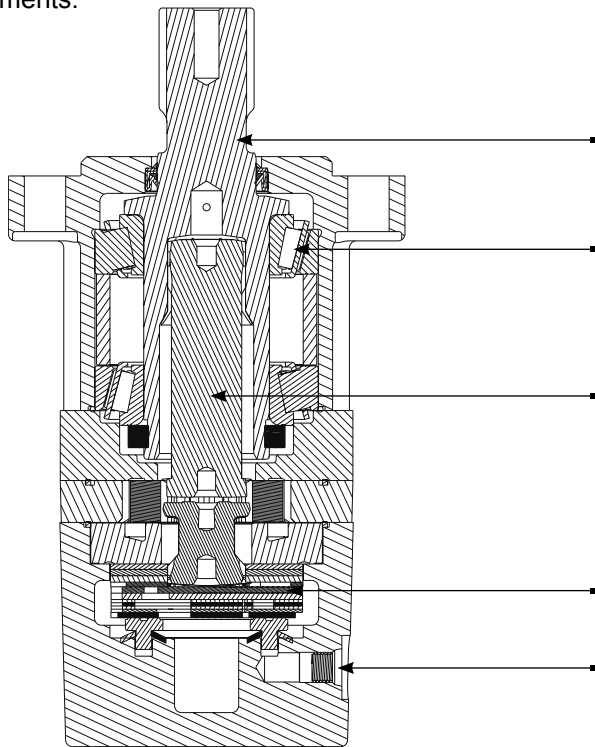
WS SERIES HYDRAULIC MOTORS



WS

OVERVIEW

The WS product family features flow rates up to 76 LPM [20 GPM], torque up to 824 Nm [7,295 lb-in], and pressures up to 207 bar [3000 PSI] at continuous ratings. The WS targets agricultural equipment, skid steer attachments, and other applications that require greater torque under demanding conditions. A distinguishing feature of the WS in relation to competitive products is its heavy duty drive link with a larger pitch diameter. This enables the WS to better withstand pressure and torque spikes and is reflected in its intermittent and peak performance ratings. Additional product features include a three zone commutator valve, heavy-duty tapered roller bearings, and case drain with integral internal drain*. The WS offers displacements from 100cc [6.1in³] to 496cc [30.3in³]. Nine (9) shaft and seven (7) mounting options are available to meet the most common SAE and European requirements.



KEY FEATURES

- **Nine shaft and seven mounting options** to meet the most common SAE and European requirements.
- **Heavy-duty tapered roller bearings** for extra side load capacity.
- **Heavy-duty drive link** with larger pitch diameter than competitors for greater resistance to pressure and torque spikes.
- **Three zone commutator valve** for high flow capacity.
- **Standard case drain with integral internal drain*** for extended shaft seal life.

*See page 18 for allowable back pressure when utilizing the internal drain.

SPECIFICATIONS

Intermittent Ratings - 10% of Operation Peak Ratings - 1% of Operation

CODE	Displacement cc [in ³ /rev]	Max. Speed rpm		Max. Flow lpm [gpm]		Max. Torque Nm [lb-in]		Max. Pressure bar [psi]		
		cont.	inter.	cont.	inter.	cont.	inter.	cont.	inter.	peak
100	100 [6.10]	745	880	76 [20]	95 [25]	280 [2475]	416 [3680]	207 [3000]	310 [4500]	310 [4500]
110	112 [6.85]	675	840	76 [20]	95 [25]	307 [2715]	468 [4145]	207 [3000]	310 [4500]	310 [4500]
130	129 [7.86]	580	730	76 [20]	95 [25]	370 [3275]	550 [4865]	207 [3000]	310 [4500]	310 [4500]
160	162 [9.90]	465	700	76 [20]	114 [30]	462 [4090]	618 [5465]	207 [3000]	276 [4000]	310 [4500]
200	202 [12.31]	375	560	76 [20]	114 [30]	576 [5100]	768 [6795]	207 [3000]	276 [4000]	310 [4500]
230	228 [13.92]	325	490	76 [20]	114 [30]	642 [5685]	806 [7135]	207 [3000]	276 [4000]	310 [4500]
320	325 [19.81]	235	350	76 [20]	114 [30]	789 [6980]	1029 [9105]	190 [2750]	224 [3250]	259 [3750]
400	399 [24.36]	190	280	76 [20]	114 [30]	816 [7225]	1034 [9150]	155 [2250]	190 [2750]	224 [3250]
500	496 [30.29]	155	230	76 [20]	114 [30]	824 [7295]	1041 [9210]	121 [1750]	155 [2250]	172 [2500]



100

Pressure - bars [psi]										Max. Cont.	Max. Inter.
17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	207 [3000]	242 [3500]	276 [4000]	310 [4500]		

100 cc [6.10 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]
Max. Cont.
Max. Inter.

2 [0.5]	14 [120] 11	35 [313] 8	77 [681] 6	116 [1025] 4							
4 [1]	15 [129] 37	38 [337] 35	80 [710] 10	122 [1079] 7	162 [1436] 5						
8 [2]	16 [138] 75	40 [354] 74	88 [781] 71	136 [1205] 68	181 [1602] 58	227 [2007] 44	267 [2364] 43	315 [2791] 42	352 [3119] 41	383 [3386] 33	
15 [4]	16 [138] 151	40 [354] 149	89 [790] 146	138 [1222] 143	187 [1654] 137	235 [2079] 129	282 [2495] 119	324 [2871] 110	370 [3277] 101	411 [3636] 87	
23 [6]	14 [127] 226	39 [344] 225	88 [779] 221	137 [1214] 217	186 [1647] 210	234 [2071] 200	282 [2494] 188	324 [2869] 174	371 [3279] 162	415 [3676] 147	
30 [8]	12 [109] 302	37 [326] 300	86 [765] 297	136 [1200] 292	184 [1625] 284	232 [2049] 273	280 [2474] 258	323 [2859] 240	369 [3268] 224	416 [3682] 206	
38 [10]	10 [88] 378	34 [305] 376	83 [738] 372	133 [1174] 366	181 [1601] 357	229 [2026] 343	276 [2446] 326	318 [2810] 300	366 [3235] 281	415 [3672] 261	
45 [12]	7 [65] 453	32 [282] 451	81 [713] 447	129 [1145] 441	178 [1574] 430	226 [2002] 415	274 [2423] 396	316 [2793] 367	364 [3220] 345	413 [3653] 324	
53 [14]	4 [39] 528	29 [254] 527	77 [686] 522	126 [1116] 515	175 [1546] 504	222 [1968] 486	266 [2351] 455	315 [2791] 433	362 [3203] 407	411 [3637] 384	
61 [16]	2 [15] 604	25 [221] 602	74 [652] 597	122 [1084] 590	171 [1513] 578	219 [1941] 559	264 [2340] 527	312 [2760] 502	360 [3182] 475	409 [3616] 447	
68 [18]		21 [186] 678	69 [614] 672	118 [1047] 664	167 [1481] 651	216 [1910] 632	260 [2300] 596	309 [2735] 570	356 [3152] 541	407 [3601] 513	
76 [20]		16 [144] 754	65 [573] 747	114 [1009] 739	163 [1441] 725	211 [1872] 704	257 [2278] 677	307 [2712] 652	353 [3121] 624	403 [3568] 595	
83 [22]					156 [1379] 801	205 [1814] 758	253 [2239] 730	300 [2653] 698	347 [3075] 698	398 [3526] 668	
91 [24]						199 [1762] 850	246 [2179] 826	294 [2604] 799	343 [3037] 768	395 [3495] 733	
95 [25]						196 [1737] 883	246 [2176] 863	294 [2605] 835	342 [3028] 800	392 [3472] 770	

Theoretical rpm

Torque - Nm [lb-in], Speed rpm Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%

27 [243]	55 [485]	110 [971]	165 [1456]	219 [1942]	274 [2427]	329 [2913]	384 [3398]	439 [3883]	494 [4369]
----------	----------	-----------	------------	------------	------------	------------	------------	------------	------------

Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]

110

Pressure - bars [psi]										Max. Cont.	Max. Inter.
17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	207 [3000]	242 [3500]	276 [4000]	310 [4500]		

112 cc [6.85 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]
Max. Cont.
Max. Inter.

2 [0.5]	12 [106] 9	38 [334] 8	86 [757] 6	132 [1166] 4							
4 [1]	12 [110] 17	38 [334] 10	89 [788] 8	137 [1213] 6	184 [1624] 5						
8 [2]	15 [129] 67	42 [373] 67	98 [863] 65	152 [1341] 62	206 [1823] 58	255 [2257] 45	297 [2629] 40	341 [3015] 36	377 [3334] 22	396 [3502] 9	
15 [4]	15 [134] 135	43 [378] 135	97 [863] 133	152 [1350] 130	208 [1838] 125	261 [2314] 118	314 [2776] 107	357 [3158] 88	402 [3558] 71	438 [3879] 49	
23 [6]	15 [128] 203	42 [373] 203	97 [856] 200	151 [1337] 196	206 [1826] 182	260 [2302] 170	313 [2770] 170	359 [3179] 124	411 [3633] 124	458 [4054] 103	
30 [8]	12 [108] 271	40 [351] 270	94 [833] 268	148 [1313] 264	203 [1798] 258	258 [2281] 248	311 [2753] 234	359 [3177] 201	413 [3656] 178	466 [4122] 155	
38 [10]	9 [80] 339	36 [322] 338	91 [803] 335	145 [1280] 331	199 [1761] 325	253 [2236] 313	307 [2715] 296	358 [3165] 255	413 [3652] 232	468 [4144] 206	
45 [12]	8 [69] 404	33 [293] 406	87 [770] 403	141 [1247] 399	194 [1716] 391	249 [2205] 378	303 [2684] 360	353 [3124] 313	408 [3613] 289	467 [4133] 259	
53 [14]	4 [38] 471	29 [254] 473	82 [728] 470	136 [1202] 465	189 [1676] 457	243 [2152] 442	294 [2605] 403	351 [3108] 376	407 [3601] 347	464 [4109] 316	
61 [16]		24 [210] 541	78 [687] 538	131 [1162] 532	185 [1635] 523	239 [2114] 508	290 [2564] 467	346 [3058] 438	402 [3553] 406	462 [4092] 372	
68 [18]		18 [163] 609	72 [639] 605	126 [1116] 599	180 [1594] 589	234 [2068] 573	286 [2534] 530	341 [3016] 502	397 [3515] 467	458 [4051] 435	
76 [20]		13 [117] 677	68 [598] 673	121 [1068] 667	174 [1541] 656	228 [2017] 639	282 [2494] 594	336 [2977] 565	393 [3481] 528	454 [4017] 492	
83 [22]			67 [596] 742	115 [1015] 735	169 [1500] 722	221 [1960] 699	276 [2445] 672	332 [2942] 637	388 [3436] 598	447 [3953] 557	
91 [24]			62 [549] 808	109 [967] 801	164 [1452] 787	218 [1926] 767	272 [2403] 737	326 [2885] 702	383 [3385] 659	441 [3906] 620	
95 [25]			60 [528] 841	105 [939] 834	161 [1425] 818	215 [1901] 800	270 [2389] 771	323 [2861] 736	380 [3361] 693	439 [3886] 648	

Theoretical rpm

Torque - Nm [lb-in], Speed rpm Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%

31 [273]	62 [545]	123 [1090]	185 [1635]	246 [2180]	308 [2726]	370 [3271]	431 [3816]	493 [4361]	554 [4906]
----------	----------	------------	------------	------------	------------	------------	------------	------------	------------

Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]



130

Pressure - bars [psi]										Max. Cont.	Max. Inter.
17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	207 [3000]	242 [3500]	276 [4000]	310 [4500]		

129 cc [7.86 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]											Theoretical rpm	
	13 [114] 8	41 [367] 6	94 [830] 3									
4 [1]	16 [144] 17	45 [400] 9	101 [890] 6	151 [1334] 4	201 [1780] 3	256 [2264] 3	306 [2706] 2					30
8 [2]	19 [172] 58	52 [456] 57	115 [1022] 55	180 [1592] 52	235 [2081] 50	294 [2600] 38	348 [3084] 35	402 [3560] 31	448 [3962] 22	477 [4219] 9		59
15 [4]	21 [182] 117	53 [469] 116	117 [1037] 114	182 [1609] 111	246 [2175] 107	309 [2735] 101	369 [3265] 92	424 [3749] 80	480 [4249] 68	528 [4671] 53		118
23 [6]	20 [174] 175	52 [460] 174	116 [1026] 172	180 [1591] 169	244 [2163] 165	308 [2730] 158	371 [3285] 148	427 [3783] 132	489 [4330] 117	547 [4837] 99		177
30 [8]	17 [150] 234	49 [436] 233	113 [1004] 230	178 [1571] 227	242 [2143] 223	307 [2714] 215	370 [3276] 202	426 [3767] 186	488 [4322] 168	550 [4866] 147		236
38 [10]	14 [120] 293	46 [403] 291	110 [974] 289	174 [1537] 285	238 [2109] 280	303 [2677] 272	367 [3246] 260	423 [3741] 240	486 [4305] 220	549 [4860] 197		294
45 [12]	10 [86] 351	42 [367] 350	106 [935] 347	169 [1499] 343	234 [2069] 337	298 [2633] 329	362 [3204] 315	417 [3688] 289	482 [4264] 266	547 [4837] 243		353
53 [14]	6 [53] 410	37 [329] 408	101 [891] 405	165 [1458] 401	229 [2027] 395	294 [2600] 385	349 [3092] 361	414 [3661] 341	478 [4230] 317	544 [4818] 289		412
61 [16]		33 [289] 467	96 [853] 464	160 [1415] 460	224 [1979] 453	287 [2543] 442	344 [3048] 415	409 [3620] 392	474 [4195] 367	539 [4773] 338		471
68 [18]			91 [803] 522	155 [1369] 518	219 [1934] 510	282 [2498] 499	340 [3007] 471	404 [3571] 448	469 [4147] 421	536 [4744] 389		530
76 [20]			85 [753] 580	148 [1314] 575	212 [1879] 568	277 [2447] 556	335 [2960] 526	399 [3528] 503	464 [4108] 474	533 [4714] 441		588
83 [22]			77 [681] 641	140 [1242] 637	204 [1805] 627	267 [2362] 613	332 [2938] 592	397 [3510] 567	461 [4076] 536	526 [4651] 504		647
91 [24]			71 [625] 701	134 [1185] 696	198 [1751] 686	261 [2307] 672	325 [2872] 651	389 [3442] 625	453 [4011] 594	520 [4599] 563		706
95 [25]			68 [601] 730	131 [1158] 726	195 [1722] 717	258 [2285] 703	322 [2849] 683	384 [3399] 657	450 [3986] 625	519 [4594] 589		735

Torque - Nm [lb-in], Speed rpm Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%

35 [313]	71 [625]	141 [1251]	212 [1876]	283 [2502]	353 [3127]	424 [3753]	495 [4378]	565 [5004]	636 [5629]
----------	----------	------------	------------	------------	------------	------------	------------	------------	------------

Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]

160

Pressure - bars [psi]										Max. Cont.	Max. Inter.
17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	207 [3000]	242 [3500]	259 [3750]	276 [4000]		

162 cc [9.90 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]											Theoretical rpm	
	20 [173] 11	55 [485] 10	125 [1102] 8	190 [1679] 6	255 [2258] 5							
4 [1]	22 [199] 23	59 [523] 22	135 [1194] 20	207 [1831] 18	274 [2425] 15	338 [2989] 13	397 [3511] 9					24
8 [2]	32 [283] 47	63 [554] 45	144 [1273] 43	223 [1974] 41	298 [2635] 37	368 [3255] 34	433 [3830] 29	480 [4251] 21	504 [4459] 16	527 [4664] 10		47
15 [4]	31 [278] 94	69 [609] 94	145 [1287] 91	228 [2014] 88	308 [2728] 84	388 [3416] 79	460 [4071] 71	526 [4654] 59	557 [4931] 53	583 [5163] 45		94
23 [6]	29 [257] 141	69 [615] 141	143 [1265] 138	225 [1990] 135	306 [2711] 130	386 [3412] 124	464 [4108] 116	535 [4737] 100	573 [5074] 93	607 [5370] 83		140
30 [8]	26 [226] 188	66 [583] 188	138 [1225] 186	221 [1958] 182	303 [2678] 177	383 [3387] 170	462 [4088] 160	538 [4761] 144	578 [5116] 135	617 [5463] 125		187
38 [10]	21 [188] 235	62 [547] 234	133 [1180] 234	216 [1914] 230	298 [2633] 224	379 [3353] 217	458 [4055] 206	534 [4730] 189	575 [5085] 180	616 [5451] 168		234
45 [12]	16 [145] 282	57 [509] 281	135 [1192] 280	210 [1861] 276	292 [2581] 270	372 [3289] 261	452 [4000] 250	530 [4688] 234	570 [5046] 224	613 [5423] 212		280
53 [14]	11 [97] 329	51 [455] 328	133 [1178] 327	205 [1817] 323	286 [2530] 316	365 [3231] 307	441 [3905] 293	523 [4627] 274	563 [4986] 264	606 [5363] 251		327
61 [16]	5 [44] 376	45 [402] 375	125 [1110] 374	199 [1761] 370	280 [2474] 363	359 [3173] 353	436 [3857] 338	517 [4572] 319	557 [4934] 308	599 [5301] 295		374
68 [18]		37 [331] 422	118 [1048] 421	192 [1697] 417	272 [2408] 410	351 [3104] 400	427 [3779] 383	508 [4498] 363	548 [4853] 353	592 [5240] 329		420
76 [20]		30 [265] 469	111 [980] 467	183 [1616] 465	264 [2337] 457	343 [3036] 446	419 [3712] 428	500 [4424] 408	540 [4777] 396	584 [5167] 382		467
83 [22]		22 [193] 516	103 [913] 514	176 [1557] 510	256 [2264] 503	335 [2965] 491	413 [3658] 476	492 [4358] 454	533 [4721] 441	575 [5093] 427		514
91 [24]				175 [1553] 558	246 [2180] 550	327 [2890] 538	405 [3587] 522	484 [4286] 500	524 [4639] 484	568 [5027] 473		560
95 [25]				163 [1443] 581	241 [2134] 573	321 [2843] 561	400 [3543] 545	481 [4253] 522	521 [4611] 511	561 [4968] 496		584
114 [30]				138 [1222] 699	217 [1917] 691	296 [2618] 679	376 [3324] 661	456 [4034] 645	495 [4383] 625	534 [4729] 609		700

Torque - Nm [lb-in], Speed rpm Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%

45 [394]	89 [788]	178 [1576]	267 [2363]	356 [3151]	445 [3939]	534 [4727]	623 [5515]	668 [5909]	712 [6303]
----------	----------	------------	------------	------------	------------	------------	------------	------------	------------

Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]



200	Pressure - bars [psi]								Max. Cont.	Max. Inter.
	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	190 [2750]	207 [3000]	242 [3500]	276 [4000]

202 cc [12.31 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	2 [0.5]	28 [249] 8	72 [638] 7	157 [1388] 5									10	Theoretical rpm
	4 [1]	33 [291] 18	81 [713] 17	170 [1508] 14	254 [2250] 12	335 [2961] 9	411 [3636] 5	454 [4019] 4	508 [4498] 6				19	
	8 [2]	39 [343] 37	85 [757] 36	185 [1637] 34	280 [2474] 31	365 [3232] 27	446 [3948] 23	483 [4279] 20	521 [4609] 17	568 [5024] 3			38	
	15 [4]	40 [354] 75	87 [773] 74	187 [1654] 72	289 [2554] 69	388 [3430] 65	481 [4254] 59	523 [4627] 56	564 [4995] 51	627 [5548] 38	696 [6156] 25		76	
	23 [6]	38 [334] 112	89 [789] 111	184 [1624] 110	285 [2524] 106	387 [3425] 102	486 [4299] 95	533 [4721] 90	579 [5128] 84	654 [5790] 67	732 [6478] 54		113	
	30 [8]	34 [298] 150	85 [752] 149	180 [1593] 148	281 [2488] 144	384 [3394] 138	484 [4285] 131	534 [4722] 126	582 [5149] 120	670 [5931] 99	755 [6685] 85		151	
	38 [10]	29 [255] 188	80 [709] 187	174 [1544] 186	276 [2446] 182	378 [3345] 176	479 [4240] 167	529 [4683] 161	576 [5098] 150	674 [5965] 134	768 [6793] 116		188	
	45 [12]	22 [197] 225	74 [651] 224	168 [1491] 220	270 [2385] 213	371 [3284] 323	473 [4190] 204	520 [4600] 194	572 [5064] 185	670 [5930] 169	767 [6789] 150		226	
	53 [14]	16 [139] 264	67 [593] 263	163 [1439] 261	263 [2324] 257	363 [3216] 251	465 [4111] 241	513 [4537] 229	563 [4980] 222	664 [5880] 205	764 [6765] 186		263	
	61 [16]	8 [70] 302	60 [530] 301	159 [1409] 299	255 [2260] 296	355 [3145] 289	454 [4022] 273	506 [4477] 266	557 [4929] 257	656 [5809] 238	756 [6688] 219		301	
	68 [18]		50 [446] 338	153 [1358] 336	246 [2181] 334	347 [3067] 327	447 [3955] 310	493 [4363] 302	547 [4838] 294	648 [5731] 274	747 [6612] 253		338	
	76 [20]		41 [363] 376	144 [1277] 374	237 [2100] 372	336 [2977] 365	437 [3868] 348	487 [4305] 340	537 [4754] 331	637 [5639] 311	740 [6546] 288		376	
	83 [22]		31 [276] 414	134 [1186] 411	227 [2007] 410	326 [2888] 403	427 [3783] 385	478 [4230] 377	527 [4665] 368	628 [5555] 347	730 [6463] 324		413	
	91 [24]				216 [1908] 449	315 [2790] 441	417 [3693] 423	467 [4137] 414	518 [4581] 405	618 [5466] 383	723 [6395] 360		451	
	95 [25]				210 [1856] 468	309 [2737] 461	413 [3656] 440	464 [4107] 432	513 [4543] 422	614 [5436] 401	718 [6353] 378		470	
114 [30]				181 [1598] 561	281 [2486] 552	382 [3380] 539	433 [3831] 530	482 [4267] 521	580 [5136] 495	689 [6100] 467		563		

Torque - Nm [lb-in], Speed rpm

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

55 [490]	111 [980]	221 [1959]	332 [2939]	443 [3918]	553 [4898]	609 [5388]	664 [5878]	775 [6857]	886 [7837]
----------	-----------	------------	------------	------------	------------	------------	------------	------------	------------

Theoretical Torque - Nm [lb-in]

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

230	Pressure - bars [psi]								Max. Cont.	Max. Inter.
	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	190 [2750]	207 [3000]	242 [3500]	276 [4000]

