

WS

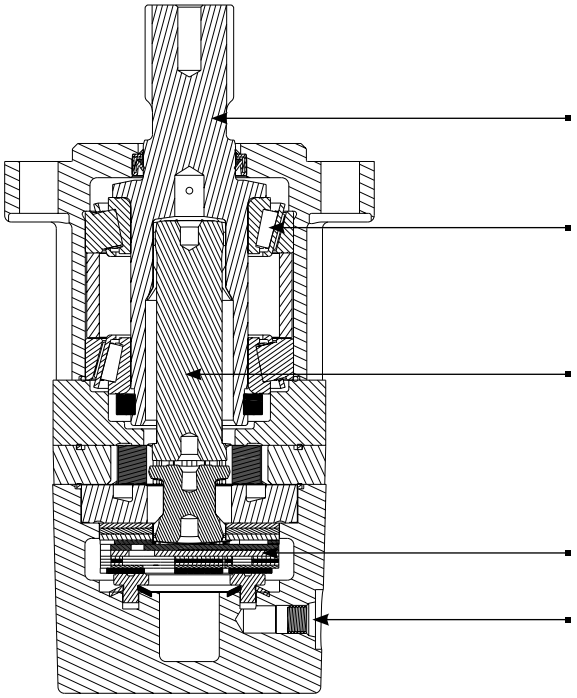
SERIES HYDRAULIC MOTORS

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 80cc [4.8in³] 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 17 for allowable back pressure when utilizing the internal drain.

SPECIFICATIONS

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

CODE	Displacement cc [in³/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
080	79 [4.78]	870	1060	61 [16]	68 [18]	207 [1832]	286 [2528]	207 [3000]	276 [4000]	276 [4000]
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]

080

79 cc [4.8 in^3/rev.] **Intermittent Ratings are below and to the right of the BOLD line.** **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Pressure - bars [psi] 17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	207 [3000] Max. Cont.	242 [3500]	276 [4000] Max. Inter.	Theoretical rpm
2 [0.5]										25
4 [1]	7 [61] **47**	23 [201] **47**								49
8 [2]	9 [79] **97**	28 [244] **95**	64 [568] **90**	100 [887] **85**	135 [1192] **78**					97
15 [4]	9 [79] **194**	27 [242] **192**	64 [567] **186**	101 [896] **178**	137 [1216] **167**	174 [1536] **157**	207 [1832] **142**			194
23 [6]	7 [58] **291**	25 [224] **289**	62 [550] **282**	99 [875] **271**	136 [1202] **258**	172 [1519] **242**	207 [1830] **222**	242 [2141] **198**		291
30 [8]	3 [29] **388**	22 [196] **388**	59 [524] **380**	95 [841] **367**	131 [1162] **349**	167 [1479] **328**	203 [1795] **305**	240 [2123] **279**	281 [2484] **221**	388
38 [10]		19 [171] **484**	56 [495] **477**	92 [814] **464**	128 [1129] **444**	164 [1447] **420**	200 [1766] **393**	236 [2092] **361**	279 [2470] **306**	484
45 [12]		14 [127] **581**	53 [465] **575**	88 [781] **562**	125 [1102] **540**	159 [1411] **513**	195 [1730] **481**	233 [2062] **441**	278 [2456] **381**	581
53 [14]		9 [80] **678**	48 [422] **674**	79 [704] **658**	119 [1055] **635**	155 [1373] **606**	191 [1689] **571**	229 [2028] **527**		678
61 [16] Max. Inter. Cont.		2 [14] **775**	38 [336] **771**	75 [662] **757**	111 [985] **736**	151 [1337] **704**	182 [1611] **664**	238 [2109] **608**	282 [2499] **540**	775
68 [18]			34 [298] **871**	68 [602] **858**	101 [896] **833**	141 [1244] **806**	188 [1661] **750**	238 [2104] **680**	283 [2507] **605**	871

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

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

22 [194]	44 [388]	88 [777]	132 [1165]	176 [1553]	219 [1942]	263 [2330]	307 [2718]	351 [3107]

Theoretical Torque - Nm [lb-in]

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

100

100 cc [6.10 in^3/rev.] **Intermittent Ratings are below and to the right of the BOLD line.** **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Pressure - bars [psi] 17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	207 [3000] Max. Cont.	242 [3500]	276 [4000]	310 [4500] Max. Inter.	Theoretical rpm
2 [0.5]	14 [120] **11**	35 [313] **8**	77 [681] **6**	116 [1025] **4**							19
4 [1]	15 [129] **37**	38 [337] **35**	80 [710] **10**	122 [1079] **7**	162 [1436] **5**						38
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**	76
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**	152
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**	228
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**	303
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**	379
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**	455
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**	531
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**	606
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**	682
76 [20] Max. Cont.		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**	758
83 [22]					156 [1379] **801**	205 [1814] **782**	253 [2239] **758**	300 [2653] **730**	347 [3075] **698**	398 [3526] **668**	834
91 [24]						199 [1762] **850**	246 [2179] **826**	294 [2604] **799**	343 [3037] **768**	395 [3495] **733**	909
95 [25] Max. Inter.						196 [1737] **883**	246 [2176] **863**	294 [2605] **835**	342 [3028] **800**	392 [3472] **770**	947

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]

WS

PERFORMANCE

110

Pressure - bars [psi]

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

112 cc [6.85 in^3/rev.]

Intermittent Ratings are below and to the right of the BOLD line. **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Theoretical rpm
2 [0.5]	17
4 [1]	34
8 [2]	68
15 [4]	135
23 [6]	203
30 [8]	270
38 [10]	338
45 [12]	405
53 [14]	473
61 [16]	540
68 [18]	608
76 [20] Max. Cont.	675
83 [22]	742
91 [24]	810
95 [25] Max. Inter.	844

12 [106] **9**	38 [334] **8**	86 [757] **6**	132 [1166] **4**						
12 [110] **17**	38 [334] **10**	89 [788] **8**	137 [1213] **6**	184 [1624] **5**					
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 [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**
15 [128] **203**	42 [373] **203**	97 [856] **200**	151 [1337] **196**	206 [1826] **190**	260 [2302] **182**	313 [2770] **170**	359 [3179] **143**	411 [3633] **124**	458 [4054] **103**
12 [108] **269**	40 [351] **267**	94 [833] **265**	148 [1313] **262**	203 [1798] **258**	258 [2281] **248**	311 [2753] **234**	359 [3177] **201**	413 [3656] **178**	466 [4122] **155**
9 [80] **337**	36 [322] **335**	91 [803] **333**	145 [1280] **331**	199 [1761] **325**	253 [2236] **313**	307 [2715] **296**	358 [3165] **255**	413 [3652] **232**	468 [4144] **206**
8 [69] **404**	33 [293] **403**	87 [770] **401**	141 [1247] **399**	194 [1716] **391**	249 [2205] **378**	303 [2684] **360**	353 [3124] **313**	408 [3613] **289**	467 [4133] **259**
4 [38] **473**	29 [254] **471**	82 [728] **470**	136 [1202] **465**	189 [1676] **457**	243 [2152] **442**	294 [2605] **403**	351 [3108] **376**	407 [3601] **347**	464 [4109] **316**
	24 [210] **540**	78 [687] **538**	131 [1162] **532**	185 [1635] **523**	239 [2114] **508**	290 [2564] **467**	346 [3058] **438**	402 [3553] **406**	462 [4092] **372**
	18 [163] **608**	72 [639] **605**	126 [1116] **599**	180 [1594] **589**	234 [2068] **573**	286 [2534] **530**	341 [3016] **502**	397 [3515] **467**	458 [4051] **432**
	13 [117] **675**	68 [598] **673**	121 [1068] **667**	174 [1541] **656**	228 [2017] **639**	282 [2494] **594**	336 [2977] **565**	393 [3481] **528**	454 [4017] **492**
		67 [596] **742**	115 [1015] **735**	169 [1500] **722**	221 [1960] **699**	276 [2445] **672**	332 [2942] **637**	388 [3436] **598**	447 [3953] **557**
		62 [549] **808**	109 [967] **801**	164 [1452] **787**	218 [1926] **767**	272 [2403] **737**	326 [2885] **702**	383 [3385] **659**	441 [3906] **620**
		60 [528] **841**	105 [939] **834**	161 [1425] **818**	215 [1901] **800**	270 [2389] **771**	323 [2861] **736**	380 [3361] **693**	439 [3886] **648**

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]

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

129 cc [7.86 in^3/rev.]

