



whitedriveproducts

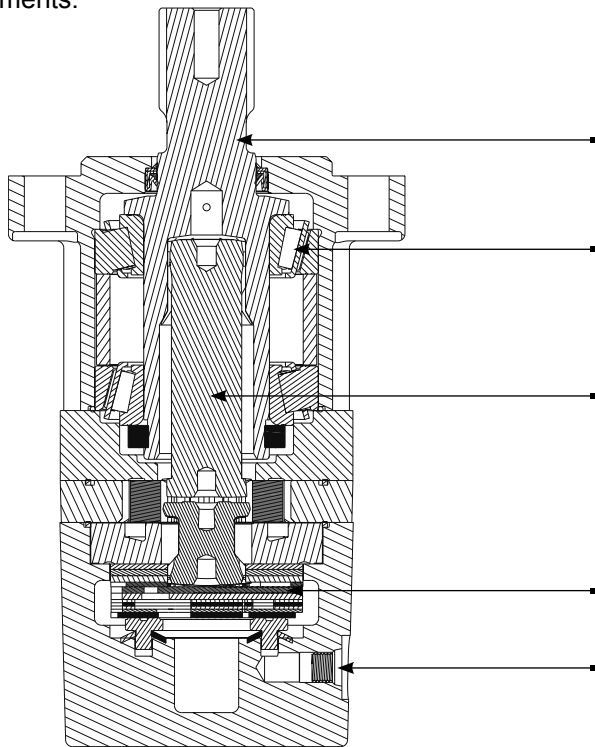
## WS SERIES HYDRAULIC MOTORS



# 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 [6.1in<sup>3</sup>] to 496cc [30.3in<sup>3</sup>]. 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 [in <sup>3</sup> /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]



<b>100</b>	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 in<sup>3</sup>/rev.]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	2 [0.5]	14 [120] <b>11</b>	35 [313] <b>8</b>	77 [681] <b>6</b>	116 [1025] <b>4</b>								19	Theoretical rpm
	4 [1]	15 [129] <b>37</b>	38 [337] <b>35</b>	80 [710] <b>10</b>	122 [1079] <b>7</b>	162 [1436] <b>5</b>							38	
	8 [2]	16 [138] <b>75</b>	40 [354] <b>74</b>	88 [781] <b>71</b>	136 [1205] <b>68</b>	181 [1602] <b>58</b>	227 [2007] <b>44</b>	267 [2364] <b>43</b>	315 [2791] <b>42</b>	352 [3119] <b>41</b>	383 [3386] <b>33</b>		76	
	15 [4]	16 [138] <b>151</b>	40 [354] <b>149</b>	89 [790] <b>146</b>	138 [1222] <b>143</b>	187 [1654] <b>137</b>	235 [2079] <b>129</b>	282 [2495] <b>119</b>	324 [2871] <b>110</b>	370 [3277] <b>101</b>	411 [3636] <b>87</b>		152	
	23 [6]	14 [127] <b>226</b>	39 [344] <b>225</b>	88 [779] <b>221</b>	137 [1214] <b>217</b>	186 [1647] <b>210</b>	234 [2071] <b>200</b>	282 [2494] <b>188</b>	324 [2869] <b>174</b>	371 [3279] <b>162</b>	415 [3676] <b>147</b>		228	
	30 [8]	12 [109] <b>302</b>	37 [326] <b>300</b>	86 [765] <b>297</b>	136 [1200] <b>292</b>	184 [1625] <b>284</b>	232 [2049] <b>273</b>	280 [2474] <b>258</b>	323 [2859] <b>240</b>	369 [3268] <b>224</b>	416 [3682] <b>206</b>		303	
	38 [10]	10 [88] <b>378</b>	34 [305] <b>376</b>	83 [738] <b>372</b>	133 [1174] <b>366</b>	181 [1601] <b>357</b>	229 [2026] <b>343</b>	276 [2446] <b>326</b>	318 [2810] <b>300</b>	366 [3235] <b>281</b>	415 [3672] <b>261</b>		379	