228 cc [13.92 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	2 [0.5]	40 [353] 7	90 [798] 7	189 [1673] 6									9	Theoretical rpm
	4 [1]	49 [435] 16	97 [856] 15	199 [1764] 14	293 [2592] 12	391 [3457] 10	483 [4272] 7	530 [4692] 5	576 [5094] 4				17	
	8 [2]	43 [378] 32	100 [889] 31	212 [1878] 30	316 [2798] 28	414 [3664] 25	507 [4491] 21	552 [4881] 19	596 [5271] 16				34	
	15 [4]	49 [433] 65	100 [884] 65	217 [1918] 63	333 [2943] 61	442 [3909] 57	542 [4801] 51	589 [5215] 48	642 [5685] 43	724 [6407] 33	806 [7135] 21		67	
	23 [6]	45 [402] 98	97 [861] 97	214 [1897] 97	331 [2929] 97	446 [3950] 97	556 [4925] 81	609 [5393] 76	651 [5762] 68	747 [6610] 68	833 [7371] 43		100	
	30 [8]	41 [360] 131	98 [871] 130	209 [1852] 130	327 [2896] 126	444 [3928] 121	557 [4933] 113	607 [5370] 102	662 [5863] 96	766 [6781] 82	858 [7595] 67		133	
	38 [10]	34 [302] 164	94 [829] 163	204 [1804] 162	321 [2841] 159	439 [3881] 154	550 [4868] 139	608 [5380] 133	665 [5882] 126	775 [6857] 110	875 [7743] 92		166	
	45 [12]	27 [235] 197	86 [763] 196	196 [1734] 195	313 [2772] 192	431 [3815] 186	545 [4819] 171	603 [5334] 164	660 [5837] 157	772 [6829] 140	882 [7803] 119		200	
	53 [14]	19 [167] 229	78 [690] 229	188 [1660] 228	305 [2698] 225	422 [3734] 219	538 [4757] 204	595 [5269] 197	653 [5778] 189	766 [6781] 170	878 [7772] 146		233	
	61 [16]	11 [100] 262	69 [612] 261	178 [1576] 262	295 [2614] 258	413 [3657] 252	528 [4677] 235	586 [5188] 227	644 [5697] 219	700 [6198] 210	815 [7214] 190		266	
	68 [18]		60 [527] 294	168 [1487] 295	286 [2514] 292	402 [3559] 280	519 [4592] 268	577 [5106] 260	634 [5611] 251	748 [6617] 229	862 [7632] 204		299	
	76 [20]		49 [430] 327	155 [1375] 328	272 [2408] 325	391 [3457] 314	506 [4482] 302	565 [5001] 294	623 [5514] 285	739 [6537] 262	850 [7525] 235		332	
	83 [22]		40 [352] 360	149 [1319] 360	262 [2321] 357	379 [3357] 350	495 [4382] 338	553 [4894] 330	611 [5409] 320	724 [6409] 298	839 [7423] 270		366	
	91 [24]		30 [268] 392	138 [1220] 392	251 [2217] 389	368 [3253] 382	482 [4268] 369	540 [4781] 361	598 [5295] 351	713 [6309] 328	829 [7333] 301		399	
	95 [25]			131 [1161] 408	245 [2167] 405	362 [3202] 397	478 [4227] 384	537 [4755] 376	592 [5237] 365	708 [6263] 343	823 [7283] 316		415	
114 [30]			92 [816] 492	208 [1837] 487	325 [2876] 480	442 [3908] 467	499 [4419] 458	557 [4928] 448	617 [5942] 423	790 [6991] 394		498		

Torque - Nm [lb-in], Speed rpm

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

63 [554]	125 [1108]	250 [2215]	376 [3323]	501 [4431]	626 [5539]	688 [6092]	751 [6646]	876 [7754]	1001 [8862]
----------	------------	------------	------------	------------	------------	------------	------------	------------	-------------

Theoretical Torque - Nm [lb-in]

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



320

Pressure - bars [psi]									Max. Cont.	Max. Inter.	
17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	155 [2250]	172 [2500]	190 [2750]	207 [3000]	224 [3250]		

325 cc [19.81 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	2 [0.5]	65 [571] 5	135 [1196] 4	272 [2406] 3	398 [3524] 1							6	Theoretical rpm	
	4 [1]	67 [595] 11	146 [1291] 10	290 [2568] 9	425 [3764] 7	558 [4937] 6	623 [5514] 4	689 [6101] 3	746 [6599] 1			12		
	8 [2]	67 [597] 22	150 [1328] 22	311 [2751] 20	461 [4083] 18	596 [5277] 16	659 [5834] 14	723 [6396] 12	788 [6977] 11	849 [7510] 9				24
	15 [4]	64 [565] 46	147 [1299] 46	312 [2761] 44	474 [4197] 41	627 [5547] 36	698 [6173] 33	762 [6747] 30	821 [7261] 26	880 [7785] 20	942 [8337] 19			47
	23 [6]	77 [677] 70	154 [1367] 69	320 [2834] 67	484 [4283] 64	642 [5679] 57	717 [6347] 52	791 [7004] 48	853 [7548] 42	917 [8116] 37	977 [8646] 32			70
	30 [8]	72 [641] 93	147 [1299] 93	313 [2766] 91	477 [4221] 87	637 [5640] 80	715 [6329] 75	786 [6959] 65	861 [7617] 59	937 [8236] 53	996 [8816] 49			94
	38 [10]	64 [566] 117	137 [1217] 117	303 [2683] 114	468 [4142] 110	629 [5568] 103	705 [6241] 94	784 [6935] 87	859 [7603] 80	934 [8265] 74	1005 [8895] 68			117
	45 [12]	53 [473] 141	131 [1155] 141	292 [2587] 138	458 [4049] 134	619 [5479] 125	695 [6151] 116	774 [6850] 109	850 [7523] 103	926 [8197] 96	1001 [8861] 89			140
	53 [14]	30 [262] 164	122 [1076] 164	281 [2483] 161	446 [3943] 157	606 [5367] 146	687 [6078] 139	764 [6764] 132	840 [7434] 124	915 [8099] 116	990 [8761] 109			164
	61 [16]	18 [161] 188	112 [994] 187	267 [2359] 185	431 [3818] 181	594 [5253] 169	674 [5966] 163	753 [6660] 155	824 [7290] 149					187
	68 [18]	18 [160] 211	113 [997] 211	265 [2344] 209	430 [3805] 204	593 [5244] 192	673 [5953] 185	751 [6649] 178	811 [7178] 174					210
	76 [20]	3 [25] 235	97 [863] 234	248 [2198] 233	415 [3673] 227	578 [5114] 216	658 [5821] 210	736 [6515] 202	797 [7052] 197					234
	83 [22]		84 [747] 258	236 [2091] 255	400 [3540] 249	562 [4973] 240	641 [5676] 234	720 [6368] 227	781 [6913] 222					257
91 [24]		75 [667] 282	215 [1900] 279	380 [3365] 273	543 [4804] 264	623 [5510] 258	701 [6202] 251	763 [6756] 246				280		
95 [25]		70 [616] 293	207 [1828] 290	370 [3272] 285	533 [4716] 276	613 [5423] 270	698 [6175] 261	758 [6711] 257				292		
114 [30]			153 [1353] 350	315 [2789] 344	478 [4230] 335	559 [4943] 329	639 [5653] 322	704 [6233] 318				350		

Torque - Nm [lb-in], Speed rpm Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%

89 [788]	178 [1576]	356 [3153]	534 [4729]	713 [6306]	802 [7094]	891 [7882]	980 [8670]	1069 [9459]	1158 [10247]
----------	------------	------------	------------	------------	------------	------------	------------	-------------	--------------

Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]

400

Pressure - bars [psi]									Max. Cont.	Max. Inter.	
17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250]	172 [2500]	190 [2750]		

399 cc [24.36 in³/rev.]

Intermittent Ratings are below and to the right of the BOLD line.

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	2 [0.5]	81 [717] 4	173 [1534] 4	356 [3148] 2								5	Theoretical rpm
	4 [1]	85 [752] 9	181 [1605] 8	369 [3263] 7	460 [4074] 6	550 [4865] 5	638 [5648] 4	724 [6404] 3	816 [7222] 2			10	
	8 [2]	86 [762] 18	187 [1654] 18	387 [3422] 16	483 [4274] 15	575 [5090] 13	662 [5861] 11	747 [6613] 10	826 [7310] 7			19	
	15 [4]	82 [724] 38	185 [1635] 37	391 [3460] 35	493 [4361] 34	592 [5240] 31	688 [6086] 27	776 [6871] 23	866 [7667] 17	942 [8337] 12		38	
	23 [6]	75 [663] 57	178 [1573] 56	383 [3393] 54	486 [4301] 52	588 [5201] 50	686 [6074] 46	783 [6926] 40	876 [7750] 33	963 [8524] 27	1056 [9345] 24	57	
	30 [8]	66 [585] 76	168 [1490] 75	374 [3306] 73	476 [4216] 72	578 [5119] 69	679 [6007] 65	776 [6868] 57	872 [7716] 50	966 [8545] 43	1055 [9341] 36	76	
	38 [10]		154 [1365] 95	361 [3197] 93	464 [4110] 91	567 [5015] 88	664 [5880] 82	764 [6764] 76	862 [7626] 69	956 [8463] 61	1050 [9289] 52	95	
	45 [12]		140 [1237] 114	346 [3066] 112	450 [3978] 110	551 [4880] 107	649 [5744] 101	750 [6638] 95	848 [7503] 88	945 [8361] 80	1039 [9195] 71	114	
	53 [14]		125 [1104] 133	330 [2924] 131	434 [3838] 129	536 [4745] 126	634 [5609] 119	735 [6504] 112	833 [7369] 102	929 [8217] 97	1024 [9058] 88	133	
	61 [16]		106 [934] 151	311 [2755] 150	415 [3672] 148	518 [4580] 145	617 [5456] 138	718 [6357] 131	817 [7228] 123	913 [8079] 114	1007 [8913] 104	152	
	68 [18]			291 [2578] 169	395 [3493] 167	498 [4405] 165	597 [5279] 158	699 [6185] 151	798 [7065] 143	896 [7931] 134	991 [8774] 122	171	
	76 [20]			269 [2379] 189	371 [3286] 187	475 [4205] 184	575 [5084] 177	678 [5997] 171	777 [6879] 163	876 [7754] 154	972 [8606] 143	190	
	83 [22]			246 [2174] 207	348 [3076] 205	451 [3987] 202	555 [4911] 198	654 [5789] 192	754 [6671] 184	852 [7543] 175	951 [8413] 165	209	
91 [24]			226 [2000] 226	322 [2850] 224	424 [3756] 221	528 [4668] 217	629 [5571] 211	728 [6446] 204	828 [7332] 195	926 [8197] 184	228		
99 [26]			197 [1739] 246	294 [2600] 244	397 [3515] 241	500 [4421] 236	602 [5323] 231	702 [6214] 224	801 [7093] 215	900 [7963] 205	247		
114 [30]			131 [1162] 284	237 [2100] 282	338 [2991] 279	441 [3901] 275	542 [4798] 269	643 [5687] 263	743 [6574] 254	843 [7458] 245	285		

Torque - Nm [lb-in], Speed rpm Overall Efficiency - 70 - 100% 40 - 69% 0 - 39%

110 [969]	219 [1939]	438 [3877]	548 [4846]	657 [5816]	767 [6785]	876 [7754]	986 [8723]	1095 [9693]	1205 [10662]
-----------	------------	------------	------------	------------	------------	------------	------------	-------------	--------------

Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]



500

Pressure - bars [psi]						Max. Cont.	Max. Inter.
17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000] 155 [2250]

496 cc [30.29 in³/rev.] **Intermittent Ratings are below and to the right of the BOLD line.** Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	2 [0.5]	94 [832] 3	210 [1861] 3	323 [2859] 3	435 [3853] 3								Theoretical rpm	
	4 [1]	98 [868] 7	197 [1743] 7	314 [2781] 7	430 [3802] 6	542 [4797] 6	652 [5766] 5	777 [6876] 4						
	8 [2]	100 [882] 15	205 [1812] 15	328 [2905] 14	447 [3959] 14	565 [5001] 13	677 [5990] 11	780 [6900] 9	879 [7779] 7					
	15 [4]	95 [843] 31	204 [1803] 30	332 [2938] 30	460 [4070] 29	584 [5170] 28	703 [6225] 25	815 [7212] 21	917 [8118] 16	1012 [8956] 13				
	23 [6]	89 [783] 46	196 [1737] 46	324 [2869] 45	453 [4009] 44	580 [5133] 43	705 [6237] 41	824 [7296] 36	930 [8234] 28	1033 [9141] 22				
	30 [8]	79 [696] 62	185 [1639] 61	314 [2778] 61	443 [3918] 60	570 [5047] 58	696 [6161] 56	814 [7205] 50	930 [8231] 43	1041 [9210] 34				
	38 [10]	68 [600] 77	172 [1523] 77	300 [2652] 76	429 [3800] 75	557 [4929] 74	684 [6052] 71	805 [7123] 66	924 [8175] 59	1037 [9175] 50				
	45 [12]		177 [1568] 92	262 [2318] 92	410 [3624] 91	519 [4593] 89	644 [5696] 86	770 [6811] 82	891 [7885] 75	1008 [8916] 68				
	53 [14]		157 [1389] 108	286 [2533] 107	415 [3673] 106	544 [4810] 104	669 [5918] 101	794 [7027] 96	914 [8092] 89	1031 [9122] 80				
	61 [16]		138 [1219] 123	265 [2347] 122	394 [3486] 121	523 [4630] 120	649 [5740] 116	775 [6861] 111	897 [7936] 104	1013 [8968] 95				
	68 [18]		114 [1004] 139	243 [2147] 138	370 [3277] 137	500 [4424] 135	626 [5536] 132	752 [6659] 127	876 [7753] 120	995 [8806] 111				
	76 [20]		96 [849] 154	217 [1919] 153	344 [3047] 152	473 [4190] 151	600 [5311] 147	728 [6446] 143	852 [7537] 136	972 [8606] 127				
	83 [22]		78 [688] 169	154 [1360] 169	276 [2439] 168	406 [3595] 167	534 [4724] 164	660 [5839] 161	784 [6938] 155	907 [8028] 148				
	91 [24]			160 [1416] 184	268 [2371] 184	397 [3512] 182	524 [4633] 179	650 [5755] 175	776 [6863] 170	898 [7950] 162				
	99 [26]			129 [1138] 200	231 [2048] 199	321 [2844] 198	451 [3988] 196	576 [5097] 193	703 [6218] 188	827 [7320] 181				
114 [30]				186 [1647] 230	292 [2581] 229	383 [3387] 227	508 [4494] 224	636 [5631] 219	761 [6738] 213					

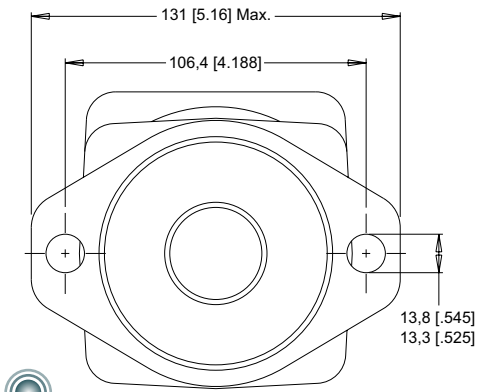
Torque - Nm [lb-in], Speed rpm **Overall Efficiency** - 70 - 100% 40 - 69% 0 - 39%

136 [1205]	272 [2410]	409 [3616]	545 [4821]	681 [6026]	817 [7231]	953 [8436]	1090 [9642]	1226 [10847]
------------	------------	------------	------------	------------	------------	------------	-------------	--------------

Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]

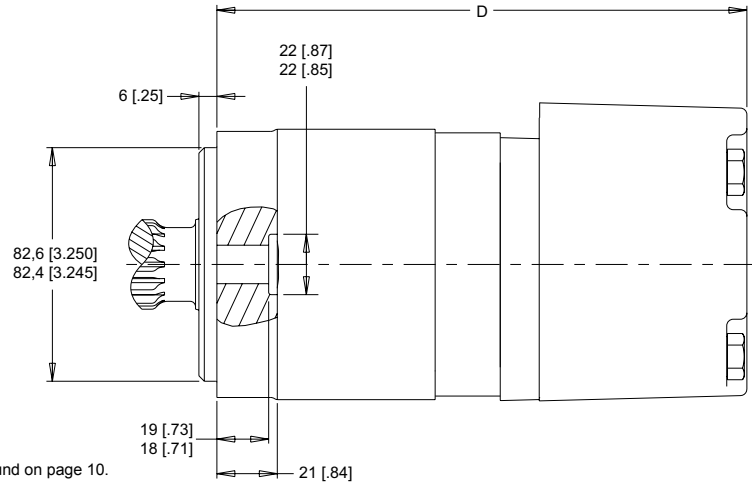


A0 2-Hole SAE A Mount with End Ports

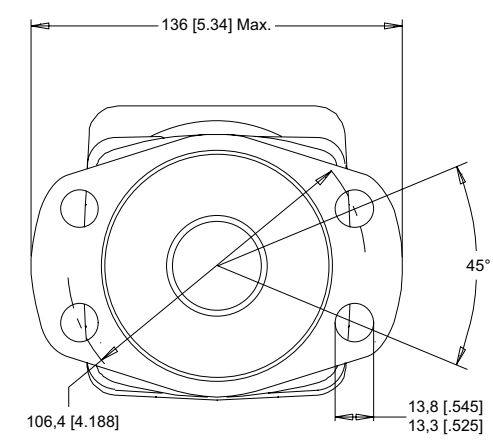


NOTE: Overall motor length varies depending on the displacement. Dimension D is found on page 10.

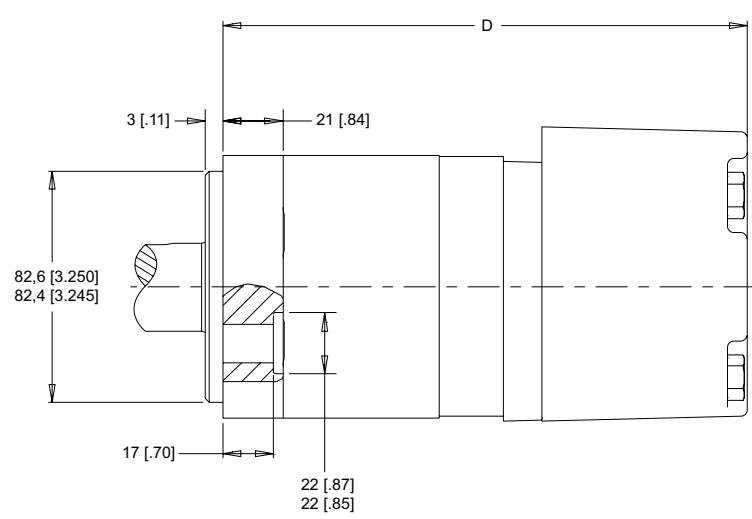
A7 2-Hole SAE A Mount with Side Ports



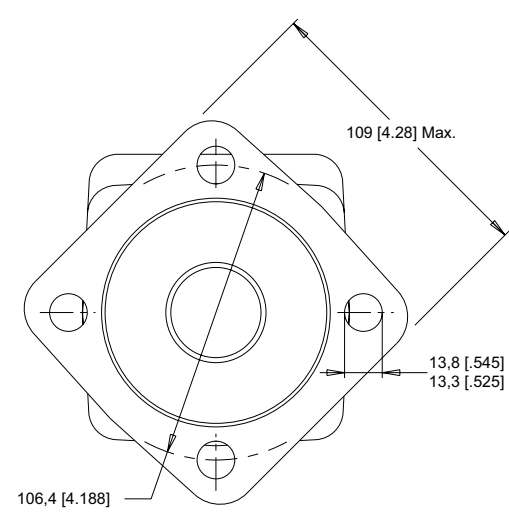
A2 4-Hole Magneto with End Ports



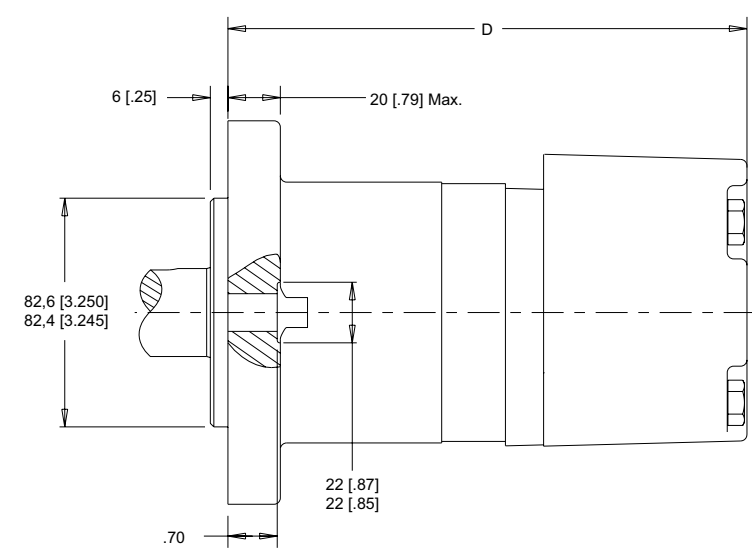
A8 4-Hole Magneto with Side Ports



AG 4-Hole Square SAE A Mount with End Ports



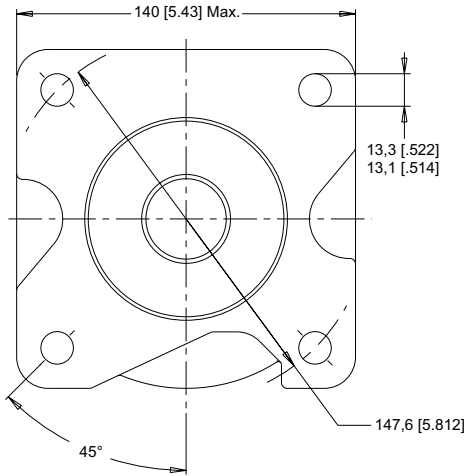
AH 4-Hole Square SAE A Mount with Side Ports



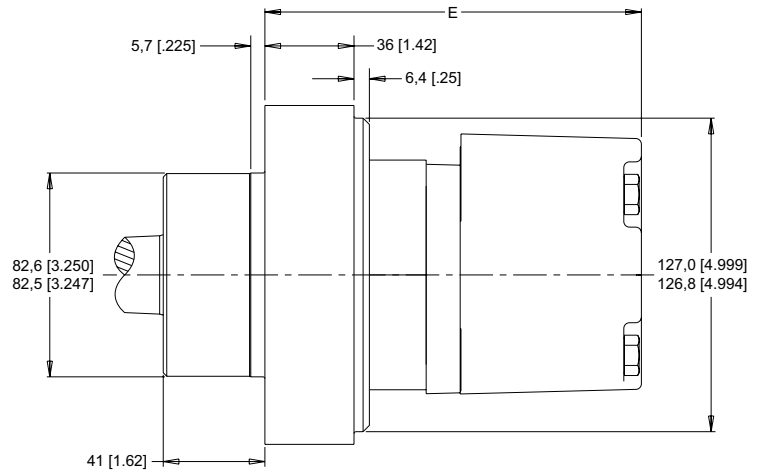


355 & 356 SERIES HOUSINGS

W2 4-Hole 3.25" Pilot Wheel Mount with End Ports

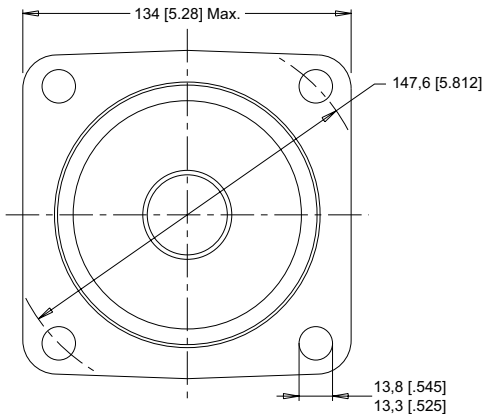


W8 4-Hole 3.25" Wheel Mount with Side Ports

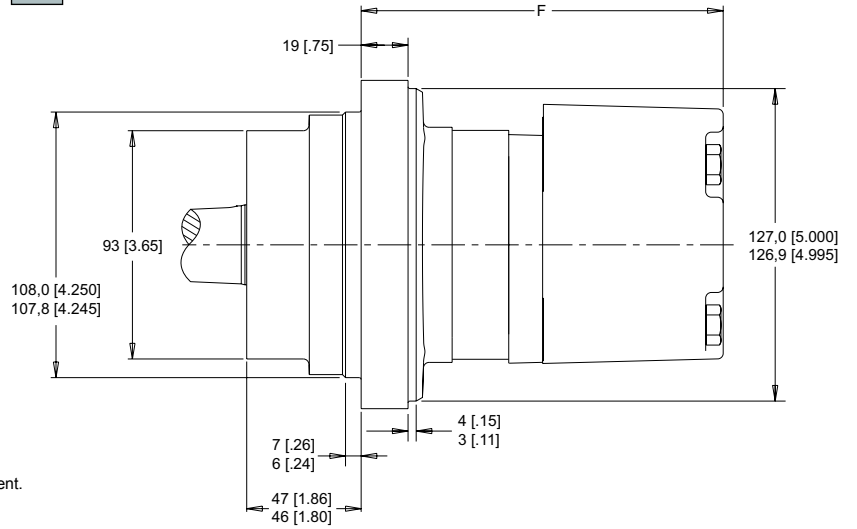


NOTE: Overall motor length varies depending on the displacement. Dimension E is found on page 10.