Intermittent Ratings are below and to the right of the BOLD line. **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Theoretical rpm
2 [0.5]	15
4 [1]	30
8 [2]	59
15 [4]	118
23 [6]	177
30 [8]	236
38 [10]	294
45 [12]	353
53 [14]	412
61 [16]	471
68 [18]	530
76 [20] Max. Cont.	588
83 [22]	647
91 [24]	706
95 [25] Max. Inter.	735

13 [114] **8**	41 [367] **6**	94 [830] **3**							
16 [144] **17**	45 [400] **9**	101 [890] **6**	151 [1334] **4**	201 [1780] **3**	256 [2264] **3**	306 [2706] **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**
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**
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**
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**
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**
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**
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**
	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**
		91 [803] **522**	155 [1369] **518**	219 [1934] **510**	282 [2498] **499**	340 [3007] **471**	404 [3571] **448**	469 [4147] **421**	536 [4744] **389**
		85 [753] **580**	148 [1314] **575**	212 [1879] **568**	277 [2447] **556**	335 [2960] **526**	399 [3528] **503**	464 [4108] **474**	533 [4714] **441**
		77 [681] **641**	140 [1242] **637**	204 [1805] **627**	267 [2362] **613**	332 [2938] **592**	397 [3510] **567**	461 [4076] **536**	526 [4651] **504**
		71 [625] **701**	134 [1185] **696**	198 [1751] **686**	261 [2307] **672**	325 [2872] **651**	389 [3442] **625**	453 [4011] **594**	520 [4599] **563**
		68 [601] **730**	131 [1158] **726**	195 [1722] **717**	258 [2285] **703**	322 [2849] **683**	384 [3399] **657**	450 [3986] **625**	519 [4594] **589**

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]

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

162 cc [9.90 in^3/rev.] **Intermittent Ratings are below and to the right of the BOLD line.** **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Theoretical rpm	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	207 [3000]	242 [3500]	259 [3750]	276 [4000]
2 [0.5]	12	20 [173] **11**	55 [485] **10**	125 [1102] **8**	190 [1679] **6**	255 [2258] **5**					
4 [1]	24	22 [199] **23**	59 [523] **22**	135 [1194] **20**	207 [1831] **18**	274 [2425] **15**	338 [2989] **13**	397 [3511] **9**			
8 [2]	47	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**
15 [4]	94	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**
23 [6]	140	29 [257] **140**	69 [615] **138**	143 [1265] **136**	225 [1990] **135**	306 [2711] **130**	386 [3412] **124**	464 [4108] **116**	535 [4737] **100**	573 [5074] **93**	607 [5370] **83**
30 [8]	187	26 [226] **186**	66 [583] **185**	138 [1225] **184**	221 [1958] **182**	303 [2678] **177**	383 [3387] **170**	462 [4088] **160**	538 [4761] **144**	578 [5116] **135**	617 [5463] **125**
38 [10]	234	21 [188] **234**	62 [547] **233**	133 [1180] **232**	216 [1914] **230**	298 [2633] **224**	379 [3353] **217**	458 [4055] **206**	534 [4730] **189**	575 [5085] **180**	616 [5451] **168**
45 [12]	280	16 [145] **280**	57 [509] **278**	135 [1192] **276**	210 [1861] **274**	292 [2581] **270**	372 [3289] **261**	452 [4000] **250**	530 [4688] **234**	570 [5046] **224**	613 [5423] **212**
53 [14]	327	11 [97] **327**	51 [455] **326**	133 [1178] **325**	205 [1817] **323**	286 [2530] **316**	365 [3231] **307**	441 [3905] **293**	523 [4627] **274**	563 [4986] **264**	606 [5363] **251**
61 [16]	374	5 [44] **374**	45 [402] **372**	125 [1110] **371**	199 [1761] **370**	280 [2474] **363**	359 [3173] **353**	436 [3857] **338**	517 [4572] **319**	557 [4934] **308**	599 [5301] **295**
68 [18]	420		37 [331] **420**	118 [1048] **419**	192 [1697] **417**	272 [2408] **410**	351 [3104] **400**	427 [3779] **383**	508 [4498] **363**	548 [4853] **353**	592 [5240] **339**
Max. Cont. 76 [20]	467		30 [265] **467**	111 [980] **466**	183 [1616] **465**	264 [2337] **457**	343 [3036] **446**	419 [3712] **428**	500 [4424] **408**	540 [4777] **396**	584 [5167] **382**
83 [22]	514		22 [193] **514**	103 [913] **512**	176 [1557] **510**	256 [2264] **503**	335 [2965] **491**	413 [3658] **476**	492 [4358] **454**	533 [4721] **441**	575 [5093] **427**
91 [24]	560				175 [1553] **558**	246 [2180] **550**	327 [2890] **538**	405 [3587] **522**	484 [4286] **500**	524 [4639] **484**	568 [5027] **473**
95 [25]	584				163 [1443] **581**	241 [2134] **573**	321 [2843] **561**	400 [3543] **545**	481 [4253] **522**	521 [4611] **511**	561 [4968] **496**
Max. Inter. 114 [30]	700				138 [1222] **699**	217 [1917] **691**	296 [2618] **679**	376 [3324] **661**	456 [4034] **645**	495 [4383] **625**	534 [4729] **609**

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]

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

202 cc [12.31 in^3/rev.] **Intermittent Ratings are below and to the right of the BOLD line.** **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Theoretical rpm	17 [250]	35 [500]	69 [1000]	104 [1500]	138 [2000]	172 [2500]	190 [2750]	207 [3000]	242 [3500]	276 [4000]
2 [0.5]	10	28 [249] **8**	72 [638] **7**	157 [1388] **5**							
4 [1]	19	33 [291] **18**	81 [713] **17**	170 [1508] **14**	254 [2250] **12**	335 [2961] **9**	411 [3636] **5**	454 [4019] **4**	508 [4498] **6**		
8 [2]	38	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**	
15 [4]	76	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**
23 [6]	113	38 [334] **112**	89 [789] **111**	184 [1624] **110**	285 [2524] **102**	387 [3425] **102**	486 [4299] **95**	533 [4721] **90**	579 [5128] **84**	654 [5790] **67**	732 [6478] **54**
30 [8]	151	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**
38 [10]	188	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**
45 [12]	226	22 [197] **226**	74 [651] **225**	168 [1491] **224**	270 [2385] **220**	371 [3284] **213**	473 [4190] **204**	520 [4600] **194**	572 [5064] **185**	670 [5930] **169**	767 [6789] **150**
53 [14]	263	16 [139] **263**	67 [593] **262**	163 [1439] **261**	263 [2324] **257**	363 [3216] **251**	465 [4111] **241**	513 [4537] **229**	563 [4980] **222**	664 [5880] **205**	764 [6765] **186**
61 [16]	301	8 [70] **301**	60 [530] **300**	159 [1409] **299**	255 [2260] **296**	355 [3145] **289**	454 [4022] **273**	506 [4477] **266**	557 [4929] **257**	656 [5809] **238**	756 [6688] **219**
68 [18]	338		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**
Max. Cont. 76 [20]	376		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**
83 [22]	413		31 [276] **413**	134 [1186] **411**	227 [2007] **410**	326 [2888] **403**	427 [3783] **385**	478 [4230] **377**	527 [4665] **368**	628 [5555] **347**	730 [6463] **324**
91 [24]	451				216 [1908] **449**	315 [2790] **441**	417 [3693] **423**	467 [4137] **414**	518 [4581] **405**	618 [5466] **383**	723 [6395] **360**
95 [25]	470				210 [1856] **468**	309 [2737] **461**	413 [3656] **440**	464 [4107] **432**	513 [4543] **422**	614 [5436] **401**	718 [6353] **378**
Max. Inter. 114 [30]	563				181 [1598] **561**	281 [2486] **552**	382 [3380] **539**	433 [3831] **530**	482 [4267] **521**	580 [5136] **495**	689 [6100] **467**

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]

WS

PERFORMANCE

230

228 cc [13.92 in³/rev.]

Pressure - bars [psi]

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

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
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] **98**	214 [1897] **97**	331 [2929] **93**	446 [3950] **89**	556 [4925] **81**	609 [5393] **76**	651 [5762] **68**	747 [6610] **56**	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
Max. Cont. 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
Max. Inter. 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

Theoretical rpm

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

325 cc [19.81 in³/rev.]

Pressure - bars [psi]

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

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
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] **140**	131 [1155] **139**	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] **187**	112 [994] **186**	267 [2359] **185**	431 [3818] **181**	594 [5253] **169**	674 [5966] **163**	753 [6660] **155**	824 [7290] **149**			187
68 [18]	18 [160] **209**	113 [997] **207**	265 [2344] **206**	430 [3805] **204**	593 [5244] **192**	673 [5953] **185**	751 [6649] **178**	811 [7178] **174**			210
Max. Cont. 76 [20]	3 [25] **234**	97 [863] **233**	248 [2198] **232**	415 [3673] **227**	578 [5114] **216**	658 [5821] **210**	736 [6515] **202**	797 [7052] **197**			234
83 [22]		84 [747] **257**	236 [2091] **255**	400 [3540] **249**	562 [4973] **240**	641 [5676] **234**	720 [6368] **227**	781 [6913] **222**			257
91 [24]		75 [667] **280**	215 [1900] **279**	380 [3365] **273**	543 [4804] **264**	623 [5510] **258**	701 [6202] **251**	763 [6756] **246**			280
95 [25]		70 [616] **292**	207 [1828] **290**	370 [3272] **285**	533 [4716] **276**	613 [5423] **270**	698 [6175] **261**	758 [6711] **257**			292
Max. Inter. 114 [30]			153 [1353] **350**	315 [2789] **344**	478 [4230] **335**	559 [4943] **329**	639 [5653] **322**	704 [6233] **318**			350

Theoretical rpm

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

399 cc [24.36 in^3/rev.]

Pressure - bars [psi]

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

Intermittent Ratings are below and to the right of the BOLD line. **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Theoretical rpm
2 [0.5]	5
4 [1]	10
8 [2]	19
15 [4]	38
23 [6]	57
30 [8]	76
38 [10]	95
45 [12]	114
53 [14]	133
61 [16]	152
68 [18]	171
76 [20] Max. Cont.	190
83 [22]	209
91 [24]	228
99 [26]	247
114 [30] Max. Inter.	285

17 [250]	35 [500]	69 [1000]	86 [1250]	104 [1500]	121 [1750]	138 [2000]	155 [2250] Max. Cont.	172 [2500]	190 [2750] Max. Inter.
81 [717] **4**	173 [1534] **4**	356 [3148] **2**							
85 [752] **9**	181 [1605] **8**	369 [3263] **7**	460 [4074] **6**	550 [4865] **5**	638 [5648] **4**	724 [6404] **3**	816 [7222] **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**		
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**	
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**
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**
	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**
	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**
	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**
	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**
		291 [2578] **169**	395 [3493] **167**	498 [4405] **165**	597 [5279] **158**	699 [6185] **151**	798 [7065] **143**	896 [7931] **134**	991 [8774] **122**
		269 [2379] **189**	371 [3286] **187**	475 [4205] **184**	575 [5084] **177**	678 [5997] **171**	777 [6879] **163**	876 [7754] **154**	972 [8606] **143**
		246 [2174] **207**	348 [3076] **205**	451 [3987] **202**	555 [4911] **198**	654 [5789] **192**	754 [6671] **184**	852 [7543] **175**	951 [8413] **165**
		226 [2000] **226**	322 [2850] **224**	424 [3756] **221**	528 [4668] **217**	629 [5571] **211**	728 [6446] **204**	828 [7332] **195**	926 [8197] **184**
		197 [1739] **246**	294 [2600] **244**	397 [3515] **241**	500 [4421] **236**	602 [5323] **231**	702 [6214] **224**	801 [7093] **215**	900 [7963] **205**
		131 [1162] **284**	237 [2100] **282**	338 [2991] **279**	441 [3901] **275**	542 [4798] **269**	643 [5687] **263**	743 [6574] **254**	843 [7458] **245**

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

496 cc [30.29 in^3/rev.]