	45 [12]	7 [65] <b>453</b>	32 [282] <b>451</b>	81 [713] <b>447</b>	129 [1145] <b>441</b>	178 [1574] <b>430</b>	226 [2002] <b>415</b>	274 [2423] <b>396</b>	316 [2793] <b>367</b>	364 [3220] <b>345</b>	413 [3653] <b>324</b>		455	
	53 [14]	4 [39] <b>528</b>	29 [254] <b>527</b>	77 [686] <b>522</b>	126 [1116] <b>515</b>	175 [1546] <b>504</b>	222 [1968] <b>486</b>	266 [2351] <b>455</b>	315 [2791] <b>433</b>	362 [3203] <b>407</b>	411 [3637] <b>384</b>		531	
	61 [16]	2 [15] <b>604</b>	25 [221] <b>602</b>	74 [652] <b>597</b>	122 [1084] <b>590</b>	171 [1513] <b>578</b>	219 [1941] <b>559</b>	264 [2340] <b>527</b>	312 [2760] <b>502</b>	360 [3182] <b>475</b>	409 [3616] <b>447</b>		606	
	68 [18]		21 [186] <b>678</b>	69 [614] <b>672</b>	118 [1047] <b>664</b>	167 [1481] <b>651</b>	216 [1910] <b>632</b>	260 [2300] <b>596</b>	309 [2735] <b>570</b>	356 [3152] <b>541</b>	407 [3601] <b>513</b>		682	
	76 [20]		16 [144] <b>754</b>	65 [573] <b>747</b>	114 [1009] <b>739</b>	163 [1441] <b>725</b>	211 [1872] <b>704</b>	257 [2278] <b>677</b>	307 [2712] <b>652</b>	353 [3121] <b>624</b>	403 [3568] <b>595</b>		758	
	83 [22]					156 [1379] <b>801</b>	205 [1814] <b>758</b>	253 [2239] <b>730</b>	300 [2653] <b>698</b>	347 [3075] <b>668</b>	398 [3526] <b>632</b>		834	
	91 [24]						199 [1762] <b>850</b>	246 [2179] <b>826</b>	294 [2604] <b>799</b>	343 [3037] <b>768</b>	395 [3495] <b>733</b>		909	
	95 [25]						196 [1737] <b>883</b>	246 [2176] <b>863</b>	294 [2605] <b>835</b>	342 [3028] <b>800</b>	392 [3472] <b>770</b>		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]
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Theoretical Torque - Nm [lb-in]