Y2 4-Hole 4.25" Pilot Wheel Mount with End Ports

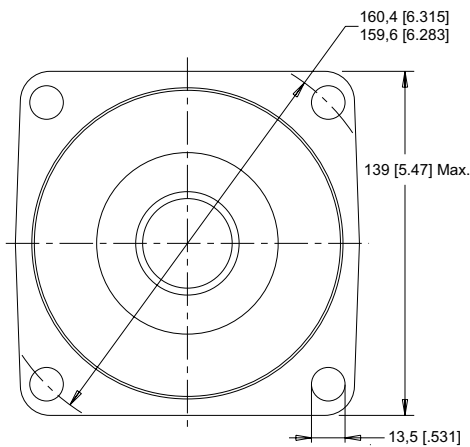


Y8 4-Hole 4.25" Wheel Mount with Side Ports

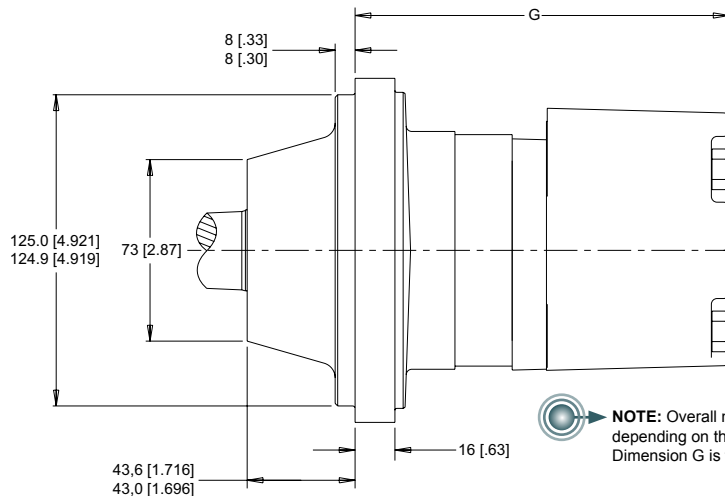


NOTE: Overall motor length varies depending on the displacement. Dimension F is found on page 11.

Z2 4-Hole Euro Wheel Mount with End Ports



Z8 4-Hole Euro Wheel Mount with Side Ports



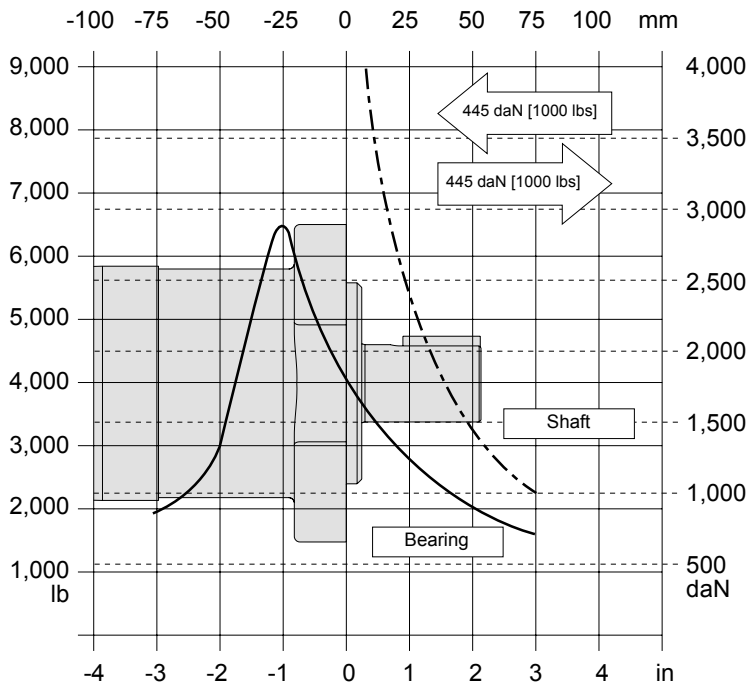
NOTE: Overall motor length varies depending on the displacement. Dimension G is found on page 11.



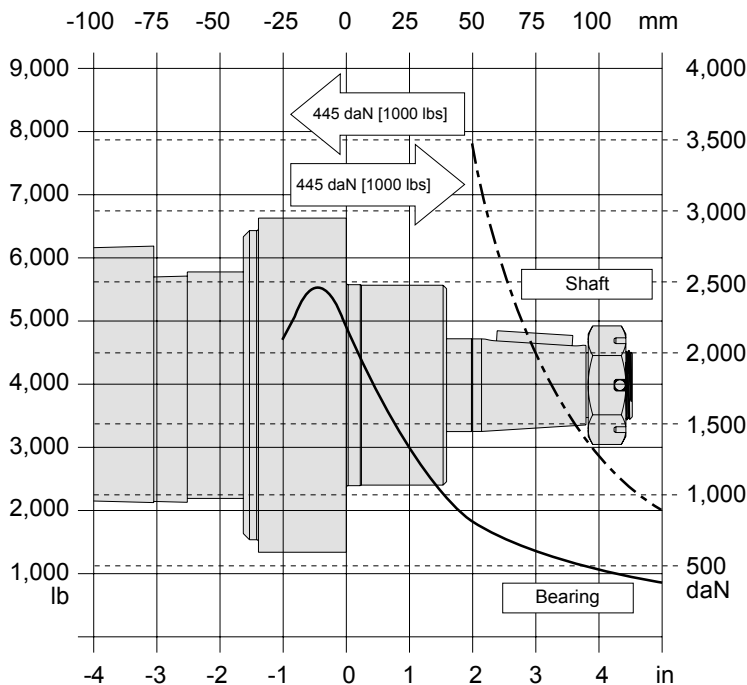
355 & 356 SERIES TECHNICAL INFORMATION

Bearing Curve: The bearing curve represents allowable bearing loads for a B10 life of 2,000 hours at 100 rpm. The curve includes affects of 1,000 lbs inward/outward net thrust* (see note on page 11). Radial loads for speeds other than 100 rpm may be calculated using the multiplication factor table located below.

SAE "A" MOUNT



3.25" PILOT WHEEL MOUNT



LENGTH / WEIGHT CHART SAE A Mount - Dimension D		
Code	mm [in]	kg [lb]
100	193 [7.60]	10,8 [23.8]
110	196 [7.70]	11,0 [24.1]
130	199 [7.83]	11,1 [24.5]
160	205 [8.08]	11,5 [25.4]
200	213 [8.38]	11,9 [26.2]
230	219 [8.62]	12,3 [27.1]
320	237 [9.33]	13,3 [29.2]
400	237 [9.33]	13,3 [29.2]
500	252 [9.93]	14,0 [30.9]

NOTE:
WS motor weights vary $\pm 0,5$ kg [1 lbs] depending upon motor configuration. Add 3,8 mm [.15 in] to dimension D for Magneto mount.

LENGTH / WEIGHT CHART 3.25" Wheel Mount - Dimension E		
Code	mm [in]	kg [lb]
100	158 [6.23]	12,5 [27.5]
110	161 [6.33]	12,6 [27.8]
130	164 [6.46]	12,8 [28.2]
160	170 [6.71]	13,3 [29.2]
200	178 [7.01]	13,6 [29.9]
230	184 [7.25]	14,0 [30.8]
320	202 [7.96]	15,0 [32.9]
400	202 [7.96]	15,0 [32.9]
500	217 [8.56]	15,8 [34.7]

NOTE:
WS motor weights vary $\pm 0,5$ kg [1 lbs] depending upon motor configuration.

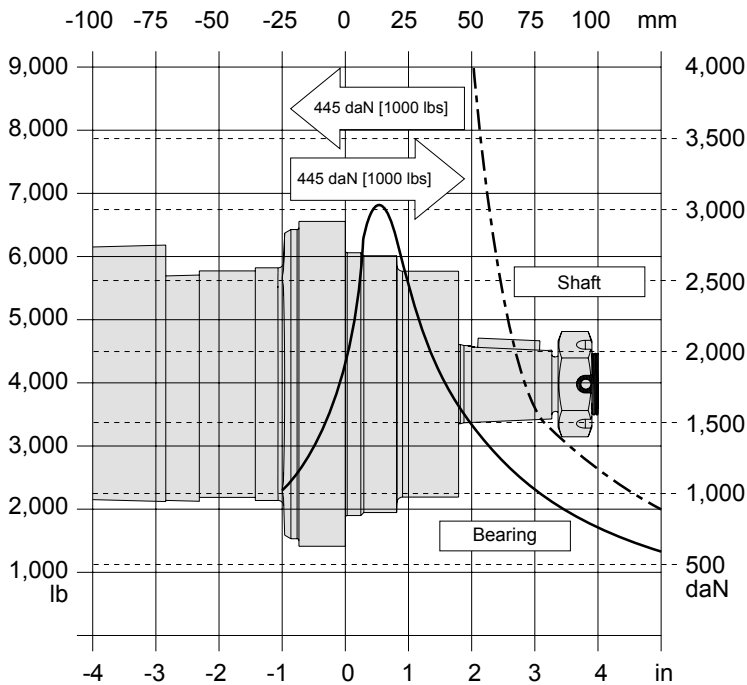
BEARING LOAD Multiplication Factor Table	
RPM	Factor
050	1.23
100	1.00
200	0.81
300	0.72
400	0.66
500	0.62
600	0.58
700	0.56
800	0.50



355 & 356 SERIES TECHNICAL INFORMATION

Bearing Curve: The bearing curve represents allowable bearing loads for a B10 life of 2,000 hours at 100 rpm. The curve includes effects of 1,000 lbs inward/outward net thrust*. Radial loads for speeds other than 100 rpm may be calculated using the multiplication factor table on page 10.

4.25" PILOT & EURO WHEEL MOUNTS



* Case pressure will push outward on the shaft. If case drain line is attached and routed directly to tank, case pressure should be negligible. If case drain line is not attached, case pressure will be nearly the same as motor return pressure. When case pressure is acting, the allowable inward axial load can be increased and the allowable outward axial load must be decreased at a rate of 59 kg / 7 bar [130 lb / 100 psi] for shaft codes 02, 10, 12, 20, 21, 22 & 23. The rate for shaft codes 28 & 31 is 78 kg / 7 bar [175 lb / 100 psi].

LENGTH / WEIGHT CHART 4.25" Wheel Mount - Dimension F		
Code	mm [in]	kg [lb]
100	153 [6.02]	12,0 [26.5]
110	155 [6.12]	12,2 [26.8]
130	159 [6.25]	12,4 [27.2]
160	165 [6.50]	12,8 [28.1]
200	173 [6.80]	13,1 [28.9]
230	179 [7.04]	13,5 [29.8]
320	197 [7.75]	14,5 [31.9]
400	197 [7.75]	14,5 [31.9]
500	212 [8.35]	15,3 [33.6]

NOTE:
WS motor weights vary $\pm 0,5$ kg [1 lbs] depending upon motor configuration.

LENGTH / WEIGHT CHART Euro Wheel Mount - Dimension G		
Code	mm [in]	kg [lb]
100	156 [6.14]	11,8 [26.0]
110	158 [6.24]	12,2 [26.3]
130	162 [6.37]	12,0 [26.7]
160	168 [6.62]	12,5 [27.6]
200	176 [6.92]	12,9 [28.4]
230	182 [7.16]	13,3 [29.3]
320	200 [7.87]	14,3 [31.4]
400	200 [7.87]	14,3 [31.4]
500	215 [8.47]	15,0 [33.1]

NOTE:
WS motor weights vary $\pm 0,5$ kg [1 lbs] depending upon motor configuration.

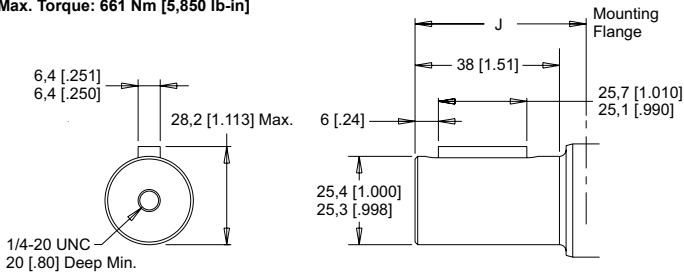
LENGTH / WEIGHT CHART Short Motor - Dimension H		
Code	mm [in]	kg [lb]
100	142 [5.60]	9,6 [21.2]
110	145 [5.70]	9,8 [21.5]
130	148 [5.83]	9,9 [21.8]
160	154 [6.08]	10,4 [22.8]
200	162 [6.38]	10,7 [23.6]
230	168 [6.62]	11,1 [24.5]
320	186 [7.33]	12,0 [26.5]
400	186 [7.33]	12,0 [26.5]
500	201 [7.93]	12,9 [28.3]

NOTE:
WS motor weights vary $\pm 0,5$ kg [1 lbs] depending upon motor configuration.



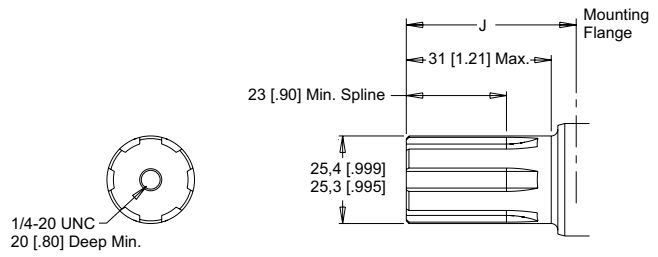
10 1" Straight

Max. Torque: 661 Nm [5,850 lb-in]



02 6-B Spline

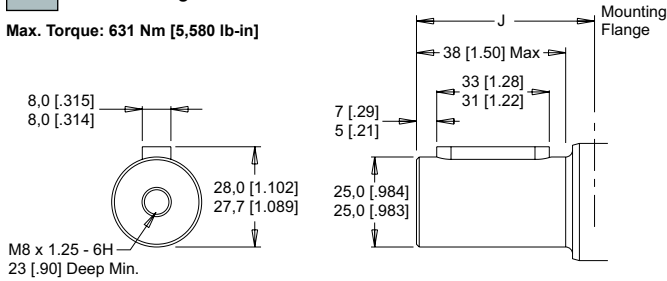
Max. Torque: 429 Nm [3,800 lb-in]



6-B Spline (SAE J499 Standard)

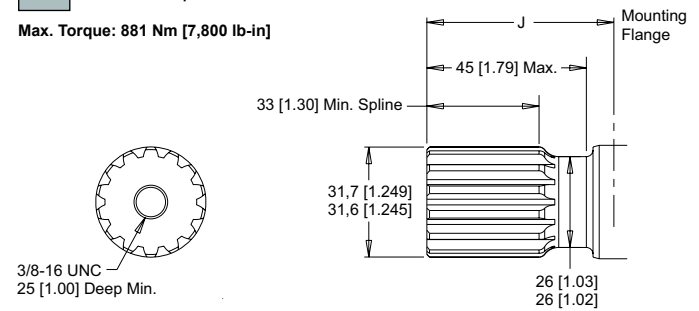
12 25mm Straight

Max. Torque: 631 Nm [5,580 lb-in]



23 14 Tooth Spline

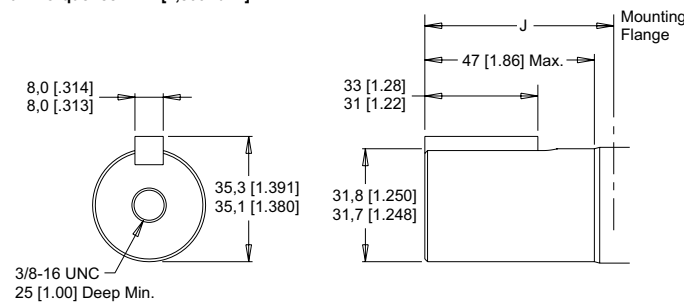
Max. Torque: 881 Nm [7,800 lb-in]



14 Tooth 12/24 pitch Std. (ANSI B92.1-1996 Spline)

20 1-1/4" Straight

Max. Torque: 881 Nm [7,800 lb-in]



MOUNTING FLANGE TO SHAFT END - Dimension J

Code	A0, A7, AG, & AH	A2 & A8	W2 & W8	Y2 & Y8	Z2 & Z8
02	51 [2.00]	47 [1.85]	85 [3.34]	91 [3.58]	88 [3.45]
10	51 [2.00]	47 [1.85]	85 [3.34]	91 [3.58]	88 [3.45]
12	51 [2.00]	56 [1.86]	85 [3.34]	91 [3.58]	88 [3.46]
20	55 [2.18]	52 [2.03]	89 [3.52]	96 [3.76]	92 [3.63]
21	65 [2.54]	61 [2.39]	99 [3.88]	105 [4.12]	101 [3.99]
22	64 [2.51]	60 [2.36]	103 [4.04]	104 [4.09]	101 [3.96]
23	55 [2.17]	52 [2.03]	89 [3.51]	95 [3.75]	92 [3.63]
28	N/A	N/A	102 [4.02]	107 [4.20]	104 [4.08]
31	N/A	N/A	117 [4.62]	123 [4.86]	120 [4.73]



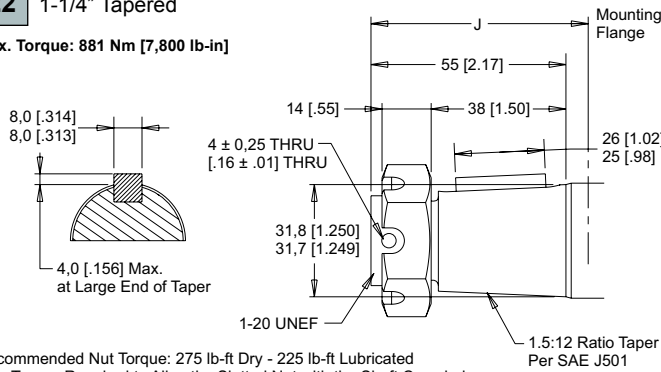
NOTE: Shaft lengths vary $\pm 0,8$ mm [0.030 in.]



355 & 356 SERIES SHAFTS

22 1-1/4" Tapered

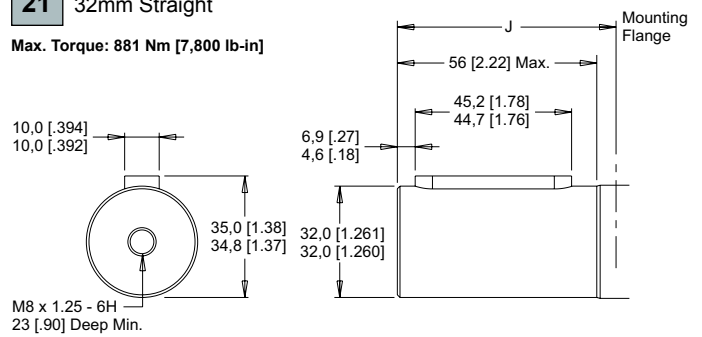
Max. Torque: 881 Nm [7,800 lb-in]



Recommended Nut Torque: 275 lb-ft Dry - 225 lb-ft Lubricated
Plus Torque Required to Align the Slotted Nut with the Shaft Crosshole.

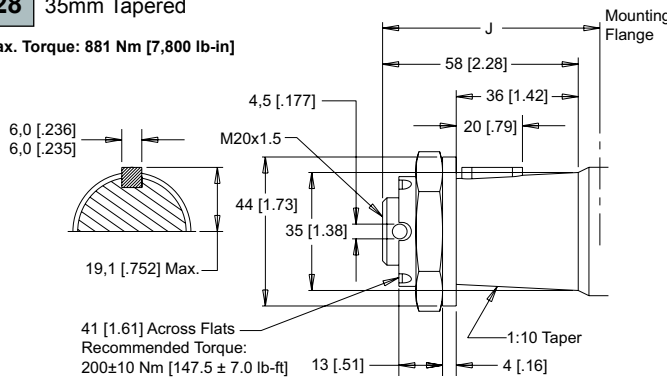
21 32mm Straight

Max. Torque: 881 Nm [7,800 lb-in]



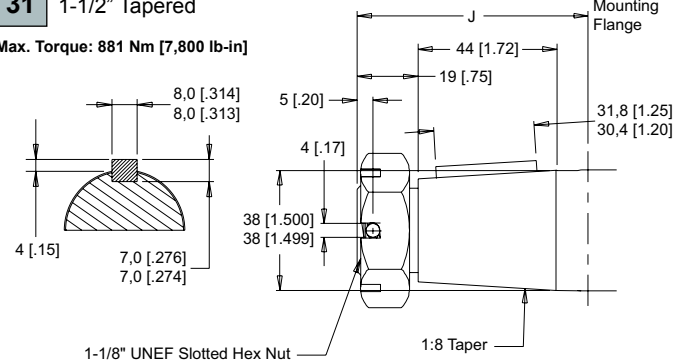
28 35mm Tapered

Max. Torque: 881 Nm [7,800 lb-in]



31 1-1/2" Tapered

Max. Torque: 881 Nm [7,800 lb-in]



NOTE: Dimension J is found on page 12.

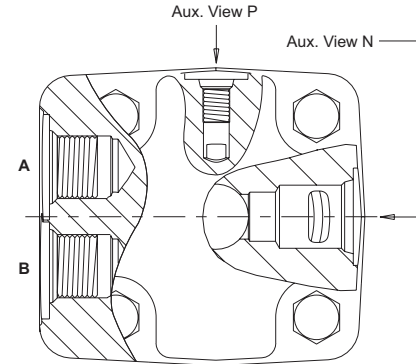
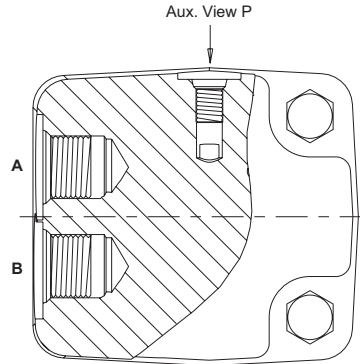
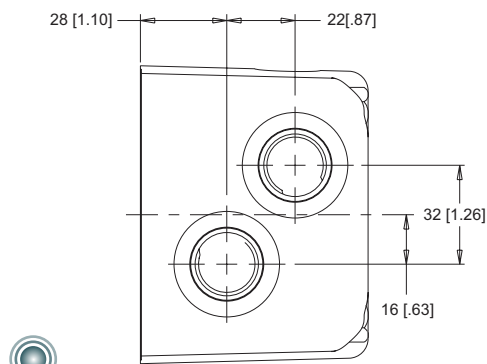


355 & 356 SERIES PORTING OPTIONS

SIDE PORTS

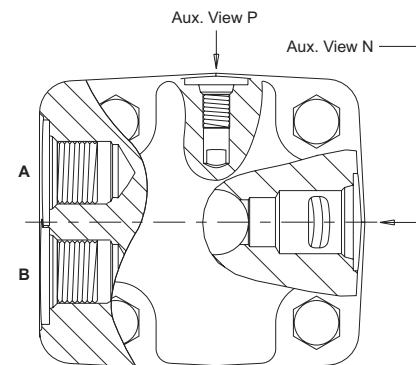
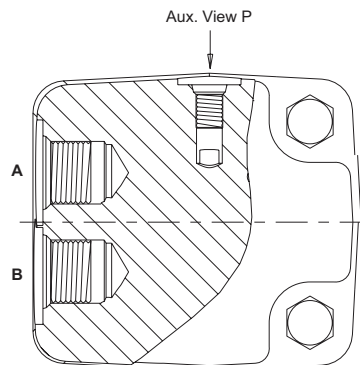
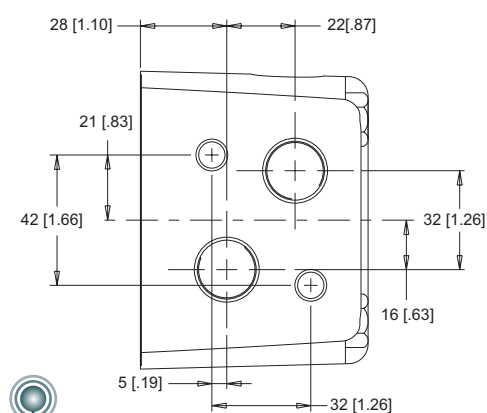
1 7/8" O-Ring with 7/16" Drain Port

2 1/2" BSP.F with 1/4" Drain Port



NOTE: The #1 and #2 WS side ported options can be ordered with a relief valve cavity (10 Series / 2 Way Valve Cavity 7/8" - 14 UNF-2B). See page 15 for Auxillary views N and P.