Pressure - bars [psi]

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

Intermittent Ratings are below and to the right of the BOLD line. **Intermittent Ratings -** 10% of Operation

Flow - lpm [gpm]	Theoretical rpm
2 [0.5]	4
4 [1]	8
8 [2]	16
15 [4]	31
23 [6]	46
30 [8]	62
38 [10]	77
45 [12]	92
53 [14]	107
61 [16]	123
68 [18]	138
76 [20] Max. Cont.	153
83 [22]	168
91 [24]	184
99 [26]	199
114 [30] Max. Inter.	229

17 [250]	35 [500]	52 [750]	69 [1000]	86 [1250]	104 [1500]	121 [1750] Max. Cont.	138 [2000]	155 [2250] Max. Inter.
94 [832] **3**	210 [1861] **3**	323 [2859] **3**	435 [3853] **3**					
98 [868] **7**	197 [1743] **7**	314 [2781] **7**	430 [3802] **6**	542 [4797] **6**	652 [5766] **5**	777 [6876] **4**		
100 [882] **15**	205 [1812] **15**	328 [2905] **14**	447 [3959] **14**	565 [5001] **13**	677 [5990] **11**	780 [6900] **9**	879 [7779] **7**	
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**
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**
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**
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**
	177 [1568] **92**	262 [2318] **92**	410 [3624] **91**	519 [4593] **89**	644 [5696] **86**	770 [6811] **82**	891 [7885] **75**	1008 [8916] **68**
	157 [1389] **107**	286 [2533] **106**	415 [3673] **105**	544 [4810] **104**	669 [5918] **101**	794 [7027] **96**	914 [8092] **89**	1031 [9122] **80**
	138 [1219] **123**	265 [2347] **122**	394 [3486] **121**	523 [4630] **120**	649 [5740] **116**	775 [6861] **111**	897 [7936] **104**	1013 [8968] **95**
	114 [1004] **138**	243 [2147] **137**	370 [3277] **136**	500 [4424] **135**	626 [5536] **132**	752 [6659] **127**	876 [7753] **120**	995 [8806] **111**
	96 [849] **153**	217 [1919] **153**	344 [3047] **152**	473 [4190] **151**	600 [5311] **147**	728 [6446] **143**	852 [7537] **136**	972 [8606] **127**
	78 [688] **168**	154 [1360] **168**	276 [2439] **167**	406 [3595] **166**	534 [4724] **164**	660 [5839] **161**	784 [6938] **155**	907 [8028] **148**
		160 [1416] **184**	268 [2371] **184**	397 [3512] **182**	524 [4633] **179**	650 [5755] **175**	776 [6863] **170**	898 [7950] **162**
		129 [1138] **199**	231 [2048] **198**	321 [2844] **197**	451 [3988] **196**	576 [5097] **193**	703 [6218] **188**	827 [7320] **181**
			186 [1647] **229**	292 [2581] **228**	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]

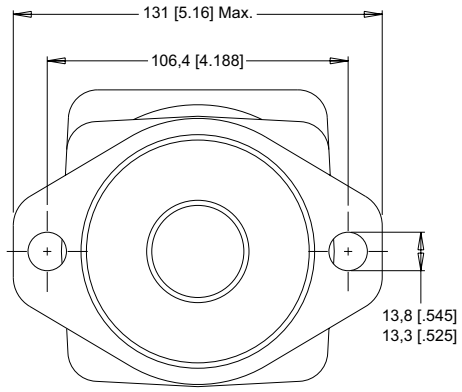
Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]

WS

NOTE: Dimensions shown are without paint. Paint thickness can be up to 0,13 [.005]

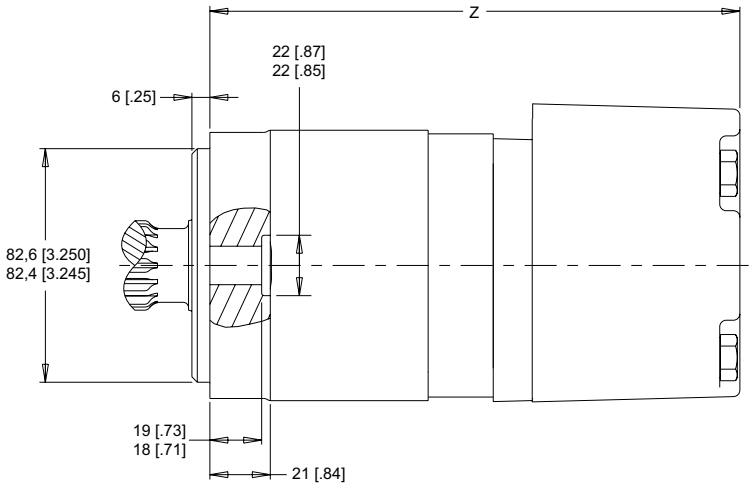
355 & 356 SERIES HOUSINGS

A0 2-Hole SAE A Mount with End Ports

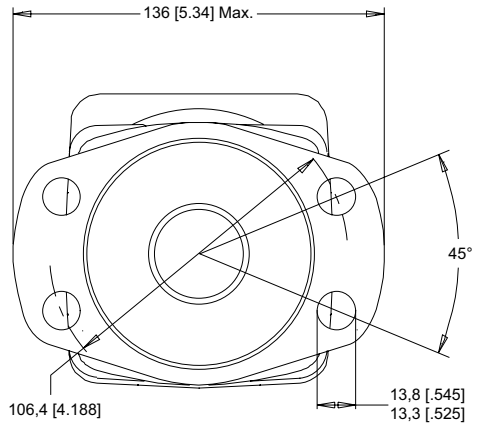


NOTE: Dimension Z is found on page 10.

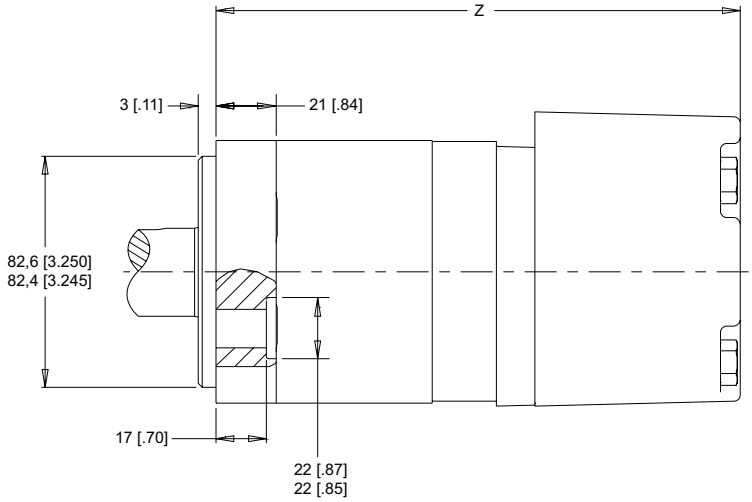
A7 2-Hole SAE A Mount with Side Ports



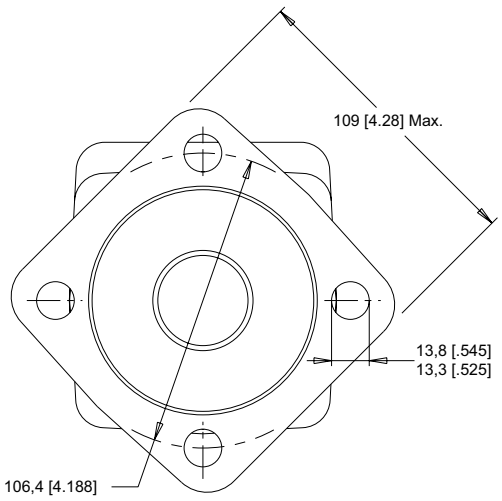
A2 4-Hole Magneto with End Ports



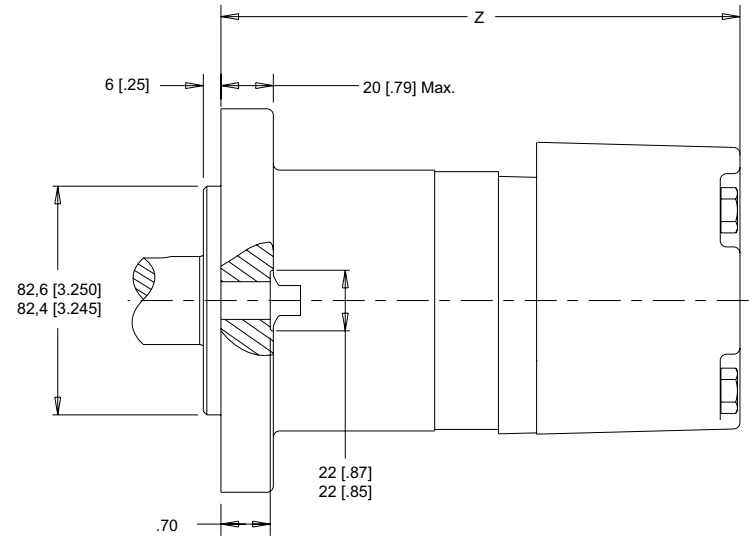
A8 4-Hole Magneto with Side Ports



AG 4-Hole Square SAE A Mount with End Ports



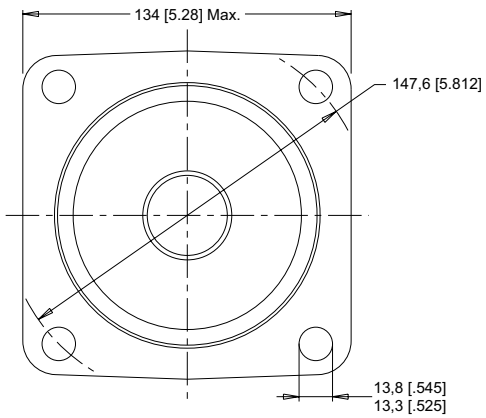
AH 4-Hole Square SAE A Mount with Side Ports