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

<b>110</b>	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 in<sup>3</sup>/rev.]

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	2 [0.5]	12 [106] <b>9</b>	38 [334] <b>8</b>	86 [757] <b>6</b>	132 [1166] <b>4</b>								17	Theoretical rpm
	4 [1]	12 [110] <b>17</b>	38 [334] <b>10</b>	89 [788] <b>8</b>	137 [1213] <b>6</b>	184 [1624] <b>5</b>							34	
	8 [2]	15 [129] <b>67</b>	42 [373] <b>67</b>	98 [863] <b>65</b>	152 [1341] <b>62</b>	206 [1823] <b>58</b>	255 [2257] <b>45</b>	297 [2629] <b>40</b>	341 [3015] <b>36</b>	377 [3334] <b>22</b>	396 [3502] <b>9</b>		68	
	15 [4]	15 [134] <b>135</b>	43 [378] <b>135</b>	97 [863] <b>133</b>	152 [1350] <b>130</b>	208 [1838] <b>125</b>	261 [2314] <b>118</b>	314 [2776] <b>107</b>	357 [3158] <b>88</b>	402 [3558] <b>71</b>	438 [3879] <b>49</b>		135	
	23 [6]	15 [128] <b>203</b>	42 [373] <b>203</b>	97 [856] <b>200</b>	151 [1337] <b>196</b>	206 [1826] <b>182</b>	260 [2302] <b>170</b>	313 [2770] <b>170</b>	359 [3179] <b>124</b>	411 [3633] <b>103</b>	458 [4054] <b>103</b>		203	
	30 [8]	12 [108] <b>271</b>	40 [351] <b>270</b>	94 [833] <b>268</b>	148 [1313] <b>264</b>	203 [1798] <b>258</b>	258 [2281] <b>248</b>	311 [2753] <b>234</b>	359 [3177] <b>201</b>	413 [3656] <b>178</b>	466 [4122] <b>155</b>		270	
	38 [10]	9 [80] <b>339</b>	36 [322] <b>338</b>	91 [803] <b>335</b>	145 [1280] <b>331</b>	199 [1761] <b>325</b>	253 [2236] <b>313</b>	307 [2715] <b>296</b>	358 [3165] <b>255</b>	413 [3652] <b>232</b>	468 [4144] <b>206</b>		338	
	45 [12]	8 [69] <b>404</b>	33 [293] <b>406</b>	87 [770] <b>403</b>	141 [1247] <b>399</b>	194 [1716] <b>391</b>	249 [2205] <b>378</b>	303 [2684] <b>360</b>	353 [3124] <b>313</b>	408 [3613] <b>289</b>	467 [4133] <b>259</b>		405	
	53 [14]	4 [38] <b>471</b>	29 [254] <b>473</b>	82 [728] <b>470</b>	136 [1202] <b>465</b>	189 [1676] <b>457</b>	243 [2152] <b>442</b>	294 [2605] <b>403</b>	351 [3108] <b>376</b>	407 [3601] <b>347</b>	464 [4109] <b>316</b>		473	
	61 [16]		24 [210] <b>541</b>	78 [687] <b>538</b>	131 [1162] <b>532</b>	185 [1635] <b>523</b>	239 [2114] <b>508</b>	290 [2564] <b>467</b>	346 [3058] <b>438</b>	402 [3553] <b>406</b>	462 [4092] <b>372</b>		540	
	68 [18]		18 [163] <b>609</b>	72 [639] <b>605</b>	126 [1116] <b>599</b>	180 [1594] <b>589</b>	234 [2068] <b>573</b>	286 [2534] <b>530</b>	341 [3016] <b>502</b>	397 [3515] <b>467</b>	458 [4051] <b>435</b>		608	
	76 [20]		13 [117] <b>677</b>	68 [598] <b>673</b>	121 [1068] <b>667</b>	174 [1541] <b>656</b>	228 [2017] <b>639</b>	282 [2494] <b>594</b>	336 [2977] <b>565</b>	393 [3481] <b>528</b>	454 [4017] <b>492</b>		675	
	83 [22]			67 [596] <b>742</b>	115 [1015] <b>735</b>	169 [1500] <b>722</b>	221 [1960] <b>699</b>	276 [2445] <b>672</b>	332 [2942] <b>637</b>	388 [3436] <b>598</b>	447 [3953] <b>557</b>		742	
	91 [24]			62 [549] <b>808</b>	109 [967] <b>801</b>	164 [1452] <b>787</b>	218 [1926] <b>767</b>	272 [2403] <b>737</b>	326 [2885] <b>702</b>	383 [3385] <b>659</b>	441 [3906] <b>620</b>		810	
	95 [25]			60 [528] <b>841</b>	105 [939] <b>834</b>	161 [1425] <b>818</b>	215 [1901] <b>800</b>	270 [2389] <b>771</b>	323 [2861] <b>736</b>	380 [3361] <b>693</b>	439 [3886] <b>648</b>		844	

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]
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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 in<sup>3</sup>/rev.]