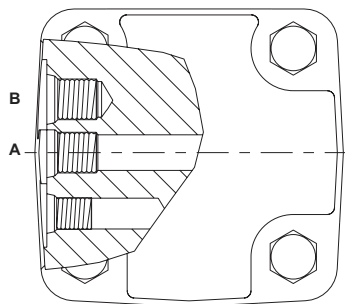
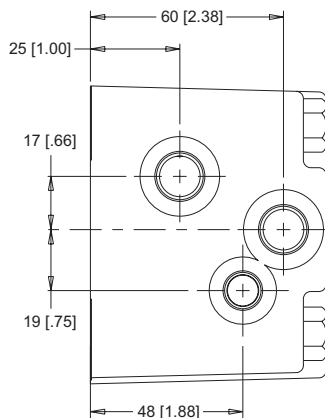
3 1/2" BSP.F Offset Manifold with 1/4" Drain Port



NOTE: The #3 WS side ported option can be ordered with a relief valve cavity (10 Series / 2 Way Valve Cavity 7/8" - 14 UNF-2B). See page 15 for Auxillary views N and P.

5 9/16" O-Ring with 7/16" Drain Port

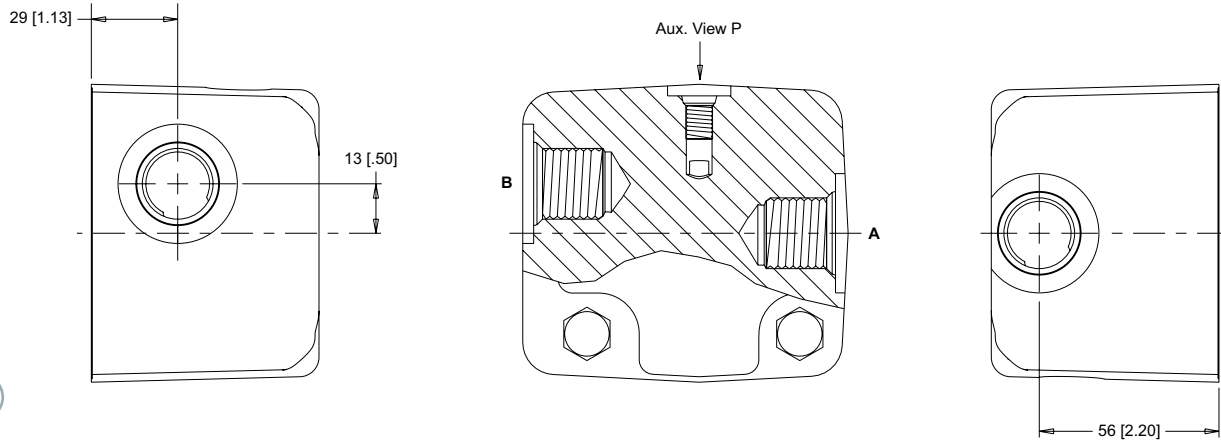
9 3/8" BSP.F with 1/4" Drain Port





SIDE PORTS

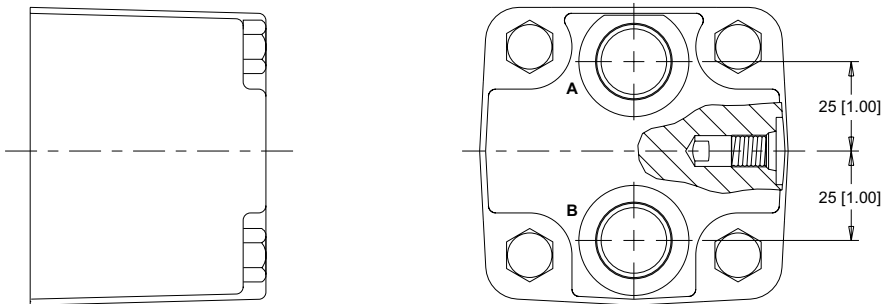
- 6** 1-1/16" O-Ring with 7/16" Drain Port



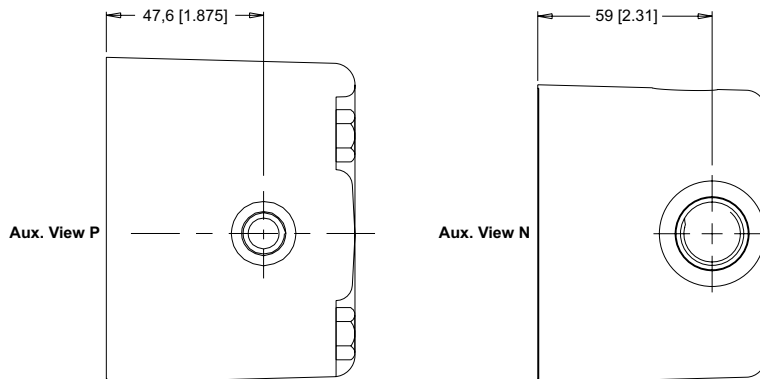
NOTE: See below for Auxillary view P.

END PORTS

- 1** 7/8" O-Ring with 7/16" Drain Port
- 2** 1/2" BSP.F with 1/4" Drain Port



AUXILLARY VIEWS





355 & 356 SERIES SHORT MOTOR

SHORT MOTOR TECHNICAL INFORMATION

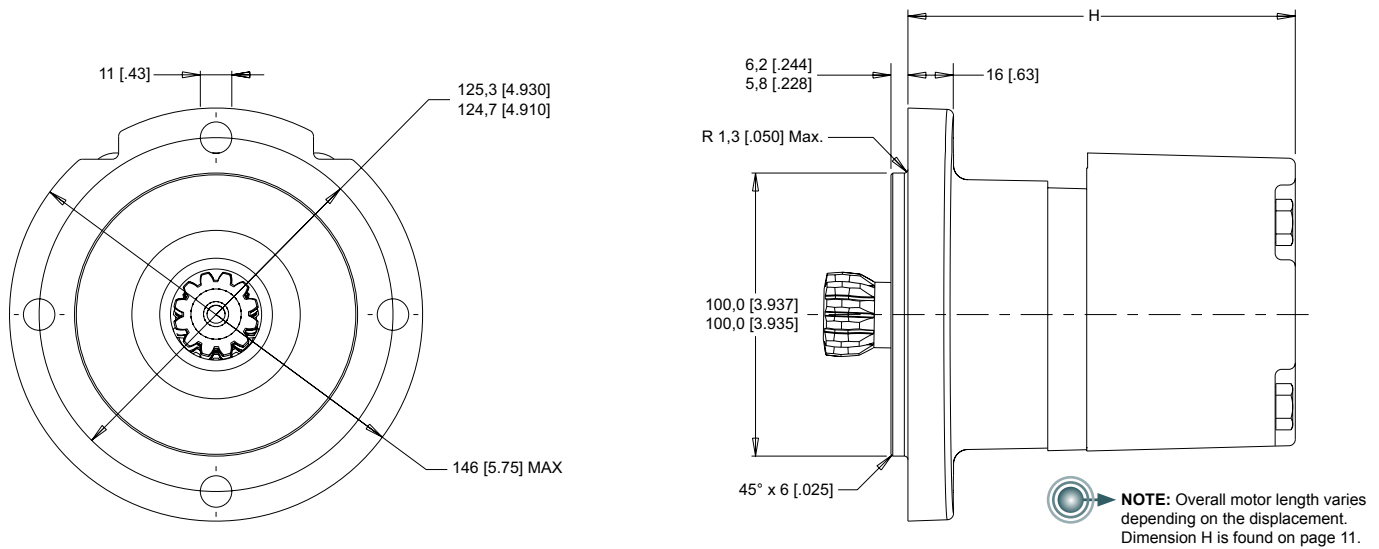
The WS short motor comes without bearings or an output shaft. It is designed for direct mounting onto a gearbox or similar add-on component that provides the internal splined input shaft and bearings. Spline specifications provided below.

The add-on component must be fitted with a shaft seal on its input shaft if it is desired to prevent the motor leakage oil from flowing into the add-on component. In addition, the recommended 4mm diameter hole in the bottom of the add-on component input shaft should be omitted or plugged. If a shaft seal is used, make sure the motor back pressure or case pressure will never exceed the pressure rating of the shaft seal. A case drain line is recommended to keep pressure on the shaft seal low.

HOUSINGS

SG Short Motor with End Ports

SH Short Motor with Side Ports



SHORT MOTOR SPECIFICATIONS

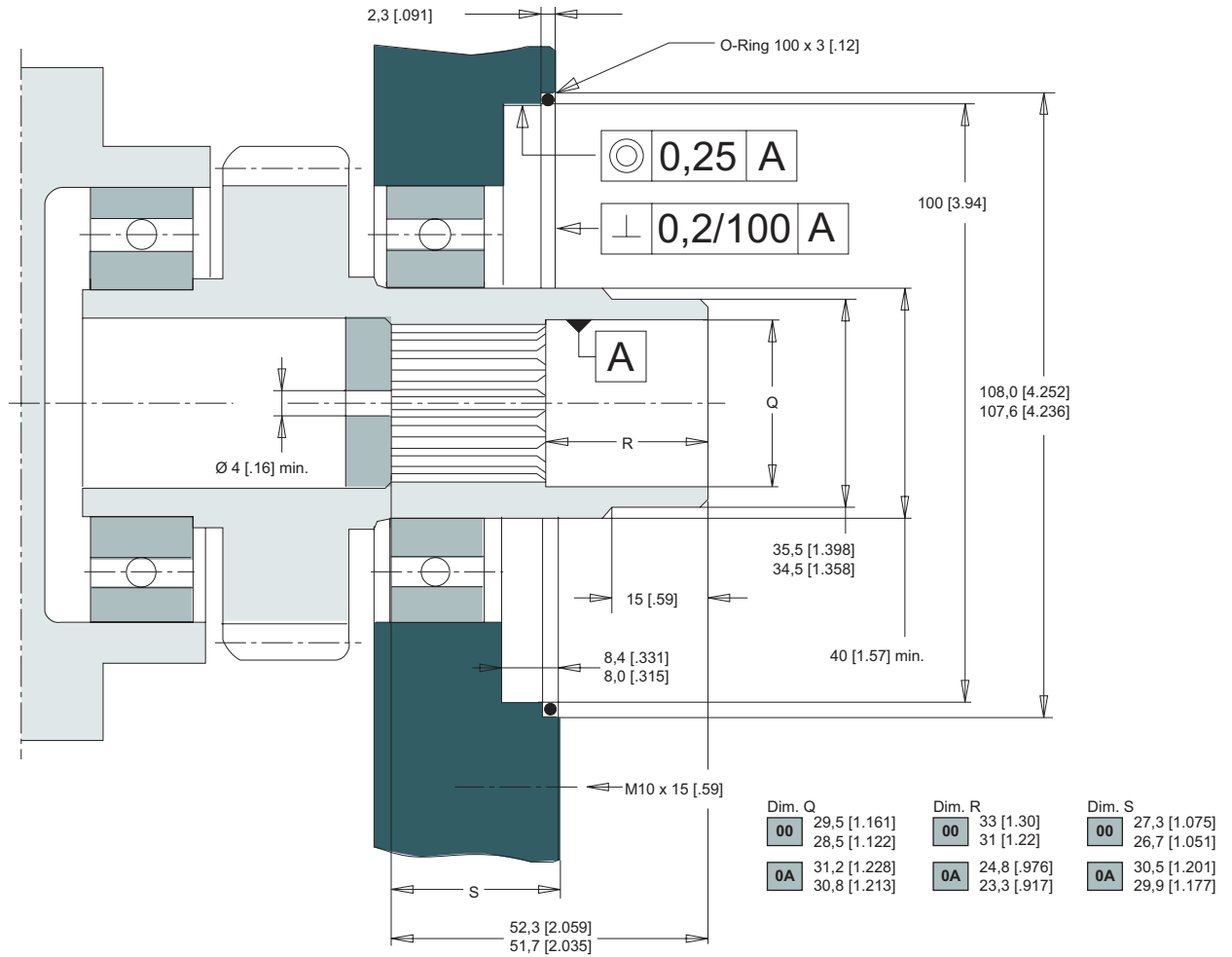
Intermittent Ratings - 10% of Operation Peak Ratings - 1% of Operation

CODE	Displacement cc [in ³ /rev]	Max. Torque Nm [lb-in]	Max. Pressure bar [psi]		
			Inter.	Cont.	Inter. Peak
100	100 [6.10]	390 [3450]	207 [3000]	275 [3990]	295 [4280]
110	112 [6.85]	418 [3700]	207 [3000]	275 [3990]	295 [4280]
130	129 [7.86]	490 [4340]	207 [3000]	275 [3990]	295 [4280]
160	162 [9.90]	600 [5310]	207 [3000]	260 [3770]	280 [4060]
200	202 [12.31]	720 [6370]	207 [3000]	250 [3630]	270 [3920]
230	228 [13.92]	806 [7135]	207 [3000]	250 [3630]	270 [3920]
320	325 [19.81]	990 [8760]	190 [2750]	224 [3250]	259 [3750]
400	399 [24.36]	990 [8760]	155 [2250]	190 [2750]	210 [3050]
500	496 [30.29]	990 [8760]	121 [1750]	140 [2030]	160 [2320]

NOTE: The above specifications chart references a torque reduction in Short Motor operation when the WS 00 Cardan Shaft listed on page 17 is used. When using the WS 0A Cardan shaft please refer to the specifications listed on page 2.



355 & 356 SERIES SHORT MOTOR



SHAFTS

The recommended shaft material is SAE 8620 or similar case hardening steel such as 20 MoCr4 (900 N/mm²) hardened to 59 - 62 HRC to a depth of 0,762 - 1,016 [0.030 - .040]

00 Cardan

Fillet Root Side Fit

Number of teeth..... 12	Pitch..... 12/24
Pressure Angle 30°	Pitch Dia. 25,4 [1.0]
Major Diameter D_{fi} 28,0 [1.10] - 27,9 [1.096]	
Form Diameter (Min.) D_{fi} 27,6 [1.09]	
Minor Diameter D_i 23,033 [.9068] - 23,0 [.9055]	
Space Width (Circular) L_o 4,328 [1.704] - 4,288 [1.688]	
Tooth Thickness (Circular) S_o 2,341 [.09217]	
Fillet Radius R_{min} 0,2 [.008]	
*Max Distance Between Pins I 17,77 [7.00] - 17,62 [6.94]	
Pin Diameter d 4,836 [1.9034] - 4,834 [1.9026]	

Internal involute spline data per ANSI B92.1-1970, class 5 (corrected $m \cdot X = 0.8$; $m = 2.1166$)

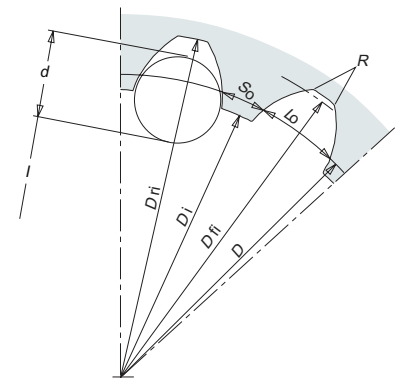
* Dimensions apply after heat treatment.

0A Cardan

Fillet Root Side Fit

Number of teeth..... 12	Pitch..... 10.9091
Pressure Angle 30°	Pitch Dia. D 27,94 [1.1]
Base Diameter..... 24,199 [.9527]	
Major Diameter D_{fi} 30,7 [1.210] - 30,5 [1.200]	
Form Diameter (Min.) D_{fi} 29,97 [1.180]	
Minor Diameter D_i 25,578 [1.007] - 25,705 [1.012]	
*Space Width (Circular) L_o	
Max. Actual..... 4,232 [1.666]	
Min. Effective..... 4,155 [1.636]	
Fillet Radius R_{max} 0,38 [0.015]	
Max Distance Between Pins I 21,51 [8.469]	
Pin Diameter d 4,5085 [1.775]	
with 3,175 [.125] Flat for root clearance	

* Dimensions apply after heat treatment.



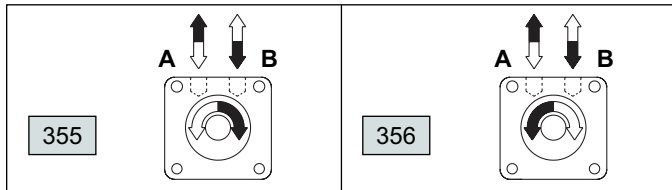


355 & 356 SERIES MODEL CODE BUILDER

SERIES	DISPLACEMENT	HOUSING	SHAFT	PAINT	CAVITY	ADD ON	MISCELLANEOUS
STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8

STEP 1 - Select a series

- 355** Clockwise Rotation
- 356** Counterclockwise Rotation



STEP 2 - Select a displacement option

100	100 cc	[6.1 in ³ /rev]	230	228 cc	[13.9 in ³ /rev]
110	112 cc	[6.9 in ³ /rev]	320	325 cc	[19.8 in ³ /rev]
130	129 cc	[7.9 in ³ /rev]	400	399 cc	[24.4 in ³ /rev]
160	162 cc	[9.9 in ³ /rev]	500	496 cc	[30.3 in ³ /rev]
200	202 cc	[12.3 in ³ /rev]			

STEP 3 - Select a mounting option

NOTE: To complete the three (3) digit WS Series housing code a two (2) digit mounting option must be followed with the single (1) digit porting option found in STEP 3 part II. Side port mounting options need side port porting options and end port mounting options need end port porting options.

- A0** 2-Hole SAE A Mount With End Ports
- A2** 4-Hole Magneto With End Ports
- A7** 2-Hole SAE A Mount With Side Ports
- A8** 4-Hole Magneto With Side Ports
- AG** 4-Hole Square SAE A Mount With End Ports
- AH** 4-Hole Square SAE A Mount With Side Ports
- SG** Short Motor With End Ports
- SH** Short Motor With Side Ports
- W2** 4-Hole 3.25" Pilot Wheel Mount With End Ports
- W8** 4-Hole 3.25" Pilot Wheel Mount With Side Ports
- Y2** 4-Hole 4.25" Pilot Wheel Mount With End Ports
- Y8** 4-Hole 4.25" Pilot Wheel Mount With Side Ports
- Z2** 4-Hole Euro Wheel Mount with End Ports
- Z8** 4-Hole Euro Wheel Mount with Side Ports

WS series motors have been tested per NFPA/T2.6.1-1974 in order to establish ratings for infinite housing life. These ratings are based on pressure cycles with the case drain connected. The ratings for each housing are listed below:

Mounting Option	Rated Fatigue Pressure
4-Hole Square SAE A and 4-Hole Euro Wheel Mounts	34 bar [500 psi]
2-Hole SAE A and 4-Hole Magneto Mounts	48 bar [700 psi]
3.25" and 4.25" Wheel Mounts	117 bar [1700 psi]

STEP 3 (part II) - Select a porting option

END PORTS

- 1** 7/8" O-Ring With 7/16" Drain
- 2** 1/2" BSP.F With 1/4" Drain

SIDE PORTS

- 1** 7/8" O-Ring With 7/16" Drain
- 2** 1/2" BSP.F With 1/4" Drain
- 3** 1/2" BSP.F Offset Manifold With 1/4" Drain
- 5** 9/16" O-Ring With 7/16" Drain
- 6** 1-1/16" O-Ring With 7/16" Drain
- 9** 3/8" BSP.F With 1/4" Drain

STEP 4 - Select a shaft option

- | | | | |
|-----------|-----------------|-----------|--------------------------|
| 02 | 6B Spline | 23 | 14 Tooth Spline |
| 10 | 1" Straight | 28 | 35mm Tapered |
| 12 | 25mm Straight | 31 | 1-1/2" Tapered |
| 20 | 1-1/4" Straight | 00 | Cardan (Drive Link Only) |
| 21 | 32mm Straight | 0A | Cardan (Drive Link Only) |
| 22 | 1-1/4" Tapered | | |

NOTE: The 00 & 0A shafts must be used on the Short Motor and only the Short Motor. The 28 and 31 shafts are not available on the SAE A mounts or the Magneto mounts.

STEP 5 - Select a paint option

- A** Black
- B** Black (unpainted flange face)
- Z** No Paint

STEP 6 - Select a valve cavity option and installed valve

- | | | | |
|----------|---------------------|----------|--------------------|
| A | None | F | 121 bar [1750 psi] |
| B | Relief Valve Cavity | G | 138 bar [2000 psi] |
| C | 69 bar [1000 psi] | J | 173 bar [2500 psi] |
| D | 86 bar [1250 psi] | L | 207 bar [3000 psi] |
| E | 104 bar [1500 psi] | | |

NOTE: Valve cavity is only available on Side Ports 1, 2, and 3. The B option will not have a valve cartridge listed above installed.

STEP 7 - Select an add on option

- A** Standard
- B** Lock Nut
- C** Solid Hex Nut

STEP 8 - Select a miscellaneous option

- AA** None

Important Information

Before selecting or using a White Drive Products' product, it is important that all information concerning the product warranty, limitation of liability and responsibility of the customer be reviewed. This information is located below. Please direct any questions regarding this information to your White Drive Products representative.

Disclaimer

This catalog provides product options for further investigation by customers having technical expertise with respect to the use of such products. It is the responsibility of the customer to thoroughly analyze all aspects of the customer's application and to review the information concerning the product in the current product catalog. Due to the diversity of possible applications, the customer is solely responsible for making the final selection of the product(s) to be used and to assure that all performance, safety and warning requirements of the application are met. The customer is further responsible for all testing to verify acceptable life and performance of White Drive Products' products under actual operating conditions.

White Drive Products has made all reasonable efforts to present accurate information in this catalog and shall not be responsible for any incorrect information which may result from unintentional oversight. Due to continuous product improvement, the product specifications as stated in this catalog are subject to change by White Drive Products at any time without notice. The customer should consult a sales representative of White Drive Products for detailed information and to determine any changes in the information in this catalog.

Improper selection or improper use of the products described herein can result in death, personal injury and/or property damage. White Drive Products, Inc.'s sole responsibility with respect to its products is set forth in the warranty/limitation of liability policy state herein.

Warranty

White Drive Products' products are sold subject to a limited warranty and a limitation of remedies policy, both of which constitute part of any and all agreements to purchase White Drive Products' products. White Drive Products makes no other warranties or promises other than those specifically noted in its written policies, and no White Drive Products employee or agent has the power to alter those policies other than in writing.