NOTE: Dimensions shown are without paint. Paint thickness can be up to 0,13 [.005]

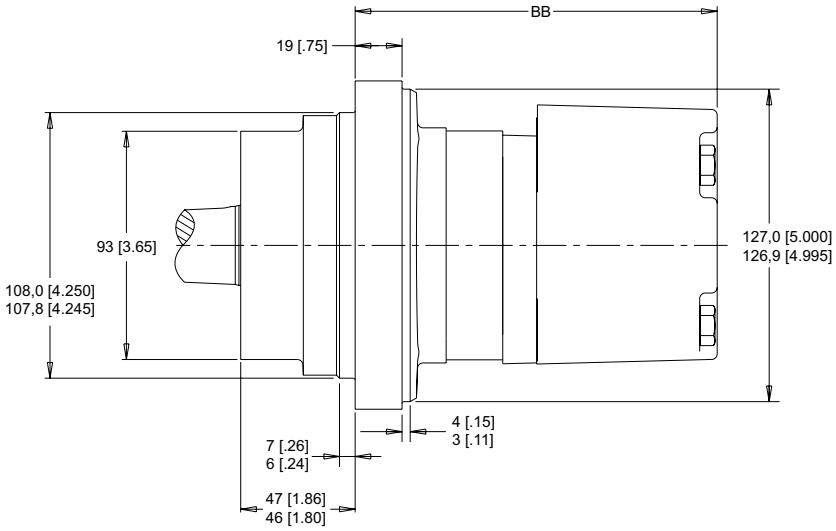
355 & 356 SERIES HOUSINGS (WHEEL MOUNTS)

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

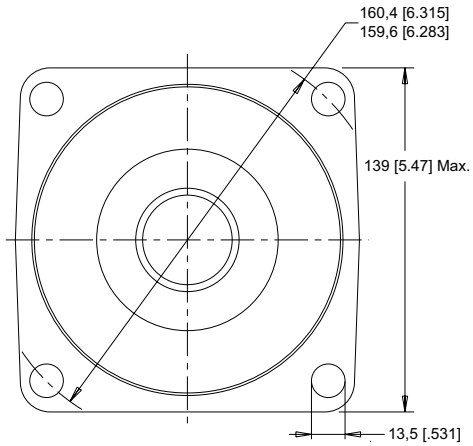


NOTE: Dimension BB is found on page 11.

Y8 4-Hole 4.25” Wheel Mount with Side Ports

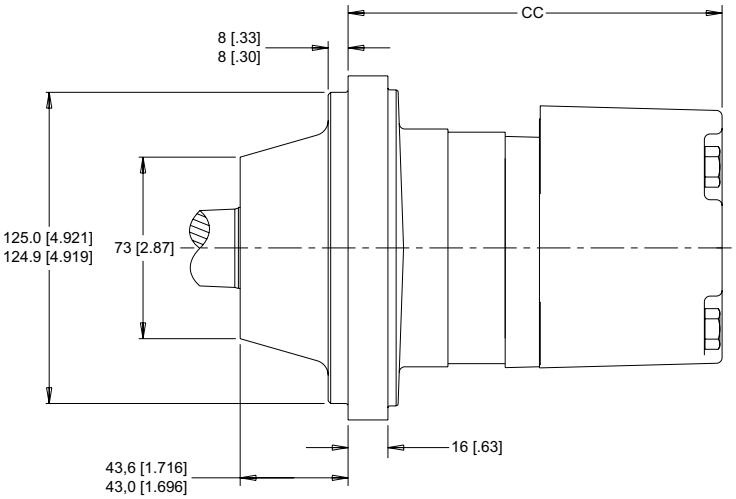


Z2 4-Hole Euro Wheel Mount with End Ports



NOTE: Dimension CC is found on page 11.

Z8 4-Hole Euro Wheel Mount with Side Ports

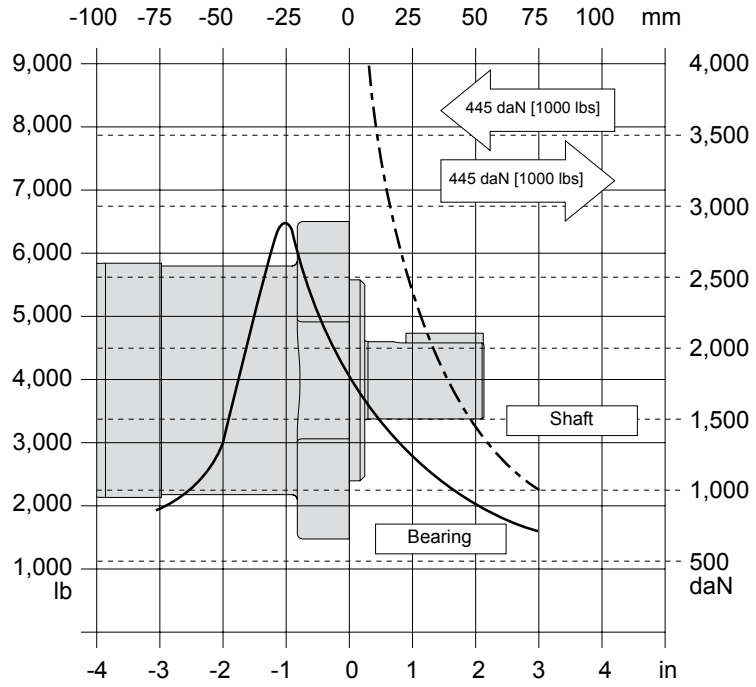


WS

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 on page 13.

SAE “A” MOUNT



LENGTH / WEIGHT CHART SAE A Mount - Dimension **Z**		
Code	**mm [in]**	**kg [lb]**
080	193 [7.60]	10,8 [23.8]
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]

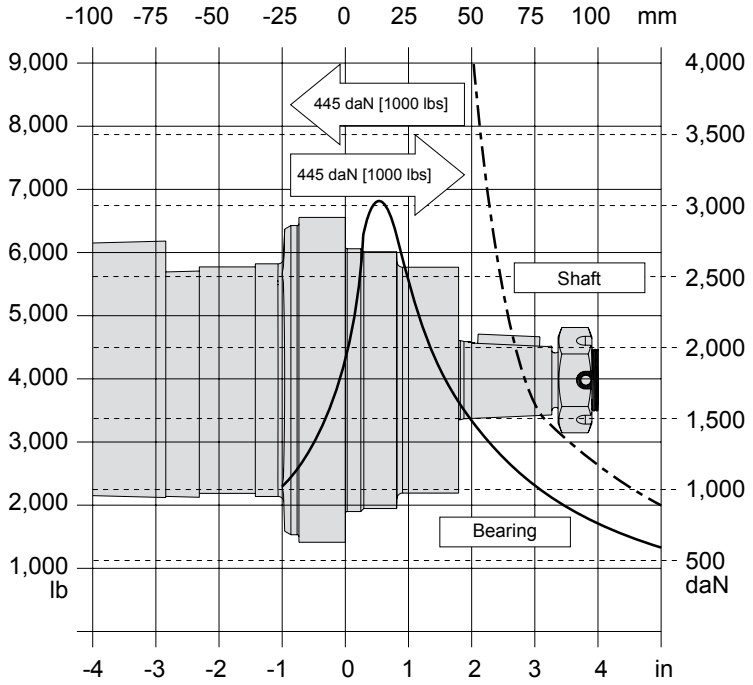
NOTE:
WS motor weights vary ± 0,5 kg [1 lbs] depending upon motor configuration. Add 3,8 mm [.15 in] to dimension AA for Magneto mount.

LENGTH / WEIGHT CHART Short Motor - Dimension **GG**		
Code	**mm [in]**	**kg [lb]**
080	142 [5.60]	9,6 [21.2]
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 ± 0,5 kg [1 lbs] depending upon motor configuration.

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*. Radial loads for speeds other than 100 rpm may be calculated using the multiplication factor table on page 13.