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

Intermittent Ratings - 10% of Operation

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

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

Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	Pressure - bars [psi]										Theoretical rpm
	20 [173] <b>11</b>	55 [485] <b>10</b>	125 [1102] <b>8</b>	190 [1679] <b>6</b>	255 [2258] <b>5</b>						
4 [1]	22 [199] <b>23</b>	59 [523] <b>22</b>	135 [1194] <b>20</b>	207 [1831] <b>18</b>	274 [2425] <b>15</b>	338 [2989] <b>13</b>	397 [3511] <b>9</b>				24
8 [2]	32 [283] <b>47</b>	63 [554] <b>45</b>	144 [1273] <b>43</b>	223 [1974] <b>41</b>	298 [2635] <b>37</b>	368 [3255] <b>34</b>	433 [3830] <b>29</b>	480 [4251] <b>21</b>	504 [4459] <b>16</b>	527 [4664] <b>10</b>	47
15 [4]	31 [278] <b>94</b>	69 [609] <b>94</b>	145 [1287] <b>91</b>	228 [2014] <b>88</b>	308 [2728] <b>84</b>	388 [3416] <b>79</b>	460 [4071] <b>71</b>	526 [4654] <b>59</b>	557 [4931] <b>53</b>	583 [5163] <b>45</b>	94
23 [6]	29 [257] <b>141</b>	69 [615] <b>141</b>	143 [1265] <b>138</b>	225 [1990] <b>135</b>	306 [2711] <b>130</b>	386 [3412] <b>124</b>	464 [4108] <b>116</b>	535 [4737] <b>100</b>	573 [5074] <b>93</b>	607 [5370] <b>83</b>	140
30 [8]	26 [226] <b>188</b>	66 [583] <b>188</b>	138 [1225] <b>186</b>	221 [1958] <b>182</b>	303 [2678] <b>177</b>	383 [3387] <b>170</b>	462 [4088] <b>160</b>	538 [4761] <b>144</b>	578 [5116] <b>135</b>	617 [5463] <b>125</b>	187
38 [10]	21 [188] <b>235</b>	62 [547] <b>234</b>	133 [1180] <b>234</b>	216 [1914] <b>230</b>	298 [2633] <b>224</b>	379 [3353] <b>217</b>	458 [4055] <b>206</b>	534 [4730] <b>189</b>	575 [5085] <b>180</b>	616 [5451] <b>168</b>	234
45 [12]	16 [145] <b>282</b>	57 [509] <b>281</b>	135 [1192] <b>280</b>	210 [1861] <b>276</b>	292 [2581] <b>270</b>	372 [3289] <b>261</b>	452 [4000] <b>250</b>	530 [4688] <b>234</b>	570 [5046] <b>224</b>	613 [5423] <b>212</b>	280
53 [14]	11 [97] <b>329</b>	51 [455] <b>328</b>	133 [1178] <b>327</b>	205 [1817] <b>323</b>	286 [2530] <b>316</b>	365 [3231] <b>307</b>	441 [3905] <b>293</b>	523 [4627] <b>274</b>	563 [4986] <b>264</b>	606 [5363] <b>251</b>	327
61 [16]	5 [44] <b>376</b>	45 [402] <b>375</b>	125 [1110] <b>374</b>	199 [1761] <b>370</b>	280 [2474] <b>363</b>	359 [3173] <b>353</b>	436 [3857] <b>338</b>	517 [4572] <b>319</b>	557 [4934] <b>308</b>	599 [5301] <b>295</b>	374
68 [18]		37 [331] <b>422</b>	118 [1048] <b>421</b>	192 [1697] <b>417</b>	272 [2408] <b>410</b>	351 [3104] <b>400</b>	427 [3779] <b>383</b>	508 [4498] <b>363</b>	548 [4853] <b>353</b>	592 [5240] <b>329</b>	420
76 [20]		30 [265] <b>469</b>	111 [980] <b>467</b>	183 [1616] <b>465</b>	264 [2337] <b>457</b>	343 [3036] <b>446</b>	419 [3712] <b>428</b>	500 [4424] <b>408</b>	540 [4777] <b>396</b>	584 [5167] <b>382</b>	467
83 [22]		22 [193] <b>516</b>	103 [913] <b>514</b>	176 [1557] <b>510</b>	256 [2264] <b>503</b>	335 [2965] <b>491</b>	413 [3658] <b>476</b>	492 [4358] <b>454</b>	533 [4721] <b>441</b>	575 [5093] <b>427</b>	514
91 [24]				175 [1553] <b>558</b>	246 [2180] <b>550</b>	327 [2890] <b>538</b>	405 [3587] <b>522</b>	484 [4286] <b>500</b>	524 [4639] <b>484</b>	568 [5027] <b>473</b>	560
95 [25]				163 [1443] <b>581</b>	241 [2134] <b>573</b>	321 [2843] <b>561</b>	400 [3543] <b>545</b>	481 [4253] <b>522</b>	521 [4611] <b>511</b>	561 [4968] <b>496</b>	584