OTHER FINE PRODUCTS AVAILABLE FROM WHITE DRIVE PRODUCTS



**A COMPLETE RANGE
OF LSHT HYDRAULIC
MOTORS**



GEAR DRIVE UNITS



**PISTON AND
GEAR PUMPS**



**HYDRAULIC
CONTROLLED
PRESSURE
RELEASED BRAKES**



whitedriveproducts

DELIVERING THE POWER TO GET WORK DONE

White Drive Products, Inc.
P.O. Box 1127
Hopkinsville, KY. USA 42241
Phone: +1.270.885.1110
Fax: +1.270.886.8462
infousa@whitedriveproducts.com

White Drive Products GmbH
Halskestrasse 15
D-40880 Ratingen, Germany
Phone: +49 2102-1237770
Fax: +49 2102-1237779
infoeu@whitedriveproducts.com

White Drive Products, Inc.
Asian Distribution Center
Unit 18, 9/F., Corporation Park
11 on Lai Street, Siu Lek Yuen
Shatin, N.T. Hong Kong
Phone: +852 2637 6682
Fax: +852 2637 6978
infohk@whitedriveproducts.com

White (China) Drive Products Co., Ltd.
1-8 Ning Zhen Gong Lu
Zhenjiang, 212021, Jiangsu, China
Phone: +86 511 5729988
Fax: +86 511 5728921
infochina@whitedriveproducts.com

Distributed by:



www.whitedriveproducts.com

WS SERIES HYDRAULIC MOTORS



PC990355 rev. 7.07

WHITE HYDRAULICS



HK Series

FEATURES

- Integrated spring-applied pressure-release motor/brake package
- Performance-matched brake/motor design
- All wear components are fully immersed in fluid (wet multi-disc design)
- Maximum release pressure up to 3,000 PSI 207 Bar
- Brake directly coupled to the output shaft
- Wide-variety of porting, mounting and shaft options

BENEFITS

- Proven, Quiet, Trouble-Free Operation
- Compact, Cost-Effective Package
- Series Circuit Operating Capability
- Design Flexibility
- Reliable Performance - Fewer Critical Components

APPLICATIONS

Aerial Work Platform Lifts, Marine Cranes and Winches, Recycling Equipment, Fishing Winches, Agricultural Equipment, Drill-Rigs, Grapples and Draglines

The new HK Series motor/brake is a performance-matched motor brake package utilizing proven BK brake and HB motor technologies. The motor performance is equal to the HB Series, less a slight reduction for mechanical losses due to mechanical drag of the rotating brake components. The package combines proven spring-applied pressure-release wet-disc brake technology used in the BK Series coupled with proven HB Series motor technology. The result is a proven, compact, integrated package suitable for applications needing load-holding capability along with smooth and efficient drive motor performance.

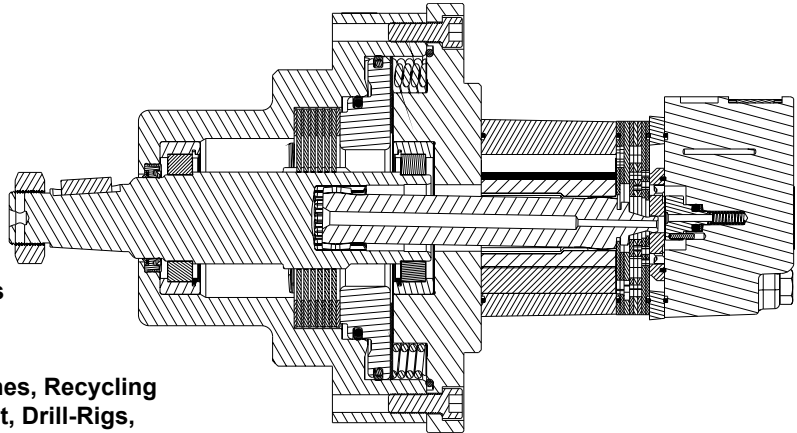
The static brake is capable of holding full motor torque and is designed for applications requiring true load-holding performance as well as emergency stop capability. Hydraulic pressure is used to release the spring-applied brake during motor operation. In the absence of brake release pressure, the brake is spring-applied providing full load-holding performance and is considered a “fail-safe” design that is biased for load holding.

With safety an important factor in the design and manufacture of equipment, it is often necessary to add a brake to many critical machine functions including wheel traction drives, boom swing drives, and winches. Spring-applied pressure-release brake technology offers many advantages over other types of brake technologies, such as mechanical caliper, disc and drum type brakes. These advantages include:

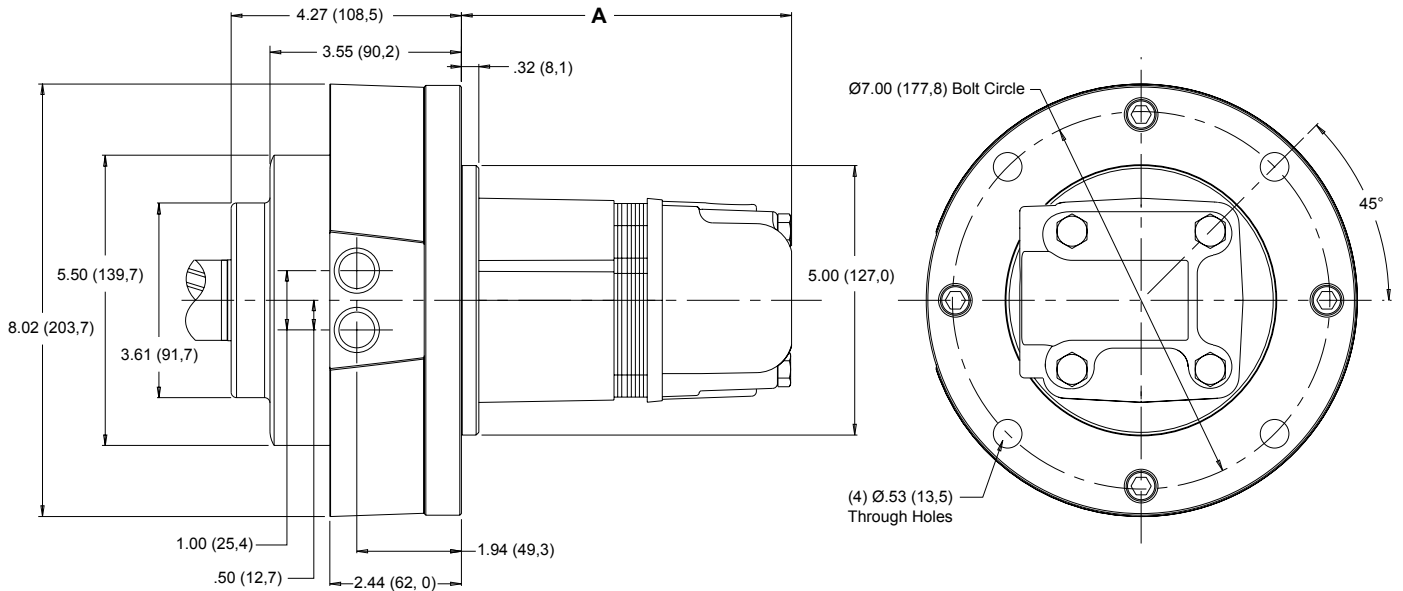
- Fail-safe design (load-holding occurs with the absence of hydraulic pressure)
- Eliminates external brake linkage components (the brake is operated via hydraulic pressure)
- Eliminates adjustments to the brake linkage during the service life of the brake.
- Corrosion protected - brake components are fully immersed in fluid in a self-contained housing
- Increases reliability
- Increases design flexibility

Other features contribute to make the HK Series a superior solution for brake motor drive applications. All internal components, including roller bearings, brake discs, springs, and seals are designed for maximum durability. To further extend service life and reduce noise, all internal components operate in an oil bath. Two brake-release ports are also provided to simplify filling and bleeding of the brake release circuit during installation. In addition, the motor offers high efficiency and reliable smooth performance. A three-zone orbiting valve, laminated motor manifold and Roller Stator® drive provide high overall efficiency over a wide range of operating conditions. The standard case drain increases shaft seal life by reducing internal pressures experienced by the seal. Case flow is also directed across all driveline components to reduce wear and increase motor life. At the heart of the motor is a heavy-duty driveline offering 30% more torque capacity than competitive designs. These features combine to make the HK Series motor brake the preferred choice for applications requiring peak efficiency with integrated load-holding capability.

Holding Torque	10,000 lb-in (1130 Nm)
Release Pressure	400 psi (28 Bar)
Maximum release pressure	3,000 psi (207 Bar)
Release volume	0.1-1.0 cu. in. (1,6 - 16,4 cc)
Max. Recommended Speed	250 rpm

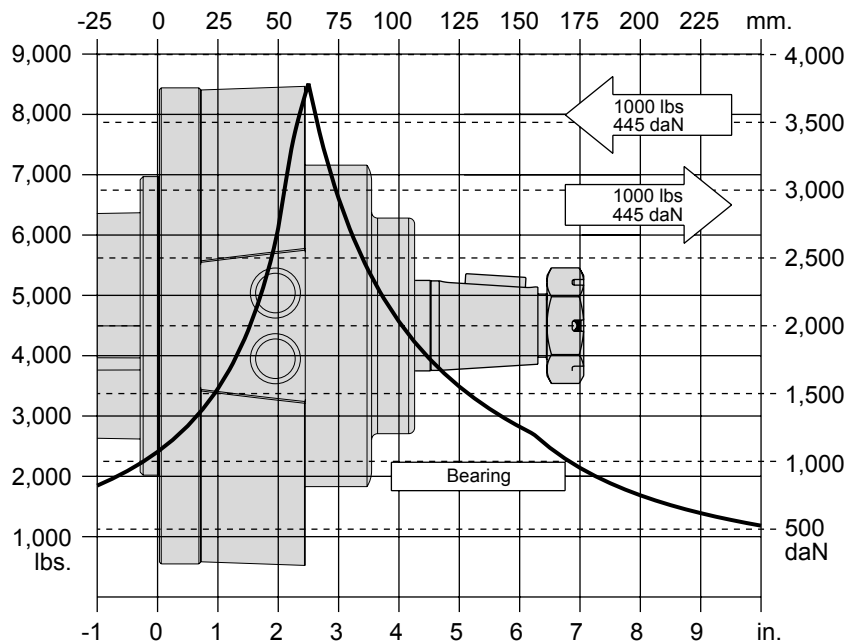


- W2** 4-Hole 7/16"-20 SAE O-Ring Release Port with End Port Endcover
- W8** 4-Hole 7/16"-20 SAE O-Ring Release Port with Side Port Endcover



ALLOWABLE BEARING LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table.



LENGTH AND WEIGHT TABLES

HK Brake		
Code	A in (mm)	Weight lbs (kg)
050	3.97 (101)	48.2 (21,9)
080	4.11 (104)	48.7 (22,1)
090	4.16 (106)	48.9 (22,2)
110	4.30 (109)	49.4 (22,5)
125	4.39 (112)	49.7 (22,6)
160	4.62 (117)	50.4 (22,9)
200	4.87 (124)	51.3 (23,3)
250	5.17 (131)	52.1 (23,7)
300	5.41 (137)	53.0 (24,1)
400	6.12 (155)	55.1 (25,0)

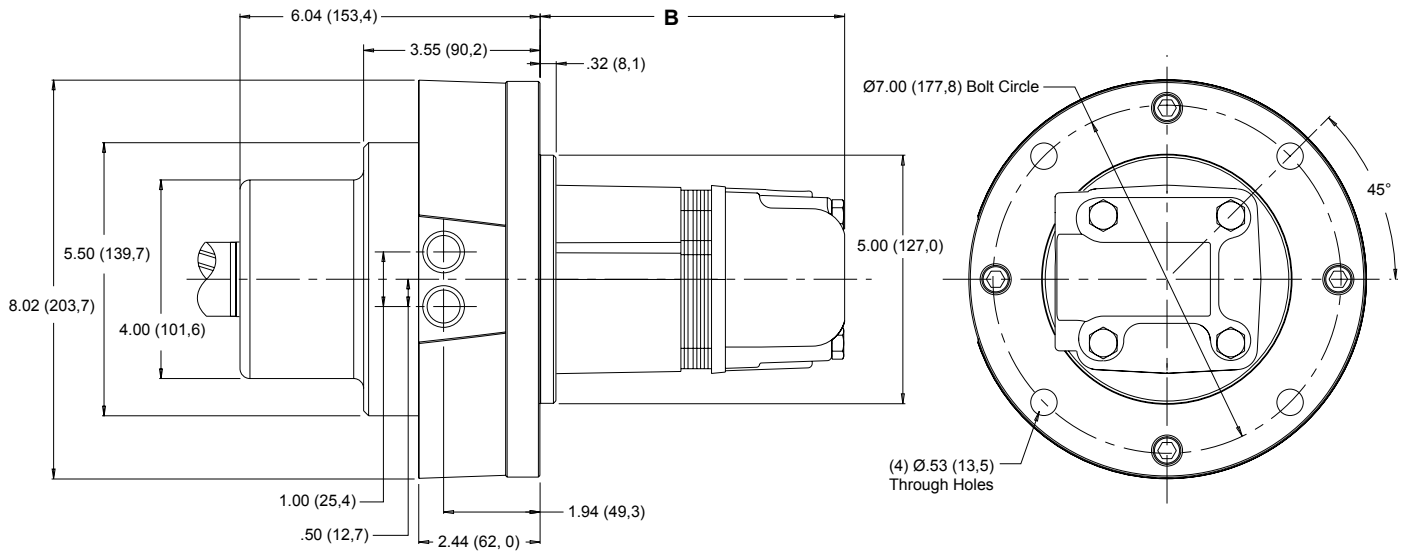
HK brake weights vary ± 2 lbs (.9 kg) depending upon motor configuration.
Subtract .71 in. (18mm) from dimension for motors with side ports 5, 6, & 7 and end ports 1 & 2.

BEARING LOAD MULTIPLICATION FACTOR TABLE

RPM	Multiplication Factor	RPM	Multiplication Factor	RPM	Multiplication Factor
50	1.23	300	0.72	600	0.58
100	1.00	400	0.66	700	0.56
200	0.81	500	0.62	800	0.50

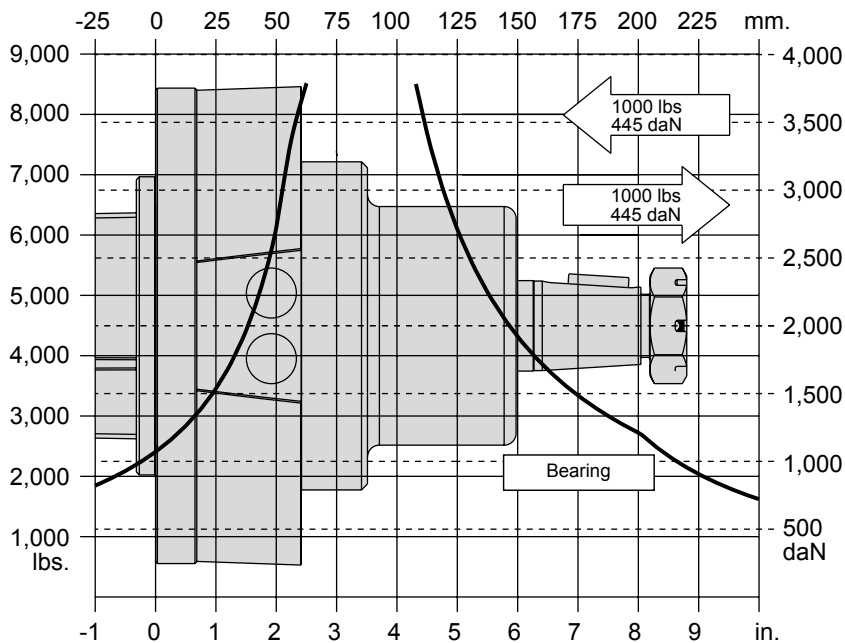
HOUSINGS

- WB** 4-Hole 7/16"-20 SAE O-Ring Release Port with End Port Endcover and Tall Pilot
- WC** 4-Hole 7/16"-20 SAE O-Ring Release Port with Side Port Endcover and Tall Pilot



ALLOWABLE BEARING LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 3.



LENGTH AND WEIGHT TABLES

HK Brake with Tall Pilot

Code	B in (mm)	Weight lbs (kg)
050	3.97 (101)	51.2 (23,3)
080	4.11 (104)	51.7 (23,5)
090	4.16 (106)	51.9 (23,6)
110	4.30 (109)	52.4 (23,8)
125	4.39 (112)	52.7 (24,0)
160	4.62 (117)	53.4 (24,3)
200	4.87 (124)	54.3 (24,7)
250	5.17 (131)	55.1 (25,0)
300	5.41 (137)	56.0 (25,5)
400	6.12 (155)	58.1 (26,4)

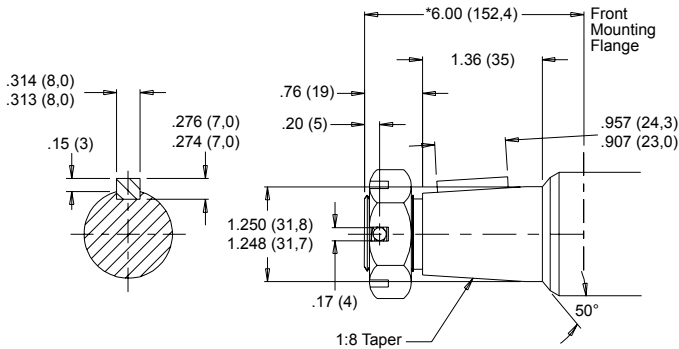
HK brake weights vary ± 2 lbs (.9 kg) depending upon motor configuration.
 Subtract .71 in. (18mm) from dimension for motors with side ports 5, 6, & 7 and end ports 1 & 2.

SPECIFICATIONS

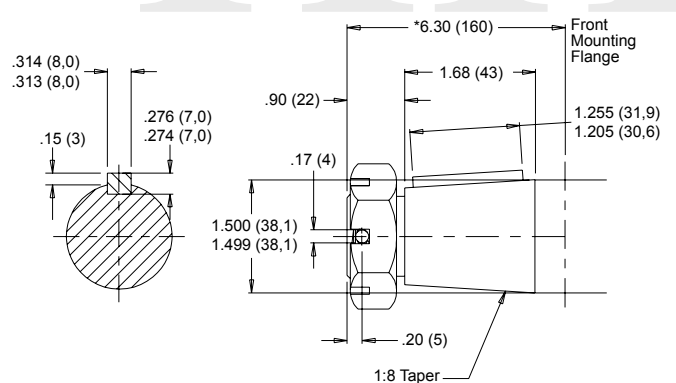
Holding Torque 10,000 lb-in (1130 Nm)
 Release Pressure 400 psi (28 Bar)
 Maximum release pressure 3,000 psi (207 Bar)
 Release volume 0.1-1.0 cu. in. (1,6 - 16,4 cc)

Max. Speed 250 rpm
 Max. Operating Temperature 180°F (82°C)
 Fluid Type Mineral based oil

22 1 1/4" Tapered



31 1 1/2" Tapered



*Subtract 1.77 (45.0) for W2 and W8 Housing

ORDERING INFORMATION

SERIES
315

DISPLACEMENT

Code	Displacements
050	3.2 in ³ /rev. 52 cc/rev.
080	4.6 in ³ /rev. 76 cc/rev.
090	5.4 in ³ /rev. 89 cc/rev.
110	6.8 in ³ /rev. 111 cc/rev.
125	7.7 in ³ /rev. 127 cc/rev.
160	10.0 in ³ /rev. 164 cc/rev.
200	12.5 in ³ /rev. 205 cc/rev.
250	15.5 in ³ /rev. 254 cc/rev.
300	17.9 in ³ /rev. 293 cc/rev.
400	24.9 in ³ /rev. 409 cc/rev.

HOUSING

Code	Housings
W2	4-Hole 7/16" O-Ring End Ports
W8	4-Hole 7/16" O-Ring Side Ports
WB	4-Hole 7/16" O-Ring End Ports / Tall Pilot
WC	4-Hole 7/16" O-Ring Side Ports / Tall Pilot

SHAFT

Code	Shafts
22	1-1/4" Tapered
31	1-1/2" Tapered

PAINT

Code	Options
A	Dark Metallic Gray
C	Black
Z	No Paint

MISCELLANEOUS

Code	Options
AA	None
AC	Freeturning Rotor

ADD ONS

Code	Options
A	Standard
B	Lock Nut
C	Solid Hex Nut

PORTS

Code	Side Ports
5	9/16" O-ring
6	180° Ports 1-1/16" O-ring
7	180° Ports 1/2" BSP.F
1	Offset Ports 7/8" O-ring
2	Offset Ports 1/2" BSP.F
3	Manifold Ports 1/2" BSP.F

Code	End Ports
1	Aligned Ports 7/8" O-ring
2	Aligned Ports 1/2" BSP.F

CAVITY

Code	Options
A	None
**B	Relief Valve Cavity
**C	1000 psi Relief Valve Installed
**D	1250 psi Relief Valve Installed
**E	1500 psi Relief Valve Installed
**F	1750 psi Relief Valve Installed
**G	2000 psi Relief Valve Installed
**J	2500 psi Relief Valve Installed
**L	3000 psi Relief Valve Installed

NOTE: To complete the 3 digit housing code, a housing and port option must be entered. A side port housing option must use side port connections, and an end port housing option must use end port connections.
 (Example: W82 = A wheel mount motor with 1/2" BSP.F threading)

** Available with end ports 1 & 2 and side ports 1, 2, & 5

NOTE: For Displacement, Porting, and Option details, please refer to White Hydraulics product catalog (PC990000) under the HB series.



White Hydraulics, Inc.
P.O. Box 1127
Hopkinsville, KY. USA 42241
Phone: 270 885 1110
Fax: 270 886 8462
info@whitehydraulics.com

White Hydraulics GmbH
Halskestrasse 15
D-40880 Ratingen, Germany
Phone: +49 2102-1237770
Fax: +49 2102-1237779
contactgmbh@whitehydraulics.com

White Hydraulics, Inc.
Asian Distribution Center
Unit 18, 9/F., Corporation Park
11 on Lai Street, Siu Lek Yuen
Shatin, N.T. Hong Kong
Phone: +852 2637 6682
Fax: +852 2637 6978
contactchina@whitehydraulics.com



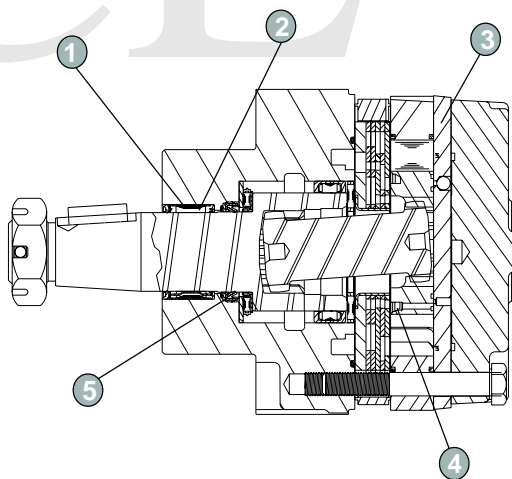
**Low Speed, High Torque Hydraulic Motors
& Drive Products**

www.whitehydraulics.com

PC990315 rev. 8.05

CE

FEATURES



- ① **Needle Roller Bearing** is in optimum location to allow load to be placed as close to center line of bearing as possible.
- ② **Three Bearing Options** allow load carrying capability of motor to be matched to application.
- ③ **Pressure-Compensated Balance Plate** improves volumetric efficiency at low flows and high pressure.
- ④ **Valve-In-Rotor Design** provides cost effective, efficient distribution of oil and reduces overall motor length.
- ⑤ **High Pressure Viton® Shaft Seal** offers superior seal life and performance.

The combination of compact size, light weight and low speed efficiency make the CE motor the best wheel drive motor available. To reduce overall motor length and weight, all unnecessary material was removed from the housing and the valve was placed in the face of the rotor. The pressure-compensated balance plate allows the motor to maintain high volumetric efficiencies at startup and high mechanical efficiencies during running conditions. All of these features unite to make the CE Series motor 10-25% lighter and more compact than competitive designs, making it perfect for applications with strict weight and size requirements.