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 **BB**

Code	mm [in]	kg [lb]
080	153 [6.02]	12,0 [26.5]
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]

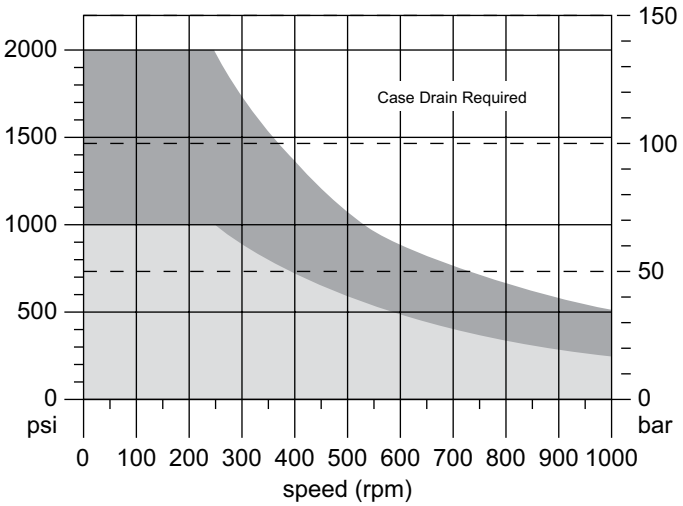
NOTE:
WS motor weights vary ± 0,5 kg [1 lbs] depending upon motor configuration.

LENGTH / WEIGHT CHART
Euro Wheel Mount - Dimension **CC**

Code	mm [in]	kg [lb]
080	156 [6.14]	11,8 [26.0]
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]

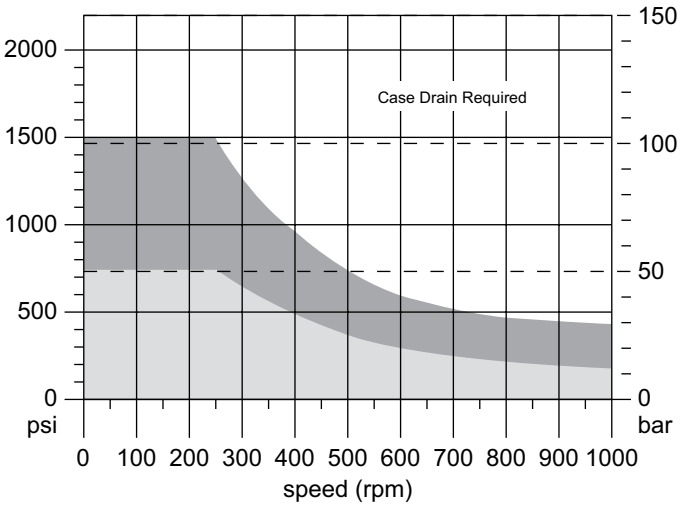
NOTE:
WS motor weights vary ± 0,5 kg [1 lbs] depending upon motor configuration.

PERMISSIBLE SHAFT SEAL PRESSURE



Intermittent - Case Drain Optional
Continuous - Case Drain Optional

NOTE: Above chart references shaft options 1-1/4" and smaller.



Intermittent - Case Drain Optional
Continuous - Case Drain Optional

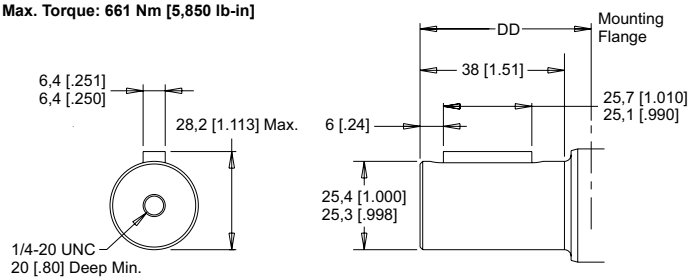
NOTE: Above chart references shaft options larger than 1-1/4".

WS

355 & 356 SERIES SHAFTS

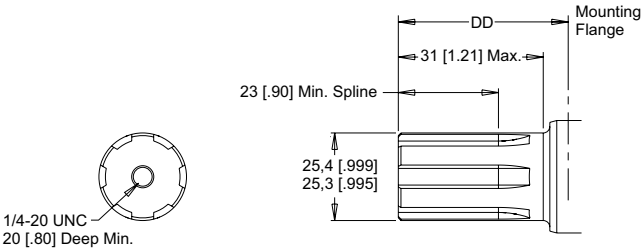
10 1" Straight

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



02 6-B Spline

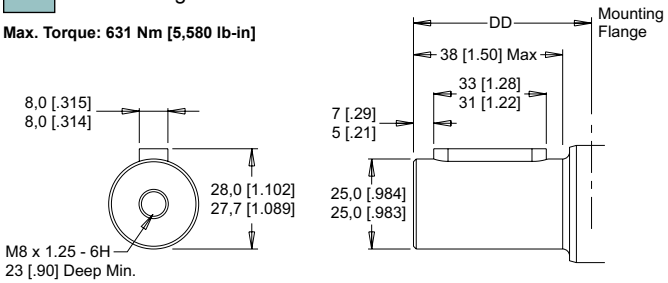
Max. Torque: 429 Nm [3,800 lb-in]



6-B Spline (SAE J499 Standard)

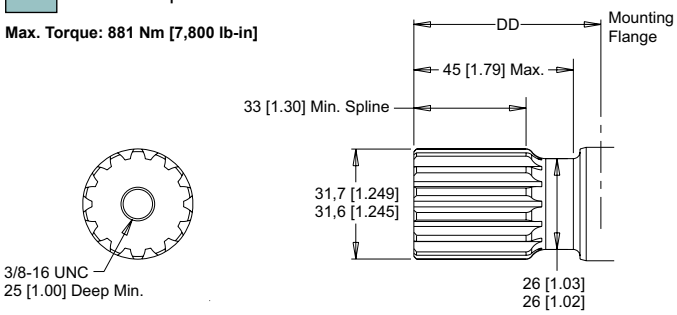
12 25mm Straight

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



23 14 Tooth Spline

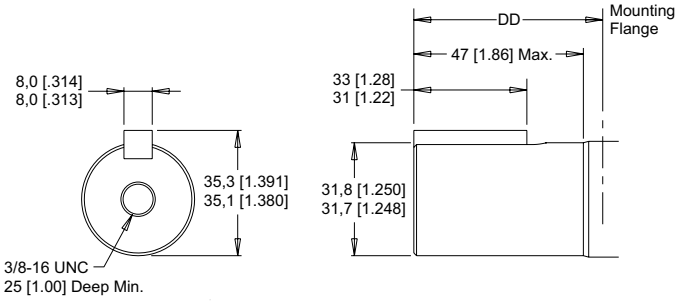
Max. Torque: 881 Nm [7,800 lb-in]



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

20 1-1/4" Straight

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

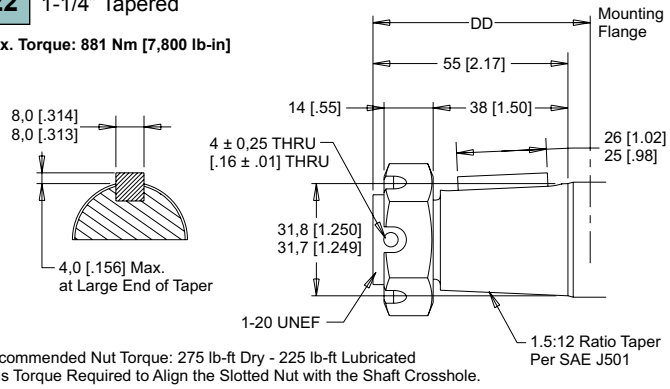


MOUNTING FLANGE TO SHAFT END - Dimension DD					
Code	**A0, A7, AG, & AH**	**A2 & A8**	**W2 & W8**	**Y2 & Y8**	**Z2 & Z8**
02	51 [2.00]	47 [1.85]	85 [3.34]	91 [3.58]	88 [3.45]
10	51 [2.00]	47 [1.85]	85 [3.34]	91 [3.58]	88 [3.45]
12	51 [2.00]	56 [1.86]	85 [3.34]	91 [3.58]	88 [3.46]
20	55 [2.18]	52 [2.03]	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 ± 0,8 mm [.030 in.]

22 1-1/4" Tapered

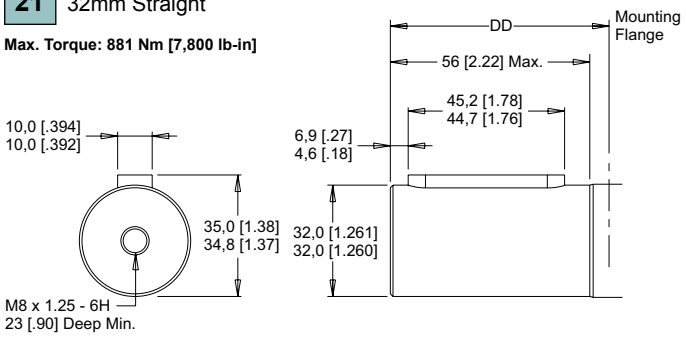
Max. Torque: 881 Nm [7,800 lb-in]



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

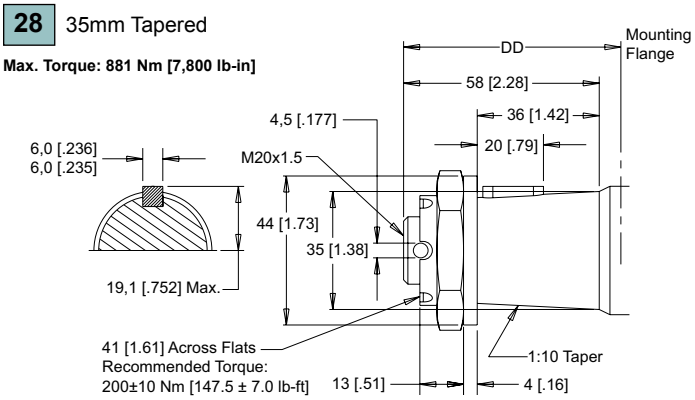
21 32mm Straight

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



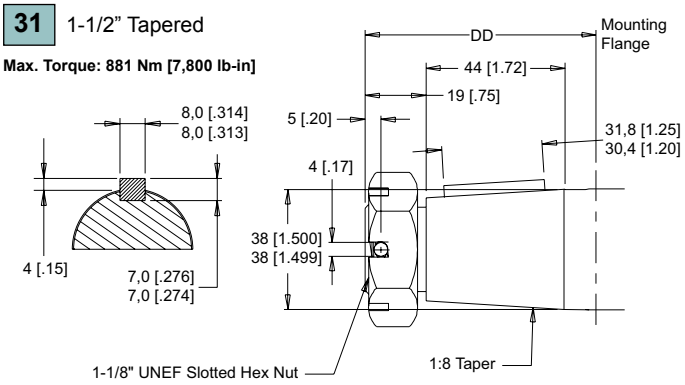
28 35mm Tapered

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



31 1-1/2" Tapered

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



NOTE: Dimension DD is found on page 12.