SPECIFICATIONS

Code	Displacement (in ³ /rev)	Max. Speed (RPM) - 1)Cont 2)Inter.		Max. Flow (GPM) - 1)Cont 2)Inter.		Max. Torque (lb-in) - 1)Cont 2)Inter.		Max. Pressure (PSI) - 1)Cont 2)Inter. 3)Peak		
		1	2	1	2	1	2	1	2	3
120	7.4	360	490	12	16	2850	3150	3000	3250	3500
160	9.9	370	470	16	20	3750	4430	3000	3250	3500
200	12.4	300	370	16	20	4650	5250	3000	3250	3500
230	14.2	260	320	16	20	4950	5720	3000	3250	3500
260	15.9	260	350	18	24	6250	6730	3000	3250	3500
300	18.3	250	320	20	25	7100	7630	3000	3250	3500
350	21.2	220	270	20	25	8000	9000	3000	3250	3500
375	22.8	200	250	20	25	8600	9200	3000	3250	3500
470	28.3	160	200	20	25	9200	10200	2500	2750	3000
540	32.7	140	170	20	25	8875	10700	2000	2500	3000
750	45.6	100	130	20	25	9575	10950	1500	1750	2000

120 7.4 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	184 (21) 14	418 (47) 13	745 (84) 10	1008 (114) 7						16	
1 (4)	226 (26) 26	459 (52) 26	969 (109) 23	1387 (157) 21	1793 (203) 18	2305 (260) 13	2566 (290) 10	2490 (281) 7		32	
2 (8)		456 (52) 58	977 (110) 56	1424 (161) 51	1845 (208) 47	2382 (269) 33	2746 (310) 29	3066 (347) 25		63	
4 (15)		422 (48) 119	975 (110) 112	1497 (169) 103	1992 (225) 95	2399 (271) 91	2896 (327) 83	3269 (369) 82		125	
6 (23)		409 (46) 187	934 (106) 182	1402 (158) 177	1803 (204) 173	2199 (248) 168	2630 (297) 160	3290 (372) 143		188	
8 (30)			876 (99) 248	1389 (157) 244	1829 (207) 240	2241 (253) 233	2857 (323) 205	3282 (371) 201		250	
10 (38)			853 (96) 306	1379 (156) 298	1834 (207) 293	2278 (257) 286	2633 (297) 279	3178 (359) 269		313	
12 (45)			749 (85) 371	1337 (151) 360	1823 (206) 352	2267 (256) 345	2695 (305) 341	3042 (344) 335		375	
14 (53)			684 (77) 437	1215 (137) 428	1745 (197) 418	2222 (251) 409	2618 (296) 404			438	
16 (61)			633 (71) 499	1191 (135) 490	1717 (194) 482	2163 (244) 467	2687 (304) 454			500	
Theo. Torque		295 (33)	589 (67)	1178 (133)	1768 (200)	2357 (266)	2946 (333)	3535 (399)	4124 (466)		

Areas within white represent maximum motor efficiencies.

Torque, lb-in (Nm)
Speed, RPM

160 9.9 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	287 (32) 11	634 (72) 11	1341 (152) 10	1906 (215) 9	2493 (282) 8	2888 (326) 6	3238 (366) 4	3643 (412) 1		12	
1 (4)	318 (36) 22	690 (78) 21	1287 (145) 20	1991 (225) 19	2567 (290) 16	3060 (346) 14	3236 (366) 8	3680 (416) 7		24	
2 (8)	296 (33) 45	649 (73) 44	1287 (145) 43	2010 (227) 40	2586 (292) 36	3156 (357) 33	3654 (413) 31	4108 (464) 28		47	
4 (15)	386 (44) 92	630 (71) 91	1296 (146) 88	2000 (226) 86	2646 (299) 79	3226 (364) 74	3768 (426) 71	4289 (485) 66		94	
6 (23)		623 (70) 133	1294 (146) 131	1991 (225) 128	2617 (296) 122	3232 (365) 117	3786 (428) 115	4352 (492) 111		140	
8 (30)		583 (66) 181	1251 (141) 177	1916 (216) 175	2533 (286) 171	3102 (350) 165	3663 (414) 159	4210 (476) 152		187	
10 (38)		537 (61) 224	1224 (138) 223	1873 (212) 219	2497 (282) 213	3072 (347) 211	3641 (411) 204	4183 (473) 196		234	
12 (45)		495 (56) 272	1150 (130) 265	1829 (207) 264	2465 (279) 262	3046 (344) 256	3603 (407) 249	4157 (470) 242		280	
14 (53)			1088 (123) 318	1737 (196) 313	2384 (269) 306	2939 (332) 297	3540 (400) 295	4111 (464) 284		327	
16 (61)			1010 (114) 362	1659 (187) 356	2327 (263) 351	2910 (329) 344	3499 (395) 334	4053 (458) 330		374	
18 (68)			903 (102) 410	1593 (180) 407	2209 (250) 401	2822 (319) 385	3438 (389) 382			420	
20 (76)			846 (96) 455	1536 (174) 448	2193 (248) 438	2798 (316) 430	3353 (379) 423			467	
Theo. Torque		394 (45)	788 (89)	1576 (178)	2365 (267)	3153 (356)	3941 (445)	4729 (534)	5518 (623)		

DO NOT operate at maximum pressure and maximum flow simultaneously.

Tested at 129°F with an oil viscosity of 213 SUS

Note: Performance data is typical. Performance of production units varies slightly from one motor to another.

CFE

PERFORMANCE



200 12.4 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	358 (40)	817 (92)	1596 (180)	2378 (269)	3083 (348)						10
1 (4)	409 (46)	787 (89)	1597 (180)	2440 (276)	3177 (359)	3782 (427)	4328 (489)				19
2 (8)	395 (45)	807 (91)	1684 (190)	2509 (284)	3268 (369)	3989 (451)	4630 (523)	5189 (586)			38
4 (15)	358 (40)	817 (92)	1662 (188)	2492 (282)	3303 (373)	4006 (453)	4693 (530)	5371 (607)			75
6 (23)		760 (86)	1600 (181)	2457 (278)	3228 (365)	3989 (451)	4636 (524)	5353 (605)			112
8 (30)		663 (75)	1539 (174)	2363 (267)	3176 (359)	3905 (441)	4584 (518)	5286 (597)			150
10 (38)		549 (62)	1430 (162)	2272 (257)	3072 (347)	3798 (429)	4488 (507)	5198 (587)			187
12 (45)			1290 (146)	2159 (244)	2996 (339)	3798 (429)	4476 (506)	5161 (583)			224
14 (53)			1145 (129)	2005 (227)	2905 (328)	3628 (410)	4354 (492)	5049 (571)			261
Max. Cont.			994 (112)	1842 (208)	2795 (316)	3534 (399)	4285 (484)	4971 (562)			299
18 (68)			799 (90)	1833 (207)	2689 (304)	3493 (395)	4260 (481)				336
Max. Inter.			665 (75)	1576 (178)	2495 (282)	3288 (372)	4115 (465)				373
			366	365	361	361	351				
Theo. Torque	494 (56)	987 (112)	1975 (223)	2962 (335)	3949 (446)	4936 (558)	5924 (669)	6911 (781)			

Areas within white represent maximum motor efficiencies.

DO NOT operate at maximum pressure and maximum flow simultaneously.

Torque, lb-in (Nm)
Speed, RPM

230 14.2 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	406 (46)	866 (98)	1849 (209)	2659 (300)	3367 (380)						9
1 (4)	435 (49)	925 (105)	1903 (215)	2839 (321)	3651 (413)	4315 (488)	4808 (543)				17
2 (8)	438 (50)	945 (107)	1954 (221)	2909 (329)	3803 (430)	4599 (520)	5260 (594)	5856 (662)			33
4 (15)	401 (45)	900 (102)	1895 (214)	2872 (325)	3773 (426)	4623 (522)	5395 (610)	6045 (683)			66
6 (23)	342 (39)	812 (92)	1801 (203)	2808 (317)	3645 (412)	4304 (486)	4953 (560)	5678 (642)			98
8 (30)		743 (84)	1739 (197)	2691 (304)	3627 (410)	4479 (506)	5313 (600)	5728 (647)			131
10 (38)		634 (72)	1650 (186)	2585 (292)	3556 (402)	4363 (493)	5169 (584)	5613 (634)			163
12 (45)			1477 (167)	2494 (282)	3479 (393)	4349 (491)	5094 (576)	5822 (658)			196
14 (53)			1343 (152)	2301 (260)	3310 (374)	4160 (470)	4910 (555)	5818 (657)			228
Max. Cont.			1198 (135)	2209 (250)	3207 (362)	4110 (464)	4895 (553)	5637 (637)			261
18 (68)			1021 (115)	2044 (231)	3042 (344)	3956 (447)	4777 (540)				293
Max. Inter.			822 (93)	1859 (210)	2898 (327)	3825 (432)	4677 (529)				326
			325	323	319	311	299				
Theo. Torque	565 (64)	1131 (128)	2261 (256)	3392 (383)	4522 (511)	5653 (639)	6783 (767)	7914 (894)			

Tested at 129°F with an oil viscosity of 213 SUS

Note: Performance data is typical. Performance of production units varies slightly from one motor to another.

260 15.9 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	514 (58) 6	1120 (127) 5	2140 (242) 4	3068 (347) 3	3759 (425) 1						8
1 (4)	547 (62) 12	1097 (124) 10	2191 (248) 9	3133 (354) 8	3950 (446) 6	4377 (495) 2					15
2 (8)	543 (61) 26	1150 (130) 23	2200 (249) 20	3295 (372) 20	4234 (478) 17	4972 (562) 13	5599 (633) 7				30
4 (15)	536 (61) 54	1109 (125) 51	2284 (258) 48	3339 (377) 46	4436 (501) 42	5306 (600) 36	6192 (700) 30	6915 (781) 21			59
6 (23)	500 (57) 84	1067 (121) 81	2169 (245) 74	3326 (376) 74	4406 (498) 69	5391 (609) 60	6309 (713) 53	7214 (815) 45			88
8 (30)		981 (111) 113	2143 (242) 107	3268 (369) 105	4327 (489) 100	5374 (607) 89	6290 (711) 81	7167 (810) 71			117
10 (38)		909 (103) 142	2034 (230) 137	3161 (357) 134	4273 (483) 128	5267 (595) 119	6198 (700) 109	6740 (762) 98			146
12 (45)		771 (87) 173	1915 (216) 169	3057 (345) 166	4002 (452) 161	5111 (578) 152	5708 (645) 143	6557 (741) 129			175
14 (53)		664 (75) 203	1786 (202) 201	2928 (331) 195	3841 (434) 191	4897 (553) 183	5811 (657) 170	6718 (759) 157			204
16 (61)		538 (61) 232	1687 (191) 231	2769 (313) 226	3847 (435) 220	4892 (553) 210	5803 (656) 199	6601 (746) 189			233
Max. Cont.			1486 (168) 258	2614 (295) 255	3664 (414) 248	4652 (526) 242	5642 (638) 229	6567 (742) 215			262
20 (76)			1345 (152) 287	2455 (277) 286	3570 (403) 281	4598 (520) 271	5585 (631) 257				291
22 (83)			1143 (129) 319	2208 (249) 319	3372 (381) 312	4365 (493) 299	5489 (620) 287				320
Max. Inter.			924 (104) 348	2063 (233) 346	3166 (358) 335	4168 (471) 333	4875 (551) 332				349
Theo. Torque	633 (72)	1266 (143)	2532 (286)	3798 (429)	5064 (572)	6330 (715)	7596 (858)	8861 (1001)			

Areas within white represent maximum motor efficiencies.

DO NOT operate at maximum pressure and maximum flow simultaneously.

Torque, lb-in (Nm)
Speed, RPM

300 18.3 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	559 (63) 5	1202 (136) 4	2518 (285) 3	3656 (413) 3	4537 (513) 2	5129 (580) 1					7
1 (4)	493 (56) 12	1230 (139) 10	2410 (272) 10	3418 (386) 8	4272 (483) 6	4834 (546) 4					13
2 (8)	522 (59) 23	1185 (134) 21	2676 (302) 19	3781 (427) 19	4611 (521) 16	5196 (587) 14	5952 (673) 10	6572 (743) 5			26
4 (15)	503 (57) 47	1189 (134) 44	2620 (296) 40	3602 (407) 38	4398 (497) 37	5324 (602) 34	6161 (696) 29	6852 (774) 23			51
6 (23)	447 (50) 73	1109 (125) 70	2534 (286) 64	3886 (439) 62	4946 (559) 61	5992 (677) 55	6978 (789) 48	7762 (877) 43			76
8 (30)		986 (111) 97	2468 (279) 93	3752 (424) 92	5020 (567) 86	6059 (685) 77	7142 (807) 72	8139 (920) 64			101
10 (38)		853 (96) 126	2306 (261) 121	3687 (417) 118	4712 (532) 112	5832 (659) 104	7121 (805) 95	7994 (903) 86			127
12 (45)		689 (78) 150	2013 (228) 149	3252 (367) 146	4434 (501) 140	5694 (643) 130	6781 (766) 121	7875 (890) 109			152
14 (53)		525 (59) 176	1889 (213) 174	3410 (385) 171	4383 (495) 166	5509 (623) 155	6618 (748) 143	7186 (812) 136			177
16 (61)			1603 (181) 200	3085 (349) 196	4195 (474) 194	5484 (620) 181	6471 (731) 172	7519 (850) 157			202
18 (68)			1405 (159) 227	2823 (319) 225	4241 (479) 219	5112 (578) 212	6356 (718) 196	7348 (830) 186			228
Max. Cont.			1115 (126) 252	2560 (289) 251	3703 (418) 248	4962 (561) 240	6221 (703) 225	7180 (811) 207			253
22 (83)			919 (104) 277	2309 (261) 276	3454 (390) 274	4907 (555) 263	6011 (679) 252				278
24 (91)			590 (67) 302	1925 (218) 301	3441 (389) 299	4686 (530) 293	5766 (652) 282				303
Max. Inter.			496 (56) 314	1740 (197) 313	3225 (364) 310	4281 (484) 309	5594 (632) 298				316
Theo. Torque	729 (82)	1457 (165)	2914 (329)	4371 (494)	5828 (659)	7285 (823)	8742 (988)	10199 (1152)			

Tested at 129°F with an oil viscosity of 213 SUS

Note: Performance data is typical. Performance of production units varies slightly from one motor to another.

CFE

PERFORMANCE



350 21.2 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	617 (70) 5	1297 (147) 5	2383 (269) 4							6	
1 (4)	649 (73) 10	1318 (149) 10	2580 (291) 10	3647 (412) 9						11	
2 (8)	670 (76) 21	1403 (159) 21	2767 (313) 21	4007 (453) 20	4927 (557) 18	5915 (668) 16	6919 (782) 13			22	
4 (15)	609 (69) 43	1409 (159) 42	2868 (324) 42	4101 (463) 40	5273 (596) 37	6316 (714) 36	7261 (820) 32	8204 (927) 25		44	
6 (23)	544 (62) 65	1319 (149) 65	2837 (321) 64	4228 (478) 61	5363 (606) 57	6514 (736) 53	7475 (845) 52	8410 (950) 43		66	
8 (30)	395 (45) 87	1134 (128) 86	2693 (304) 85	4134 (467) 84	5502 (622) 80	6870 (776) 75	8022 (906) 67	8734 (987) 61		88	
10 (38)		962 (109) 108	2550 (288) 107	4027 (455) 106	5500 (621) 100	6670 (754) 94	8028 (907) 85	9105 (1029) 77		109	
12 (45)		833 (94) 130	2376 (268) 129	3889 (439) 128	5205 (588) 124	6712 (758) 115	7970 (901) 104	9120 (1031) 94		131	
14 (53)		575 (65) 152	2162 (244) 151	3619 (409) 150	5059 (572) 148	6433 (727) 137	7777 (879) 127	9070 (1025) 117		153	
16 (61)			1947 (220) 174	3406 (385) 173	4855 (549) 171	6172 (697) 163	7570 (855) 152	8853 (1000) 139		175	
18 (68)			1644 (186) 196	3195 (361) 194	4599 (520) 192	6062 (685) 187	7297 (825) 177	8555 (967) 165		197	
Max. Cont. 20 (76)			1301 (147) 216	2863 (324) 213	4275 (483) 212	5634 (637) 209	6993 (790) 194	8357 (944) 183		218	
22 (83)			960 (109) 239	2560 (289) 237	3921 (443) 234	5357 (605) 232	6814 (770) 223			240	
24 (91)	Max. Inter.		684 (77) 261	2225 (251) 258	3814 (431) 257	5207 (588) 256	6488 (733) 248			262	
25 (95)			493 (56) 272	2004 (226) 270	3621 (409) 264	5048 (570) 261	6435 (727) 259			273	
Theo. Torque											
		844 (95)	1688 (191)	3376 (381)	5064 (572)	6752 (763)	8439 (954)	10127 (1144)	11815 (1335)		

Areas within white represent maximum motor efficiencies.

DO NOT operate at maximum pressure and maximum flow simultaneously.

375 22.8 in³/rev

Flow GPM (LPM)	Pressure psi (bars)								Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)	3000 (207)	3500 (242)			
0.5 (2)	687 (78) 4	1438 (162) 4	2840 (321) 4	3958 (447) 3	5237 (592) 2					6	
1 (4)	694 (78) 9	1443 (163) 8	2951 (333) 8	4193 (474) 7	5366 (606) 6	6457 (730) 4				11	
2 (8)	721 (81) 19	1495 (169) 18	3001 (339) 17	4288 (485) 16	5533 (625) 15	6692 (756) 13	7532 (851) 9			21	
4 (15)	651 (74) 39	1470 (166) 38	2837 (321) 36	4117 (465) 36	5404 (611) 33	6624 (748) 29	7754 (876) 26	8766 (991) 19		41	
6 (23)	547 (62) 60	1372 (155) 59	3015 (341) 58	4557 (515) 56	5931 (670) 51	6946 (785) 44	7825 (884) 40	8896 (1005) 33		61	
8 (30)	412 (47) 81	1223 (138) 80	2836 (320) 77	4453 (503) 76	5880 (664) 71	7385 (834) 63	8633 (976) 55	9442 (1067) 48		82	
10 (38)		1048 (118) 101	2684 (303) 99	4382 (495) 97	5726 (647) 92	7090 (801) 83	8161 (922) 74	9364 (1058) 64		102	
12 (45)		870 (98) 121	2547 (288) 119	4147 (469) 117	5620 (635) 112	7115 (804) 107	8605 (972) 93	9920 (1121) 85		122	
14 (53)		625 (71) 141	2308 (261) 140	3849 (435) 139	5337 (603) 135	6953 (786) 126	8298 (938) 114	9771 (1104) 101		142	
16 (61)		487 (55) 162	2134 (241) 161	3744 (423) 160	5248 (593) 155	6706 (758) 147	8160 (922) 135	9614 (1086) 124		163	
18 (68)			1805 (204) 182	3461 (391) 181	4988 (564) 177	6402 (723) 168	7899 (893) 164	9320 (1053) 145		183	
Max. Cont. 20 (76)			1942 (219) 201	3231 (365) 200	4714 (533) 198	5860 (662) 193	7643 (864) 178	9112 (1030) 163		203	
22 (83)			1173 (132) 222	2795 (316) 220	4552 (514) 219	5970 (675) 210	7141 (807) 203			223	
24 (91)	Max. Inter.		881 (100) 243	2567 (290) 242	4202 (475) 241	5667 (640) 232	7012 (792) 220			244	
25 (95)			711 (80) 253	2313 (261) 251	4113 (465) 250	5454 (616) 242	6891 (779) 235			254	
Theo. Torque											
		908 (103)	1815 (205)	3631 (410)	5446 (615)	7261 (821)	9076 (1026)	10892 (1231)	12707 (1436)		

Torque, lb-in (Nm)
Speed, RPM

Tested at 129°F with an oil viscosity of 213 SUS

Note: Performance data is typical. Performance of production units varies slightly from one motor to another.

470 28.3 in³/rev

Flow GPM (LPM)	Pressure psi (bars)						Max. Cont.	Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)			
0.5 (2)	878 (99) 4	1862 (210) 3	3713 (420) 3						5
1 (4)	899 (102) 8	1856 (210) 7	3748 (424) 7	5285 (597) 7	6847 (774) 6				9
2 (8)	906 (102) 16	1968 (222) 15	3875 (438) 15	5488 (620) 14	6922 (782) 13	8470 (957) 11	9788 (1106) 9		17
4 (15)	836 (95) 32	1837 (208) 31	3600 (407) 30	5351 (605) 28	6922 (782) 25	8504 (961) 23	10118 (1143) 20		33
6 (23)	700 (79) 48	1736 (196) 48	3772 (426) 46	5483 (620) 44	7204 (814) 41	8580 (969) 36	10172 (1149) 31		49
8 (30)	544 (61) 65	1588 (179) 65	3638 (411) 63	5578 (630) 61	7498 (847) 57	9253 (1046) 48	10541 (1191) 44		66
10 (38)	352 (40) 81	1405 (159) 80	3429 (387) 80	5471 (618) 77	7301 (825) 73	9167 (1036) 67	11019 (1245) 55		82
12 (45)		1105 (125) 97	3245 (367) 96	5197 (587) 94	7076 (800) 90	8891 (1005) 82	10898 (1232) 72		98
14 (53)		912 (103) 113	3007 (340) 113	5066 (572) 111	6787 (767) 106	8720 (985) 100	10688 (1208) 91		115
16 (61)		557 (63) 130	2712 (306) 129	4662 (527) 128	6581 (744) 124	8451 (955) 116	10285 (1162) 105		131
18 (68)			2298 (260) 146	4370 (494) 145	6262 (708) 142	8148 (921) 135	10169 (1149) 126		147
Max. Cont. 20 (76)			1941 (219) 163	4035 (456) 163	5954 (673) 158	7815 (883) 151	9647 (1090) 140		164
22 (83)			1542 (174) 179	3687 (417) 178	5612 (634) 176	7496 (847) 168			180
24 (91)			1225 (138) 195	3302 (373) 194	5354 (605) 193	7147 (808) 186			196
Max. Inter. 25 (95)				3079 (348) 204	4885 (552) 203	6808 (769) 197			205
Theo. Torque	1127 (127)	2253 (255)	4506 (509)	6760 (764)	9013 (1018)	11266 (1273)	13519 (1528)		

Areas within white represent maximum motor efficiencies.

DO NOT operate at maximum pressure and maximum flow simultaneously.

540 32.7 in³/rev

Flow GPM (LPM)	Pressure psi (bars)						Max. Cont.	Max. Inter.	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	2500 (173)			
0.5 (2)	940 (106) 3	2035 (230) 2							4
1 (4)	927 (105) 6	1975 (223) 6	4023 (455) 6	5797 (655) 5	7684 (868) 3				8
2 (8)	991 (112) 13	2100 (237) 13	4321 (488) 12	6358 (719) 10	8065 (911) 8	9617 (1087) 3			15
4 (15)	944 (107) 27	2174 (246) 26	4455 (503) 25	6593 (745) 24	8426 (952) 21	10005 (1131) 16			29
6 (23)	854 (96) 42	2033 (230) 41	4571 (516) 40	6686 (756) 40	8911 (1007) 36	10911 (1233) 30			43
8 (30)	613 (69) 56	1843 (208) 56	4214 (476) 54	6724 (760) 54	8787 (993) 49	10676 (1206) 42			57
10 (38)	521 (59) 70	1631 (184) 70	4035 (456) 69	6367 (720) 67	8568 (968) 64	10821 (1223) 56			71
12 (45)	264 (30) 84	1376 (155) 83	3702 (418) 83	6089 (688) 83	8195 (926) 78	10668 (1205) 69			85
14 (53)		1089 (123) 98	3456 (391) 98	5576 (630) 97	7896 (892) 95	10165 (1149) 88			99
16 (61)		793 (90) 113	3197 (361) 113	5622 (635) 112	7925 (896) 109	10061 (1137) 106			114
18 (68)		452 (51) 127	2901 (328) 126	5238 (592) 125	7632 (862) 124	9873 (1116) 118			128
Max. Cont. 20 (76)			2460 (278) 141	4869 (550) 140	7222 (816) 140	9526 (1076) 132			142
22 (83)			1980 (224) 154	3954 (447) 153	6369 (720) 151				156
24 (91)			1590 (180) 169	3971 (449) 168	6673 (754) 167				170
Max. Inter. 25 (95)			1358 (153) 176	3768 (426) 174	6095 (689) 173				177
Theo. Torque	1302 (147)	2604 (294)	5207 (588)	7811 (883)	10414 (1177)	13018 (1471)			

Torque, lb-in (Nm)
Speed, RPM

Tested at 129°F with an oil viscosity of 213 SUS

Note: Performance data is typical. Performance of production units varies slightly from one motor to another.