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

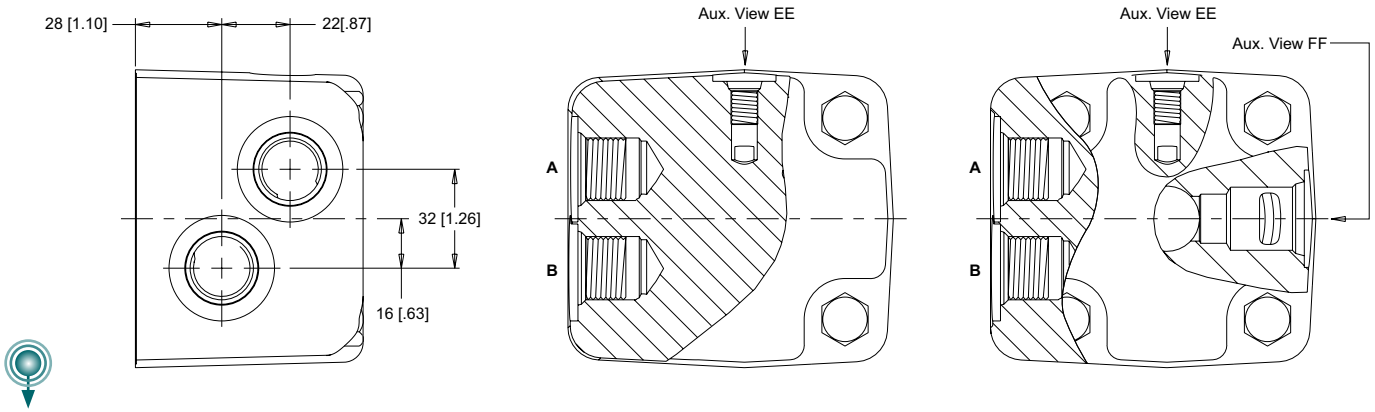
WS

355 & 356 SERIES PORTING OPTIONS

SIDE PORTS

1 7/8” O-Ring with 7/16” Drain Port

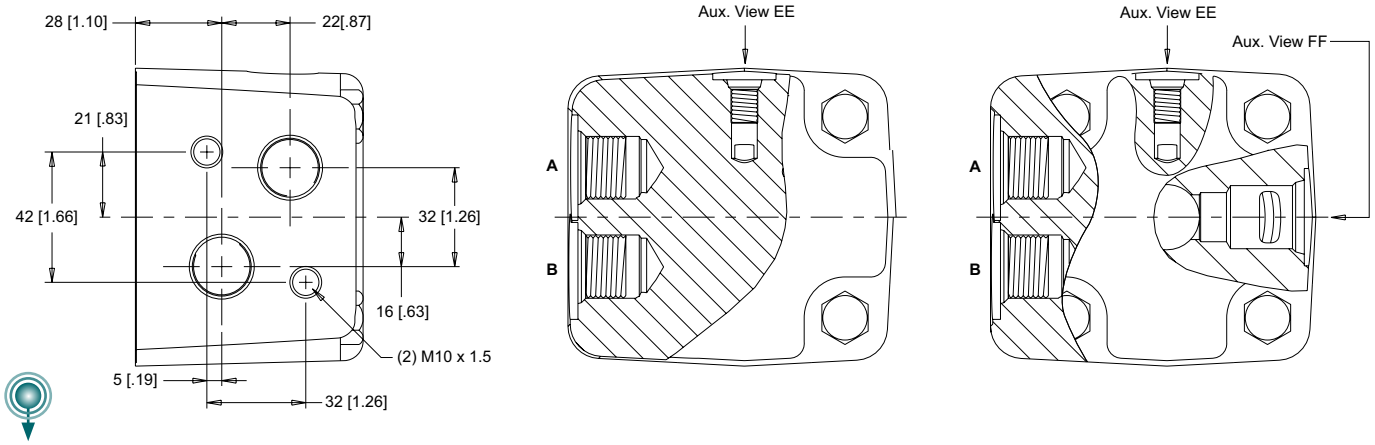
2 1/2” BSP.F with 1/4” Drain Port



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 EE and FF.

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

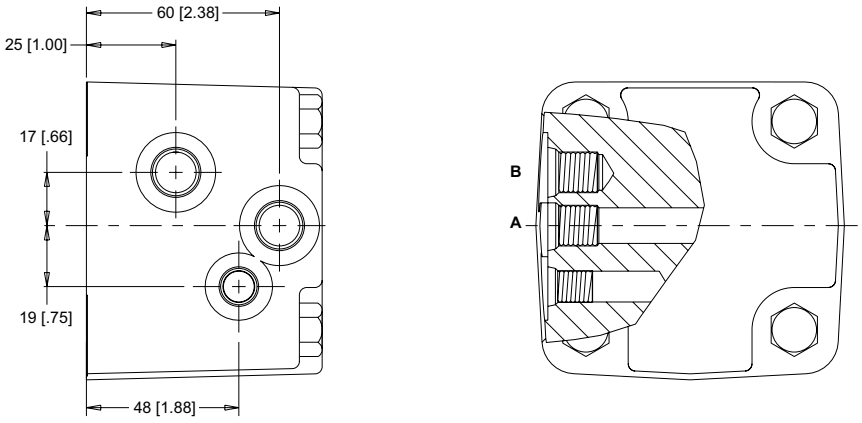


NOTE: The #3 WS side ported option can be ordered with a relief valve cavity (10 Series / 2 Way Valve Cavity 7/8” - 14 UNF-2B). See page 15 for Auxillary views EE and FF.

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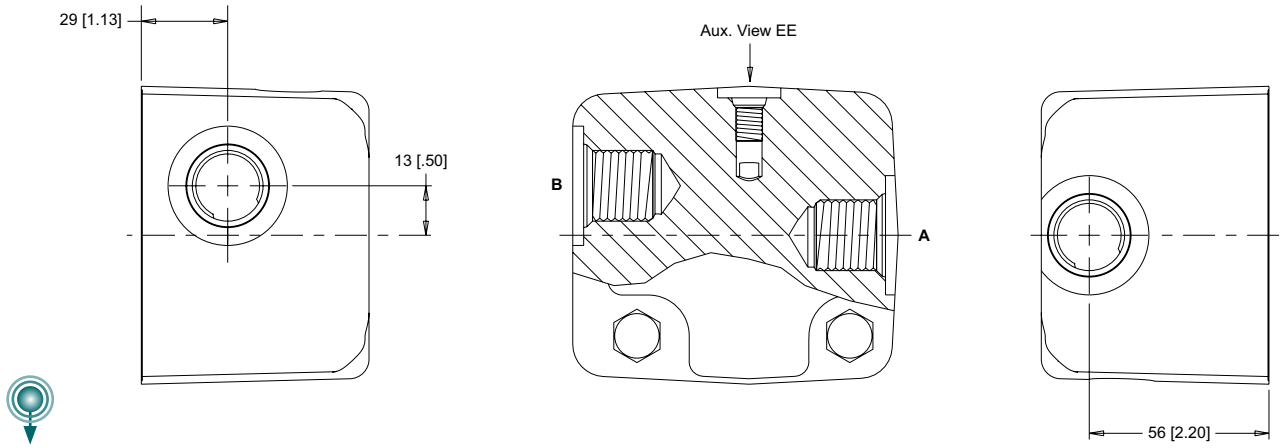
5 9/16” O-Ring with 7/16” Drain Port

9 3/8” BSP.F with 1/4” Drain Port



SIDE PORTS

6 1-1/16” O-Ring with 7/16” Drain Port

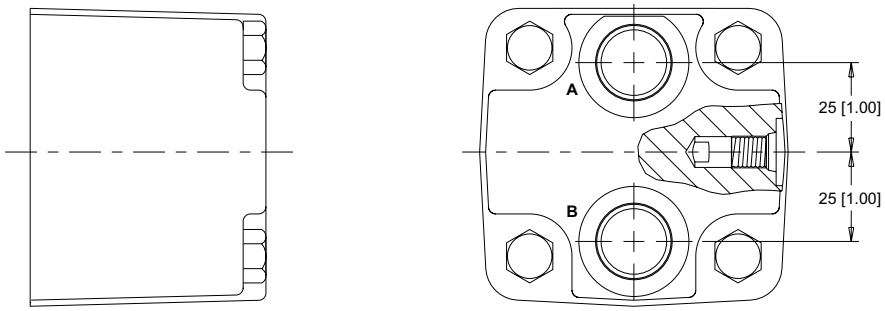


NOTE: See below for Auxillary view EE.