CFE

PERFORMANCE

750 45.6 in³/rev



Flow GPM (LPM)	Pressure psi (bars)		Max. Cont.		Peak	Theo. RPM
	250 (17)	500 (35)	1000 (69)	1500 (104)	2000 (138)	
0.5 (2)	957 (108) 2	2041 (231) 1				3
1 (4)	1540 (174) 4	3010 (340) 4	5760 (651) 4	8408 (950) 4	10916 (1233) 3	6
2 (8)	1467 (166) 9	3246 (367) 9	6154 (695) 9	9024 (1020) 9	11518 (1302) 7	11
4 (15)	1501 (170) 19	3181 (359) 19	6366 (719) 19	9607 (1086) 18	11729 (1325) 16	21
6 (23)	1477 (167) 29	3048 (344) 29	6190 (699) 28	8979 (1015) 27	11916 (1346) 25	31
8 (30)	1142 (129) 40	2866 (324) 39	6191 (700) 38	9316 (1053) 37	11898 (1345) 35	41
10 (38)	979 (111) 50	2606 (295) 49	5809 (656) 48	9191 (1039) 47	12305 (1390) 44	51
12 (45)	614 (69) 60	2246 (254) 59	5586 (631) 58	8736 (987) 57	12079 (1365) 56	61
14 (53)	413 (47) 68	2009 (227) 68	5232 (591) 66	8469 (957) 65	11913 (1346) 64	71
16 (61)		1756 (198) 80	4909 (555) 79	8243 (931) 77	11455 (1294) 74	82
18 (68)		1203 (136) 91	4571 (517) 90	7778 (879) 90	10884 (1230) 87	92
Max. Cont. 20 (76)		827 (93) 100	4010 (453) 99	7257 (820) 98	10540 (1191) 97	102
22 (83)			3620 (409) 109	6958 (786) 108		112
24 (91)			3010 (340) 120	6609 (747) 119		122
Max. Inter. 25 (95)			2810 (318) 126	6130 (693) 125		127
Theo. Torque	1815 (205)	3631 (410)	7261 (821)	10892 (1231)	14522 (1641)	

Areas within white represent maximum motor efficiencies.

DO NOT operate at maximum pressure and maximum flow simultaneously.

Torque, lb-in (Nm)
Speed, RPM

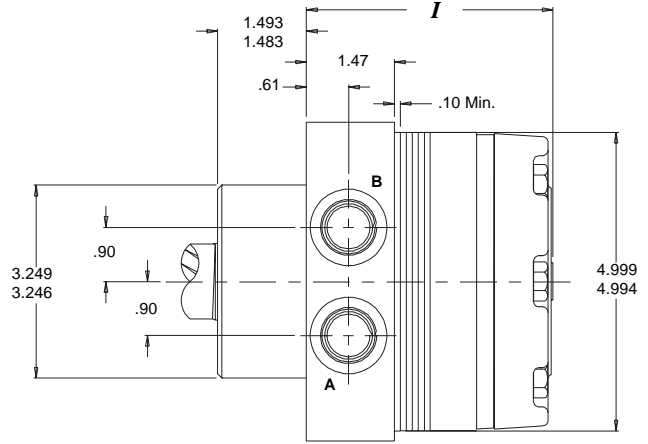
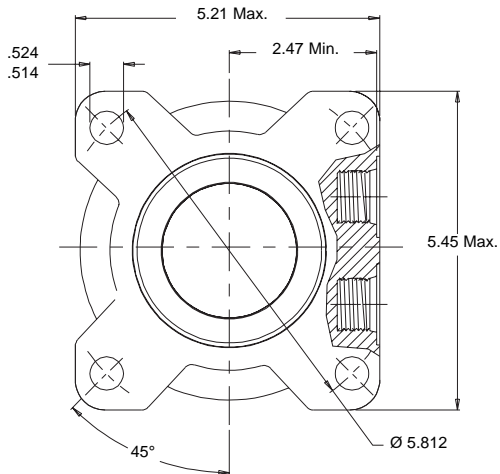
Tested at 129°F with an oil viscosity of 213 SUS

Note: Performance data is typical. Performance of production units varies slightly from one motor to another.

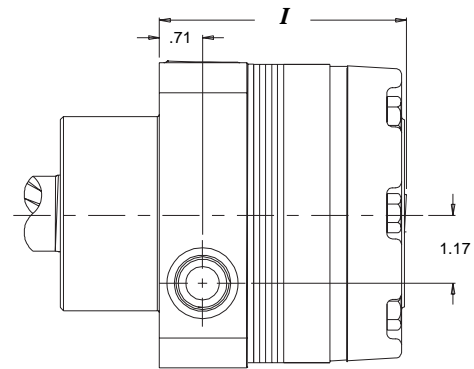
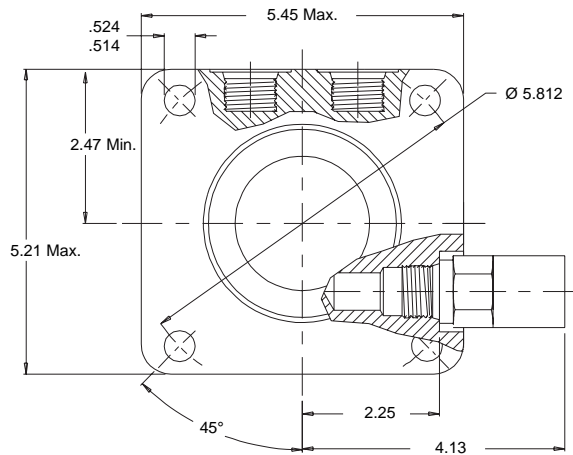
WHEEL MOUNT

W31 4-Hole Front Aligned Ports 7/8" O-Ring

W38 4-Hole Front Aligned Ports 1/2" BSP.F



Optional Relief Cartridge shown installed and is available for both the W31 and W38 housings.



Valve Cavity - 10 Series/2-way (7/8"-14 UNF-2B)

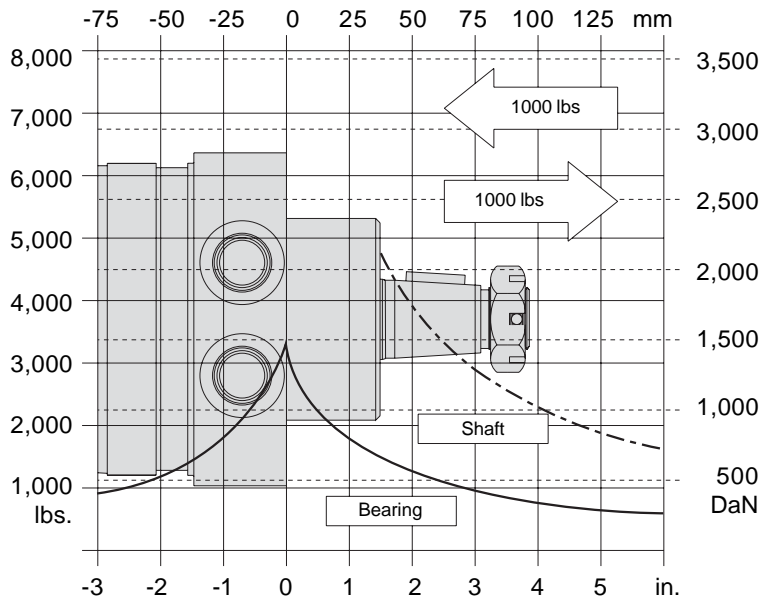
I is on page 54

4000

TECHNICAL ALLOWABLE BEARING AND SHAFT LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 24.

WHEEL MOUNT



LENGTH AND WEIGHT TABLES

Wheel Mount

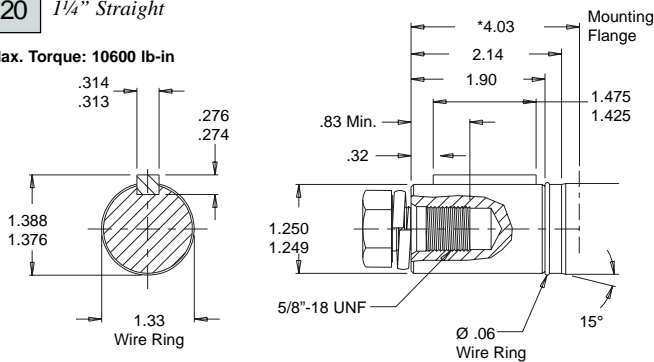
Code	I in	Weight lbs
120	3.91	24.1
160	3.91	24.1
200	4.05	24.8
230	4.15	25.2
260	4.24	25.6
300	4.37	26.3
350	4.92	28.8
375	4.62	27.4
470	4.92	28.8
540	5.16	30.0
750	5.87	33.1

CE motor weights vary ± 1 lb depending upon motor configuration.

SHAFTS

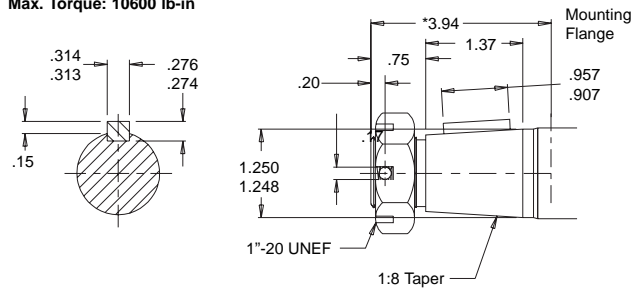
20 1/4" Straight

Max. Torque: 10600 lb-in



22 1/4" Tapered

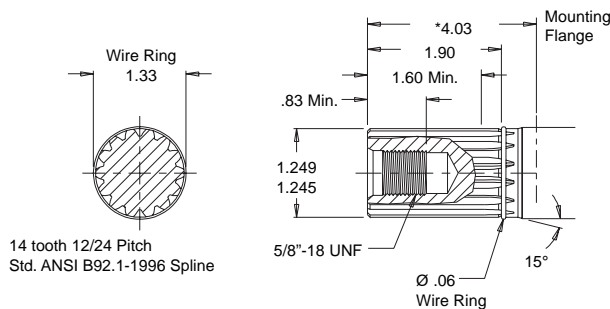
Max. Torque: 10600 lb-in



Note: A slotted nut is standard on this shaft.

23 14 Tooth Spline

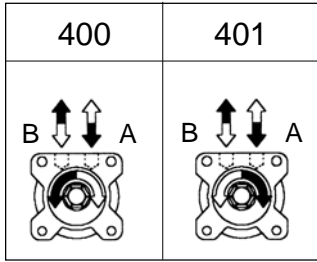
Max. Torque: 10600 lb-in



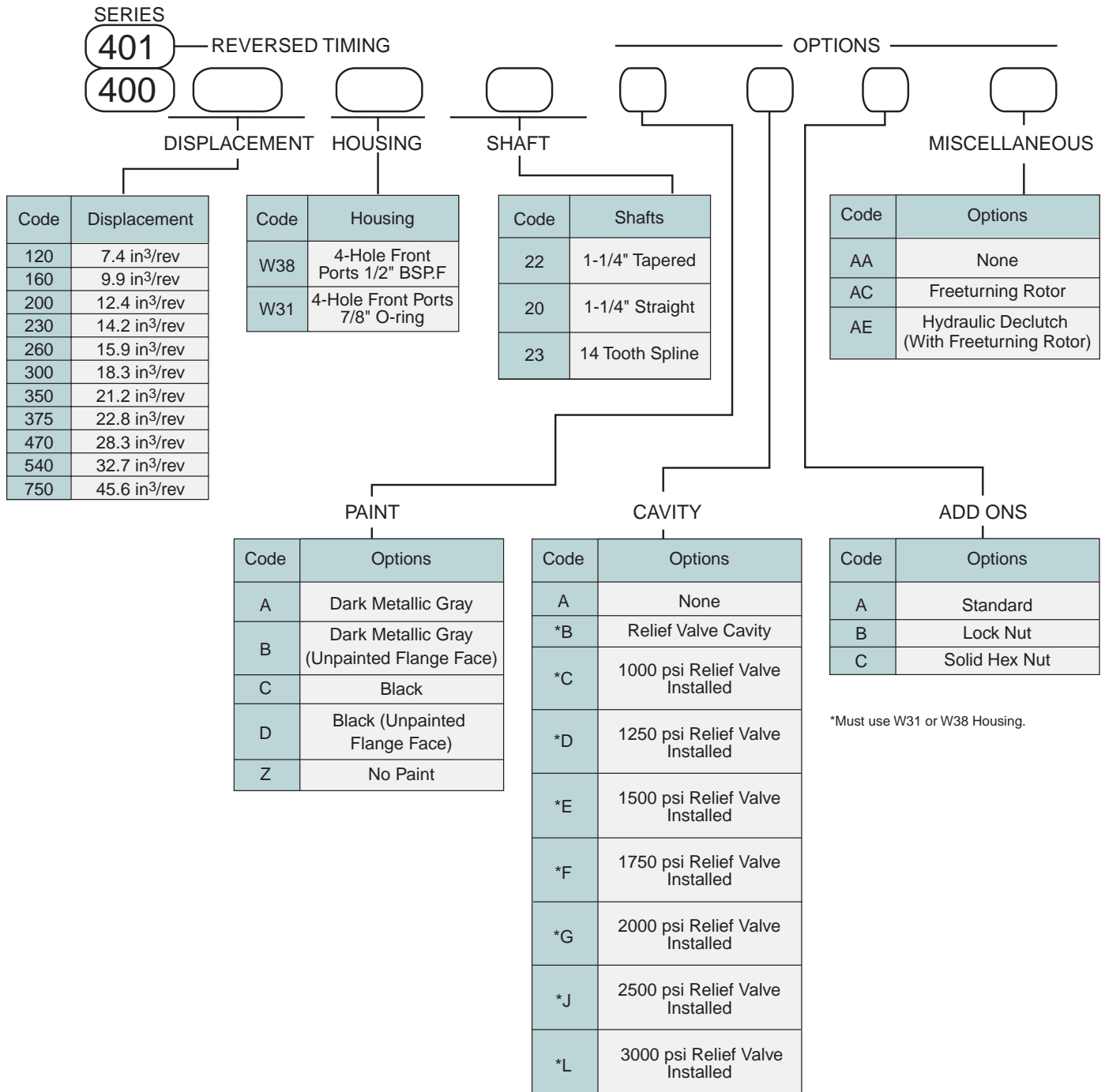
14 tooth 12/24 Pitch
Std. ANSI B92.1-1996 Spline

*Note: Shaft lengths may vary by $\pm .030$ in

SHAFT ROTATION



For applications requiring the motor to rotate in only one direction, shaft seal life may be prolonged by pressurizing the “A” port of the motor. To obtain the desired direction of shaft rotation, use the graphic at the left to determine the rotation code for the motor. For bi-directional applications, the 400 series is recommended. Preferred rotation is determined by internal valving design.

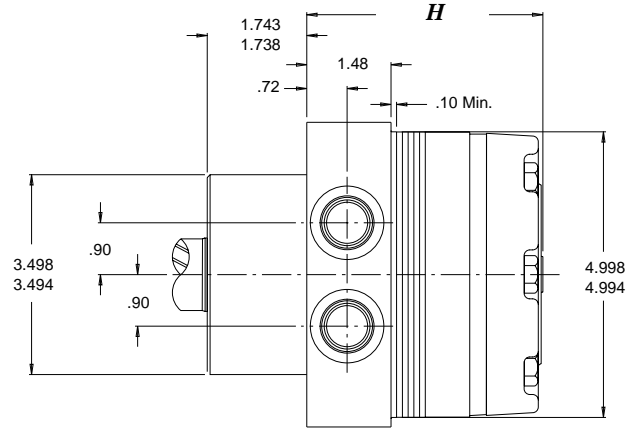
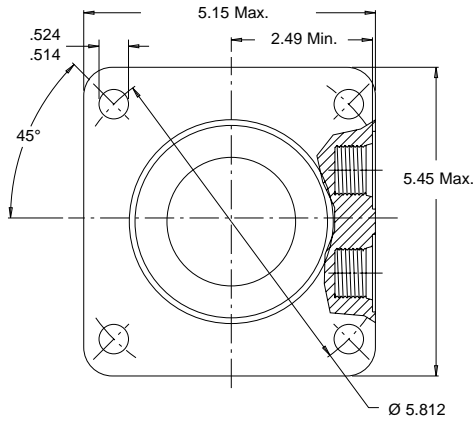


420

HOUSINGS WHEEL MOUNT



- W35** 4-Hole Front Aligned Ports 9/16" O-Ring
- W38** 4-Hole Front Aligned Ports 1/2" BSP.F
- W31** 4-Hole Front Aligned Ports 7/8" O-Ring

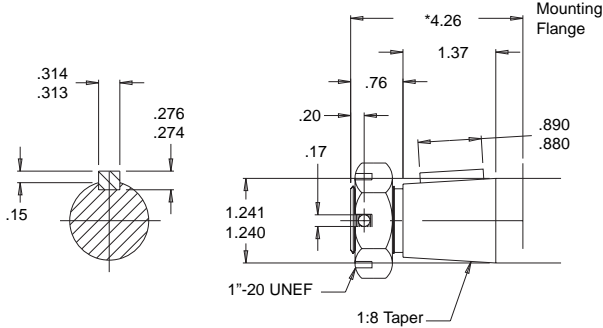


H is on page 57

SHAFTS

22 1 1/4" Tapered

Max. Torque: 10600 lb-in



*Shaft Lengths may vary $\pm .030$ in

Note: A slotted nut is standard on this shaft.

LENGTH AND WEIGHT TABLES

Wheel Mount

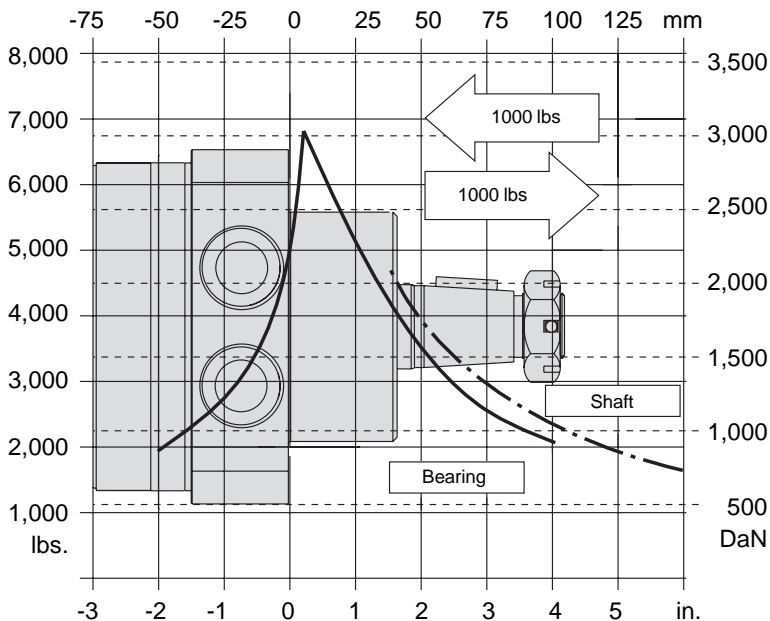
Code	H in	Weight lbs
120	3.91	24.1
160	3.91	24.1
200	4.05	24.8
230	4.15	25.2
260	4.24	25.6
300	4.37	26.3
350	4.92	28.8
375	4.62	27.4
470	4.92	28.8
540	5.16	30.0
750	5.87	33.1

CE motor weights vary ± 1 lb depending upon motor configuration.

ALLOWABLE BEARING AND SHAFT LOADS

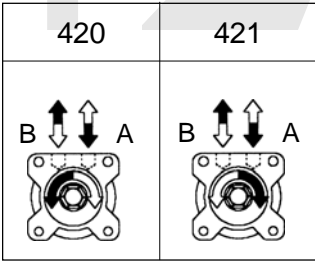
Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 24.

WHEEL MOUNT

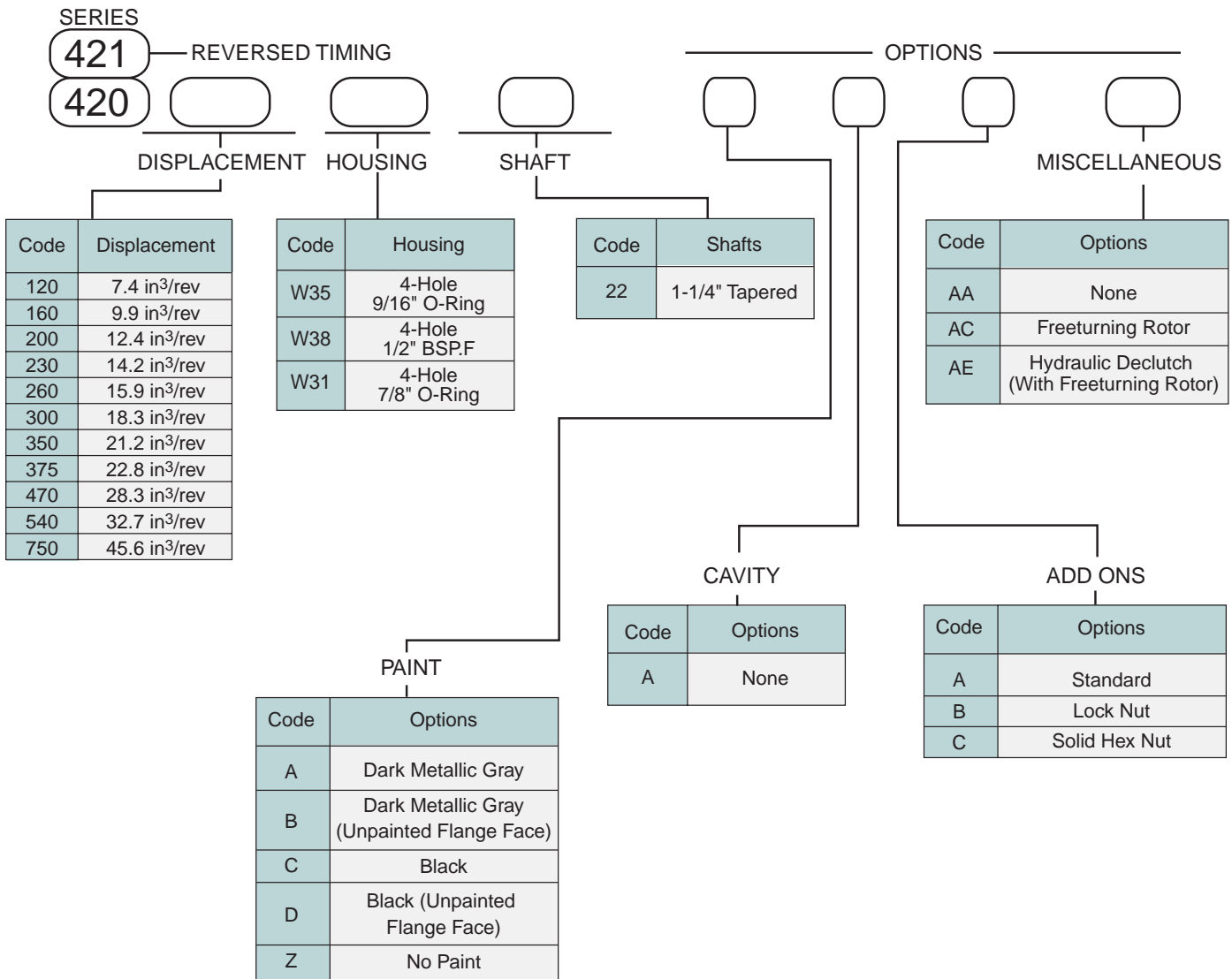


ORDERING INFORMATION

SHAFT ROTATION



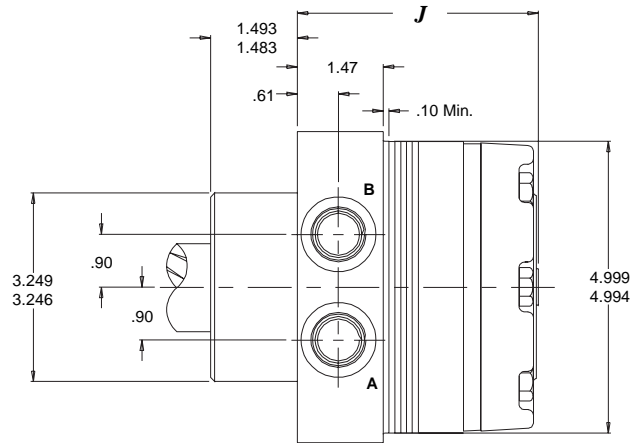
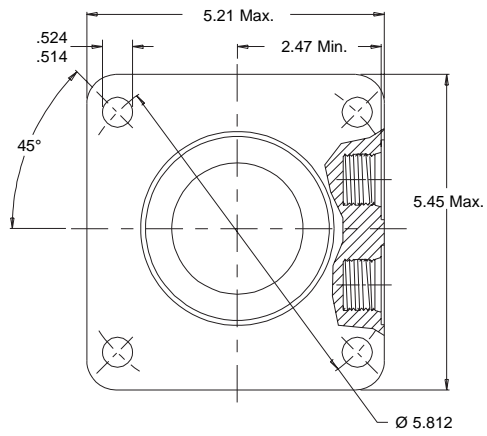
For applications requiring the motor to rotate in only one direction, shaft seal life may be prolonged by pressurizing the “A” port of the motor. To obtain the desired direction of shaft rotation, use the graphic at the left to determine the rotation code for the motor. For bi-directional applications, the 420 series is recommended. Preferred rotation is determined by internal valving design.



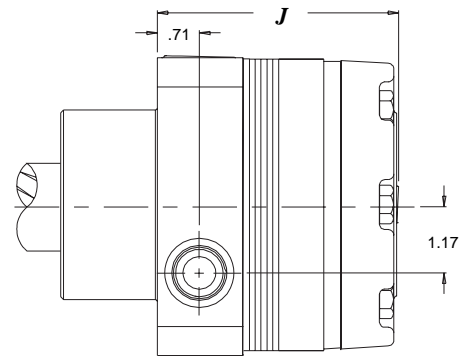
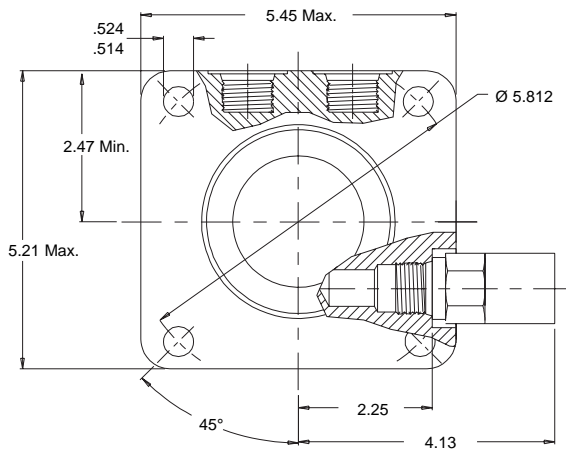
WHEEL MOUNT

W31 4-Hole Front Aligned Ports 7/8" O-Ring

W38 4-Hole Front Aligned Ports 1/2" BSP.F



Optional Relief Cartridge shown installed and is available for both the W31 and W38 housings.



Valve Cavity - 10 Series/2-way (7/8"-14 UNF-2B)

J is on page 60

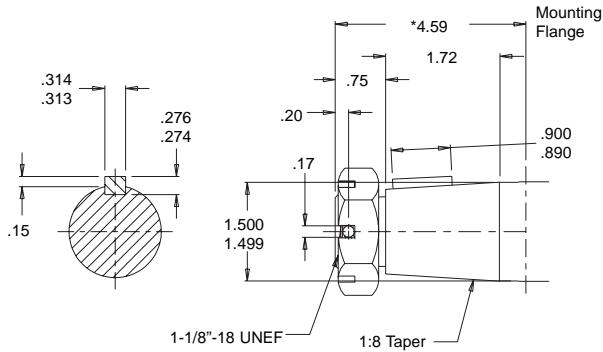
430

TECHNICAL SHAFTS



31 1 1/2" Tapered

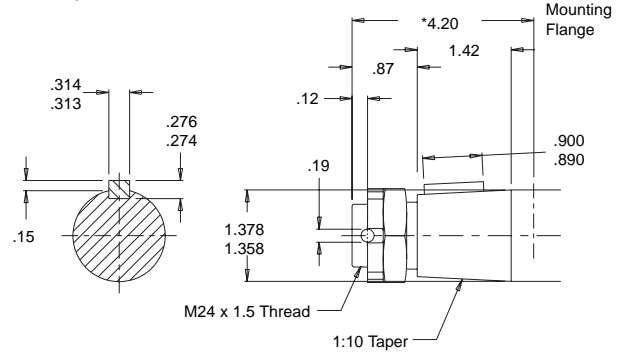
Max. Torque: 10600 lb-in



*Shaft Lengths may vary $\pm .030$ in
Note: A slotted nut is standard on this shaft.

28 35mm Tapered

Max. Torque: 10600 lb-in

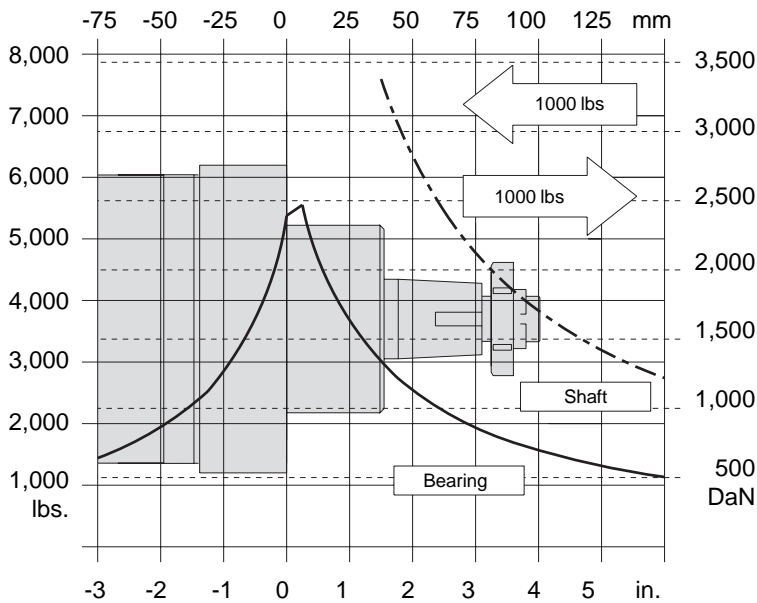


Note: A slotted nut is standard on this shaft.

ALLOWABLE BEARING AND SHAFT LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 24.

WHEEL MOUNT



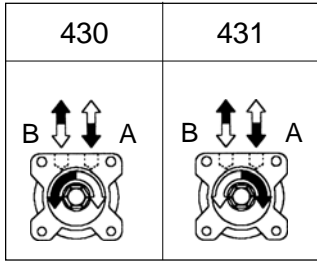
LENGTH AND WEIGHT TABLES

Wheel Mount

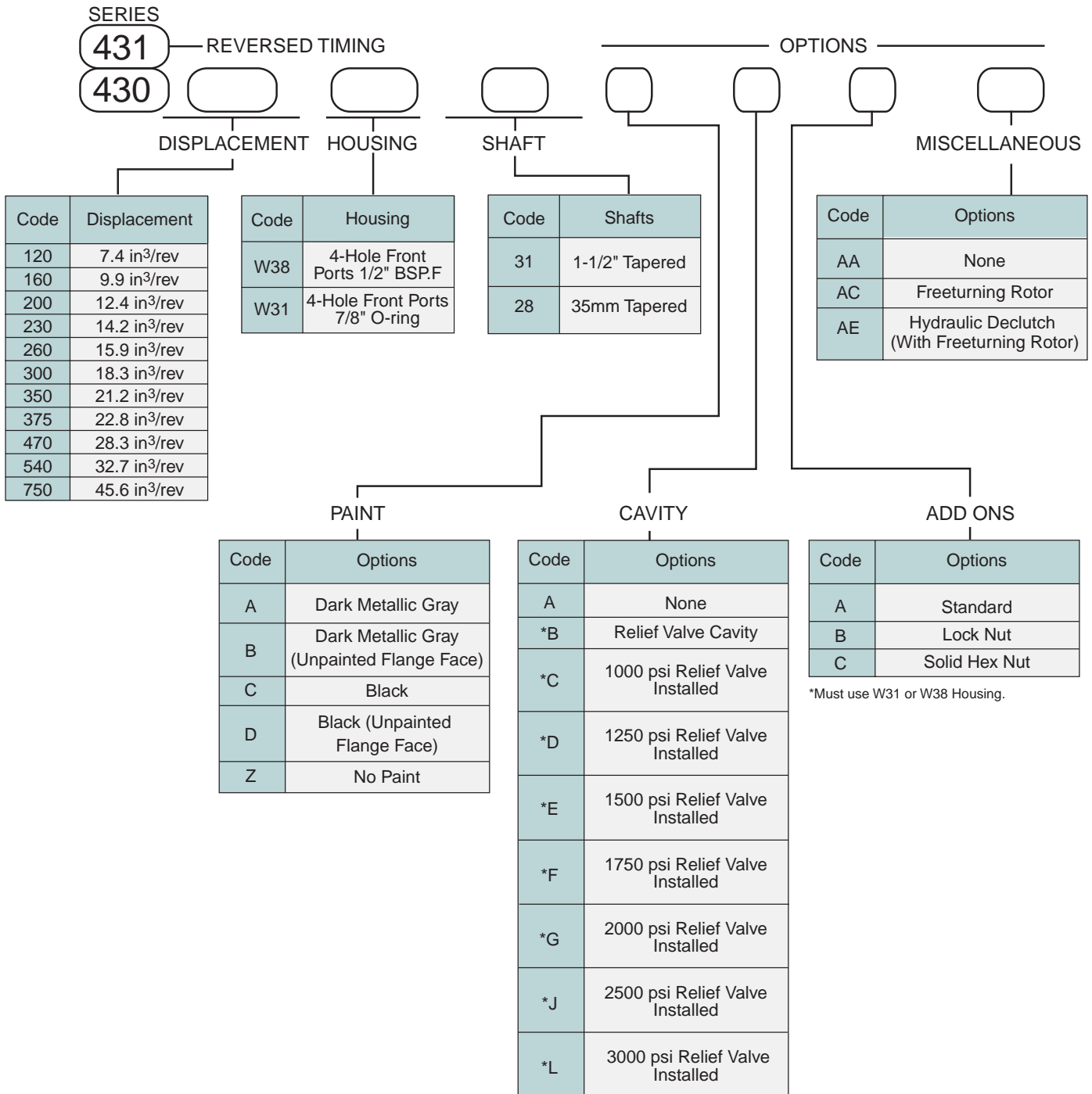
Code	J in	Weight lbs
120	3.91	24.1
160	3.91	24.1
200	4.05	24.8
230	4.15	25.2
260	4.24	25.6
300	4.37	26.3
350	4.92	28.8
375	4.62	27.4
470	4.92	28.8
540	5.16	30.0
750	5.87	33.1

CE motor weights vary ± 1 lb depending upon motor configuration.

SHAFT ROTATION



For applications requiring the motor to rotate in only one direction, shaft seal life may be prolonged by pressurizing the “A” port of the motor. To obtain the desired direction of shaft rotation, use the graphic at the left to determine the rotation code for the motor. For bi-directional applications, the 430 series is recommended. Preferred rotation is determined by internal valving design.



410

FEATURES

High Efficiency CE series Motor provides exceptional low speed performance in one of the smallest wheel drive packages available today

Self-Adjusting Brake Mechanism makes brake adjustments unnecessary by automatically adjusting for brake wear

Standard Wheel Mount Flange adapts easily to new designs and can be retro-fitted onto older machines

4 and 5 Bolt Wheel Hubs are available to accommodate a wide variety of wheel rims

Labyrinth Lip Design incorporated into hub helps protect brake components from elements

2-Position Brake Lever provides flexibility in the attachment of brake cables or actuating linkage

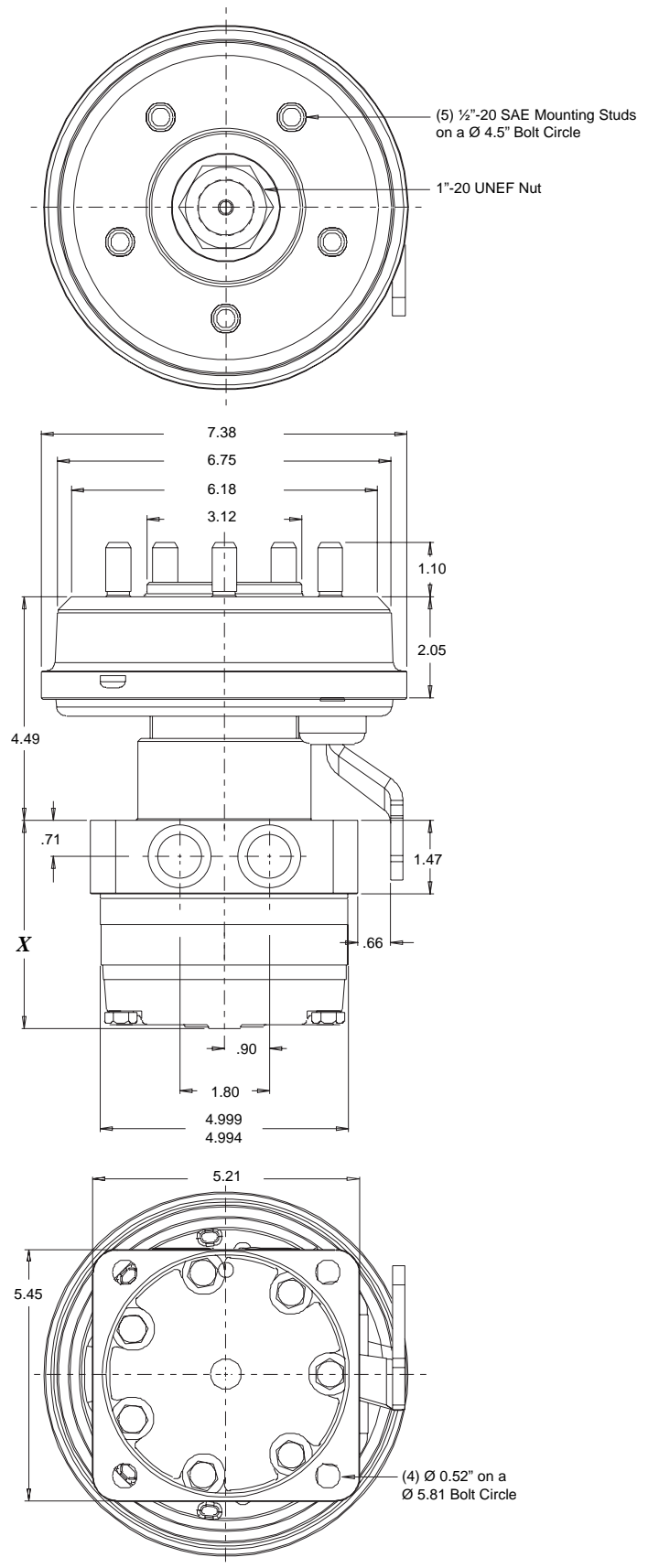
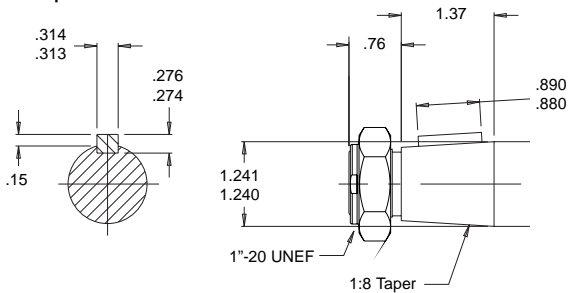
HOUSINGS

- K35** 4-Hole Aligned Ports 9/16" O-Ring with Brake Mount
- K38** 4-Hole Aligned Ports 1/2" BSP.F with Brake Mount
- K31** 4-Hole Aligned Ports 7/8" O-Ring with Brake Mount

SHAFTS

- 22** 1 1/4" Tapered

Max. Torque: 10600 lb-in

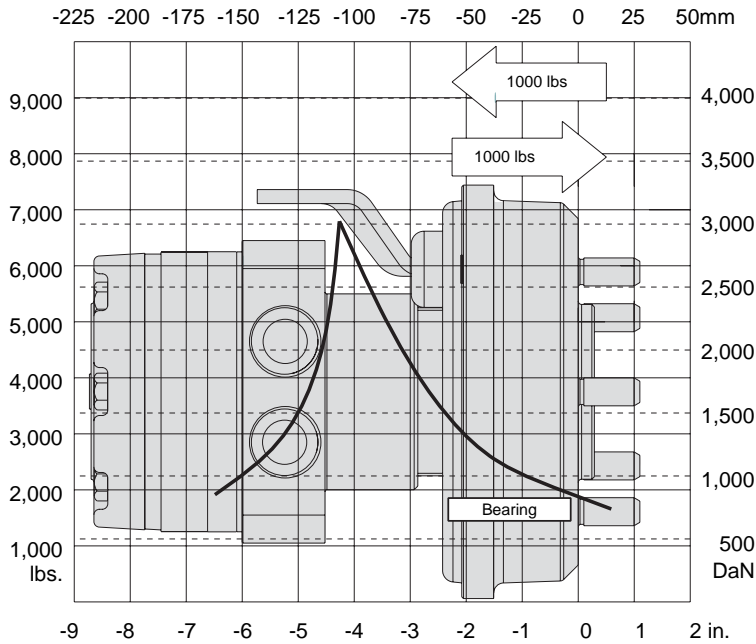


X is on page 63

ALLOWABLE BEARING AND SHAFT LOADS

Bearing Curve: The bearing curve represents allowable bearing loads based on ISO 281 bearing capacity for an L_{10} life of 2,000 hours at 100 RPM. Radial loads for speeds other than 100 RPM may be calculated using the multiplication factor table located on page 24.

WHEEL MOUNT WITH BRAKE



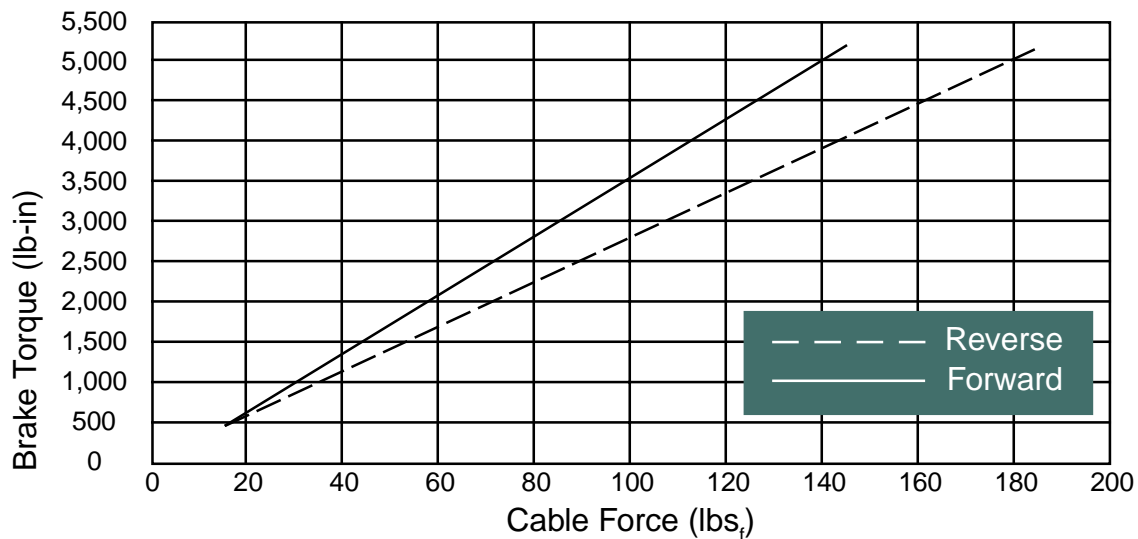
LENGTH AND WEIGHT TABLES

Wheel Mount

Code	X in	Weight lbs
120	3.91	35.2
160	3.91	35.2
200	4.05	35.9
230	4.15	36.3
260	4.24	36.7
300	4.37	37.4
350	4.92	39.9
375	4.62	38.5
470	4.92	39.9
540	5.16	41.1
750	5.87	44.2

CE motor weights vary ± 1 lb depending upon motor configuration.

BRAKE HOLDING TORQUE



ORDERING INFORMATION

SERIES

411

REVERSED TIMING

410

DISPLACEMENT

HOUSING

SHAFT

OPTIONS

MISCELLANEOUS

Code	Displacement
120	7.4 in ³ /rev
160	9.9 in ³ /rev
200	12.4 in ³ /rev
230	14.2 in ³ /rev
260	15.9 in ³ /rev
300	18.3 in ³ /rev
350	21.2 in ³ /rev
375	22.8 in ³ /rev
470	28.3 in ³ /rev
540	32.7 in ³ /rev
750	45.6 in ³ /rev

Code	Housing
K31	4-Hole w/Brake Mount 7/8" O-Ring
K38	4-Hole w/Brake Mount 1/2" BSP.F
K35	4-Hole w/Brake Mount 9/16" O-Ring

Code	Shafts
22	1-1/4" Tapered

Code	Options
ZA	Brake Drum Left Hand Position 1, 5 Bolt Hub
YA	Brake Drum Right Hand Position 2, 5 Bolt Hub
ZE	Brake Drum Left Hand Position 1, 4 Bolt Hub
YE	Brake Drum Right Hand Position 2, 4 Bolt Hub

PAINT

Code	Options
A	Dark Metallic Gray
C	Black
Z	No Paint

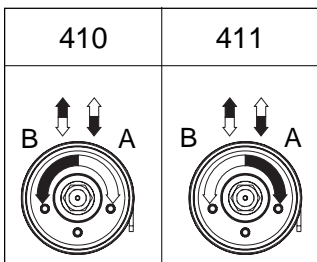
CAVITY

Code	Options
A	None

ADD ONS

Code	Options
A	Standard

SHAFT ROTATION



For applications requiring the motor to rotate in only one direction, shaft seal life may be prolonged by pressurizing the "A" port of the motor. To obtain the desired direction of shaft rotation, use the graphic at the left to determine the rotation code for the motor. For bi-directional applications, the 410 series is recommended. Preferred rotation is determined by internal valving design.