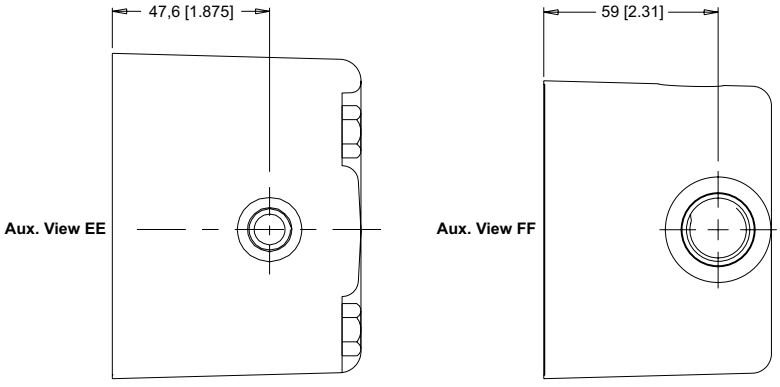
END PORTS

1 7/8” O-Ring with 7/16” Drain Port

2 1/2” BSP.F with 1/4” Drain Port



AUXILLARY VIEWS



WS

355 & 356 SERIES SHORT MOTOR

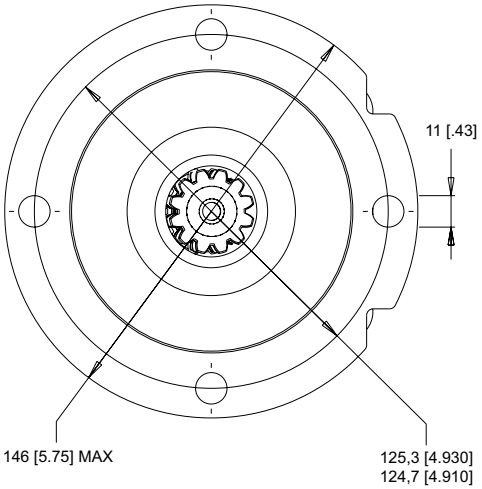
SHORT MOTOR OVERVIEW

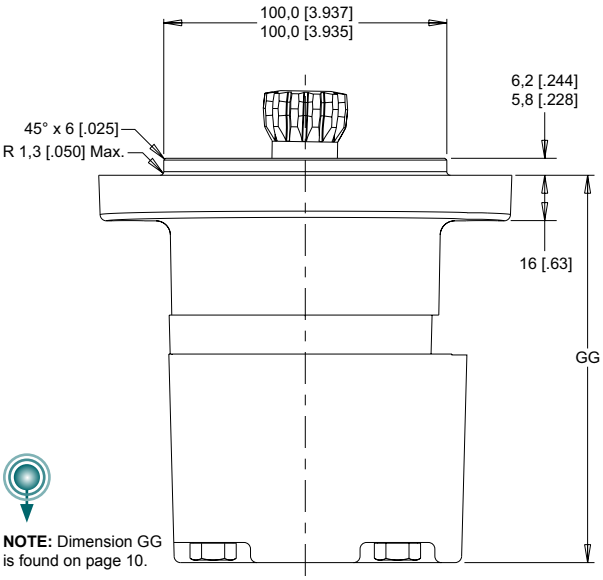
The WS short motor comes without bearings or an output shaft. It is designed for direct mounting onto a gearbox or similar add-on component that provides the internal splined input shaft and bearings.

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

S2 Short Motor with End Ports **S8** Short Motor with Side Ports





NOTE: Dimension GG is found on page 10.

SHAFT

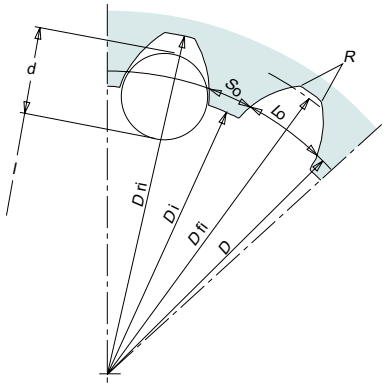
The recommended shaft material is SAE 8620 or similar case hardening steel such as 20 MoCr4 (900 N/mm^2) hardened to 59 - 62 HRc to a depth of 0,762 - 1,016 [.030 - .040]

0A Cardan

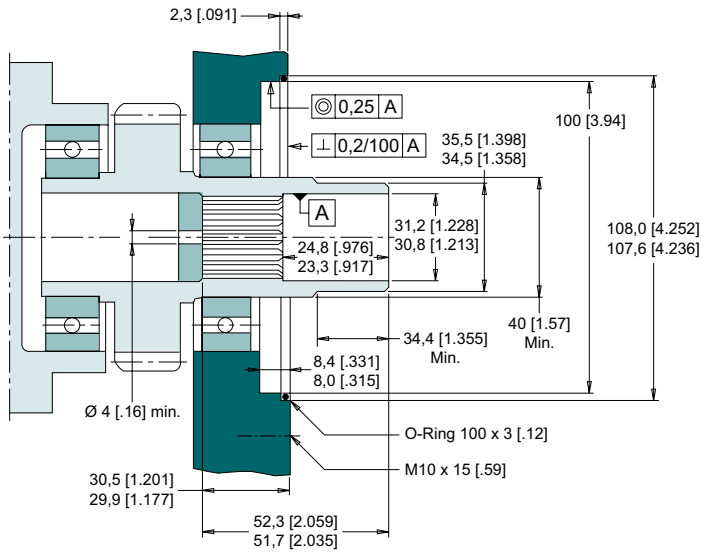
Fillet Root Side Fit

Number of Teeth 12
Pitch.....10.9091
Pressure Angle .....30°
Pitch Diameter *D* .....27,94 [1.1]
Base Diameter.....24,199 [.9527]
Major Diameter D_{ri}..... 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 [.1666]
Min. Effective .....4,155 [.1636]
Fillet Radius $R_{max.}$ .....0,38 [.015]
Max. Distance Between Pins *I*.....21,51 [.8469]
Pin Diameter *d*.....4,5085 [.1775]
with 3,175 [.125] Flat for Root Clearance

* Dimensions apply after heat treatment.



INPUT DIMENSIONS



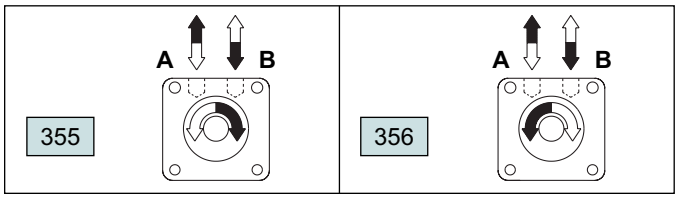
WS

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

080	78 cc	[4.8 in^3/rev]	200	202 cc	[12.3 in^3/rev]
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]

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
S2	Short Motor With End Ports
S8	Short Motor 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 closed. 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]

* The MA option is available on the A0, A2, A7, & A8 mounting options.

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

NOTE: The 0A shaft 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

NOTE: The WS short motor (S2 & S8 mounting options with 0A shaft) is only available with the Z paint code.

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	C	Solid Hex Nut
B	Lock Nut		

STEP 8 - Select a miscellaneous option

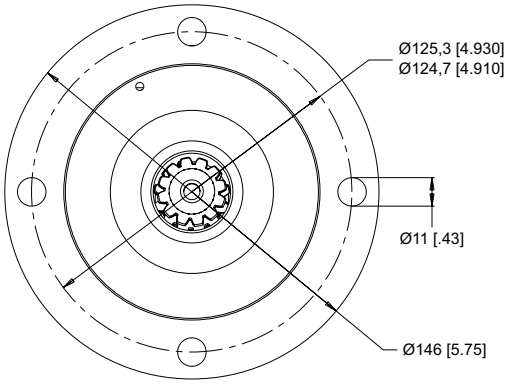
AA	None
*MA	Mounting Rotated 90°

WS

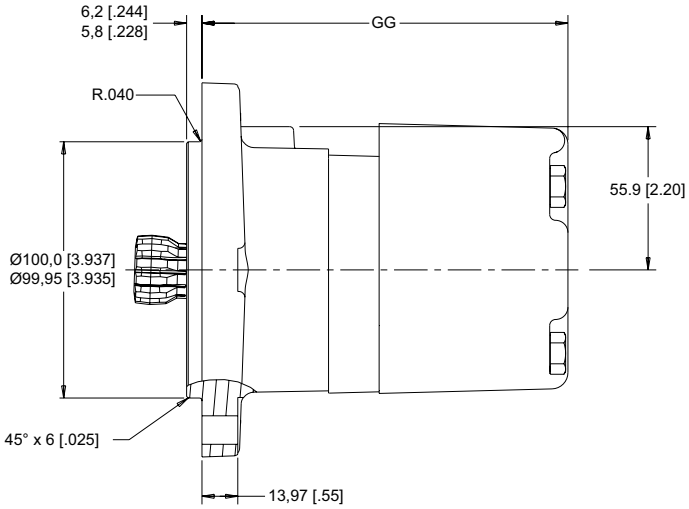
357 & 358 SERIES SHORT MOTOR

HOUSINGS

SG Short Motor with End Ports



SH Short Motor with Side Ports



SHAFT

The recommended shaft material is SAE 8620 or similar case hardening steel such as 20 MoCr4 (900 N/mm^2) hardened to 59 - 62 HRc to a depth of 0,762 - 1,016 [.030 - .040]

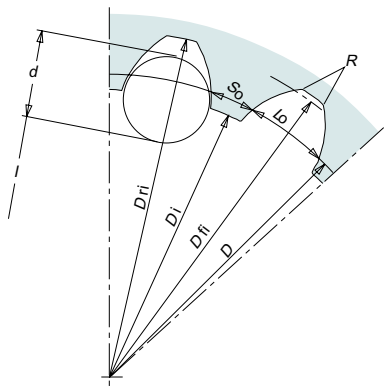
00 Cardan

Fillet Root Side Fit

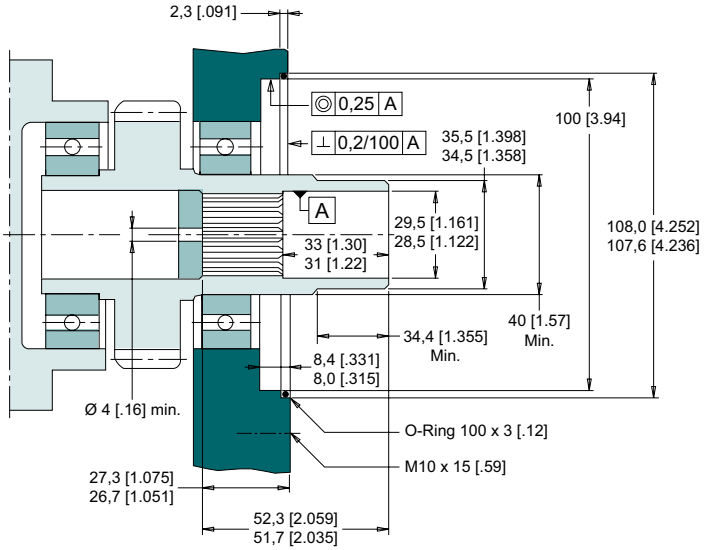
Number of Teeth	12
Pitch	12/24
Pressure Angle	30°
Pitch Diameter *D*	25,4 [1.000]
Major Diameter D_{ri}	28,0 [1.10] - 27,9 [1.096]
Form Diameter (Min.) D_{fi}	27,6 [1.09]
Minor Diameter D_i	23,033 [.9068] - 23,0 [.9055]
Space Width (Circular) L_o	4,328 [.1704] - 4,288 [.1688]
Tooth Thickness (Circular) S_o	2,341 [.09217]
Fillet Radius R_{min}	0,2 [.008]
Max. Distance Between Pins *I*	17,77 [.700] - 17,62 [.694]
Pin Diameter *d*	4,836 [.19034] - 4,834 [.19026]

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

* Dimensions apply after heat treatment.



INPUT DIMENSIONS



LENGTH / WEIGHT CHART
Short Motor - Dimension **GG**

Code	mm [in]	kg [lb]
080	142 [5.60]	9,6 [21.2]
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]

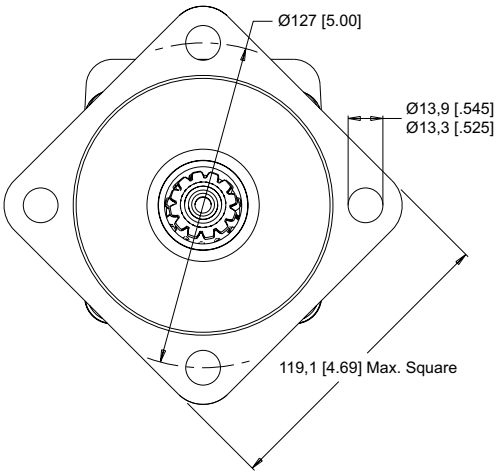
NOTE:
WS motor weights vary ± 0,5 kg [1 lbs] depending upon motor configuration.

WS

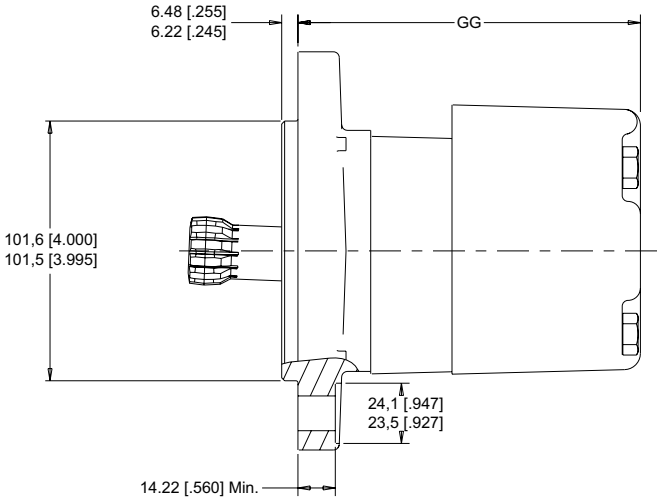
357 & 358 SERIES SHORT MOTOR

HOUSINGS

S2 Short Motor with End Ports



S8 Short Motor with Side Ports



SHAFT

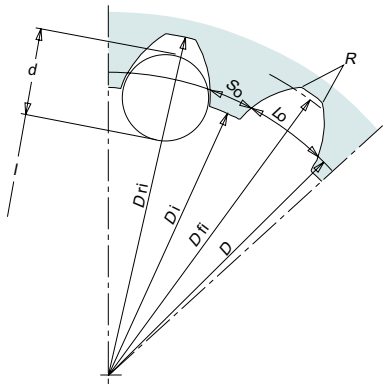
The recommended shaft material is SAE 8620 or similar case hardening steel such as 20 MoCr4 (900 N/mm^2) hardened to 59 - 62 HRc to a depth of 0,762 - 1,016 [.030 - .040]

0B Cardan

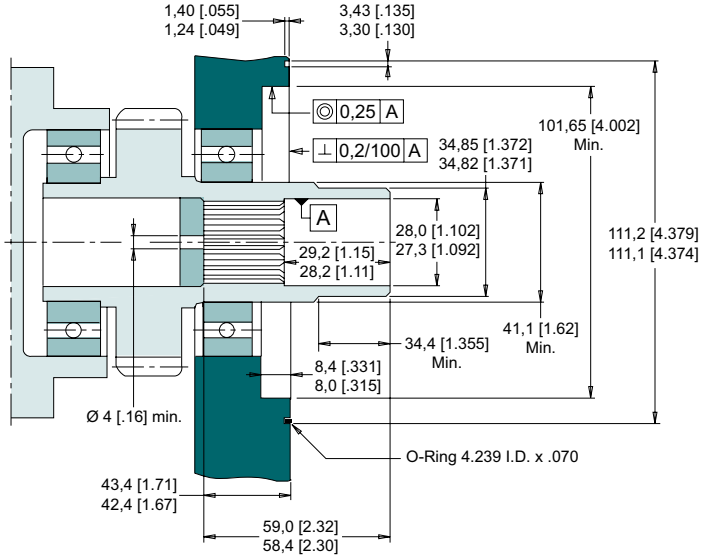
Fillet Root Side Fit

Number of Teeth 12
Pitch 12/24
Pressure Angle ..... 30°
Pitch Diameter *D* ..... 25,4 [1.000]
Base Diameter ..... 21,997 [.8660]
Major Diameter D_{ri} ..... 27,74 [1.092] - 27,59 [1.086]
Form Diameter (Min.) D_{fi} ..... 26,93 [1.060]
Minor Diameter D_i ..... 23,224 [.9143] - 23,097 [.9093]
* Space Width (Circular) L_o
Max. Actual ..... 4,318 [.1700]
Min. Effective ..... 4,216 [.1660]
Fillet Radius *R* ..... 0,76 [.030] - 0,64 [.025]
Max. Distance Between Pins *I* ..... 19,190 [.7555] - 19,020 [.7488]
Pin Diameter *d* ..... 4,496 [.1770]
with 3,38 [.133] Flat for Root Clearance

* Dimensions apply after heat treatment.



INPUT DIMENSIONS



LENGTH / WEIGHT CHART
Short Motor w / 0B - Dimension GG

Code	mm [in]	kg [lb]
080	122 [4.80]	12,5 [27.5]
100	122 [4.80]	12,5 [27.5]
110	124 [4.89]	12,6 [27.8]
130	128 [5.02]	12,8 [28.2]
160	134 [5.27]	13,3 [29.2]
200	142 [5.57]	13,6 [29.9]
230	148 [5.81]	14,0 [30.8]
320	166 [6.52]	15,0 [32.9]
400	166 [6.52]	15,0 [32.9]
500	181 [7.12]	15,8 [34.7]

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

WS

357 & 358 SERIES MODEL CODE BUILDER

CODE	Displacement cc [in³/rev]	Max. Torque Nm [lb-in]	Max. Pressure bar [psi]		
		Inter.	Cont.	Inter.	Peak
080	78 [4.78]	342 [3030]	207 [3000]	275 [3990]	276 [4000]
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]

SHORT MOTOR SPECIFICATIONS

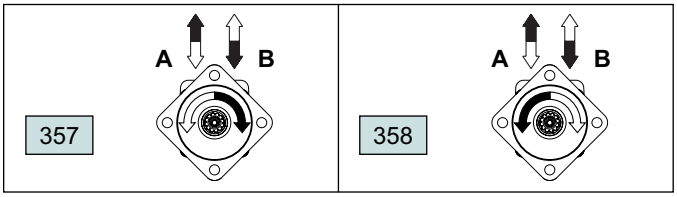
NOTE: The specifications chart to the left references a torque reduction in Short Motor operation when the WS 00 and WS 0B Cardan Shaft is used.

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

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

357	Clockwise Rotation
358	Counterclockwise Rotation



STEP 2 - Select a displacement option

080	78 cc	[4.8 in³/rev]	200	202 cc	[12.3 in³/rev]
100	100 cc	[6.1 in³/rev]	230	228 cc	[13.9 in³/rev]
110	112 cc	[6.9 in³/rev]	320	325 cc	[19.8 in³/rev]
130	129 cc	[7.9 in³/rev]	400	399 cc	[24.4 in³/rev]
160	162 cc	[9.9 in³/rev]	500	496 cc	[30.3 in³/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.

SG	Short Motor End Ports	S2	Short Motor End Ports
SH	Short Motor Side Port	S8	Short Motor Side Ports

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

STEP 3 (part II) (continued) - Select a porting option

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

00	Cardan Shaft	0B	Cardan Shaft

NOTE: The 00 cardan shaft must be used with the SG or SH mounting option. The 0B cardan shaft must be used with the S2 or S8 mounting option.

STEP 5 - Select a paint option

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

STEP 8 - Select a miscellaneous option

AA	None

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