114 [30]				138 [1222] <b>699</b>	217 [1917] <b>691</b>	296 [2618] <b>679</b>	376 [3324] <b>661</b>	456 [4034] <b>645</b>	495 [4383] <b>625</b>	534 [4729] <b>609</b>	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]
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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 in<sup>3</sup>/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] 404	520 [4600] 494	572 [5064] 585	670 [5930] 669	767 [6789] 750		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]
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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 in<sup>3</sup>/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] 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	
	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]
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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 in<sup>3</sup>/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] <b>5</b>	135 [1196] <b>4</b>	272 [2406] <b>3</b>	398 [3524] <b>1</b>							6	Theoretical rpm	
	4 [1]	67 [595] <b>11</b>	146 [1291] <b>10</b>	290 [2568] <b>9</b>	425 [3764] <b>7</b>	558 [4937] <b>6</b>	623 [5514] <b>4</b>	689 [6101] <b>3</b>	746 [6599] <b>1</b>			12		
	8 [2]	67 [597] <b>22</b>	150 [1328] <b>22</b>	311 [2751] <b>20</b>	461 [4083] <b>18</b>	596 [5277] <b>16</b>	659 [5834] <b>14</b>	723 [6396] <b>12</b>	788 [6977] <b>11</b>	849 [7510] <b>9</b>				24
	15 [4]	64 [565] <b>46</b>	147 [1299] <b>46</b>	312 [2761] <b>44</b>	474 [4197] <b>41</b>	627 [5547] <b>36</b>	698 [6173] <b>33</b>	762 [6747] <b>30</b>	821 [7261] <b>26</b>	880 [7785] <b>20</b>	942 [8337] <b>19</b>			47
	23 [6]	77 [677] <b>70</b>	154 [1367] <b>69</b>	320 [2834] <b>67</b>	484 [4283] <b>64</b>	642 [5679] <b>57</b>	717 [6347] <b>52</b>	791 [7004] <b>48</b>	853 [7548] <b>42</b>	917 [8116] <b>37</b>	977 [8646] <b>32</b>			70
	30 [8]	72 [641] <b>93</b>	147 [1299] <b>93</b>	313 [2766] <b>91</b>	477 [4221] <b>87</b>	637 [5640] <b>80</b>	715 [6329] <b>75</b>	786 [6959] <b>65</b>	861 [7617] <b>59</b>	937 [8236] <b>53</b>	996 [8816] <b>49</b>			94
	38 [10]	64 [566] <b>117</b>	137 [1217] <b>117</b>	303 [2683] <b>114</b>	468 [4142] <b>110</b>	629 [5568] <b>103</b>	705 [6241] <b>94</b>	784 [6935] <b>87</b>	859 [7603] <b>80</b>	934 [8265] <b>74</b>	1005 [8895] <b>68</b>			117
	45 [12]	53 [473] <b>141</b>	131 [1155] <b>141</b>	292 [2587] <b>138</b>	458 [4049] <b>134</b>	619 [5479] <b>125</b>	695 [6151] <b>116</b>	774 [6850] <b>109</b>	850 [7523] <b>103</b>	926 [8197] <b>96</b>	1001 [8861] <b>89</b>			140
	53 [14]	30 [262] <b>164</b>	122 [1076] <b>164</b>	281 [2483] <b>161</b>	446 [3943] <b>157</b>	606 [5367] <b>146</b>	687 [6078] <b>139</b>	764 [6764] <b>132</b>	840 [7434] <b>124</b>	915 [8099] <b>116</b>	990 [8761] <b>109</b>			164
	61 [16]	18 [161] <b>188</b>	112 [994] <b>187</b>	267 [2359] <b>185</b>	431 [3818] <b>181</b>	594 [5253] <b>169</b>	674 [5966] <b>163</b>	753 [6660] <b>155</b>	824 [7290] <b>149</b>					187
	68 [18]	18 [160] <b>211</b>	113 [997] <b>211</b>	265 [2344] <b>209</b>	430 [3805] <b>204</b>	593 [5244] <b>192</b>	673 [5953] <b>185</b>	751 [6649] <b>178</b>	811 [7178] <b>174</b>					210
	76 [20]	3 [25] <b>235</b>	97 [863] <b>234</b>	248 [2198] <b>233</b>	415 [3673] <b>227</b>	578 [5114] <b>216</b>	658 [5821] <b>210</b>	736 [6515] <b>202</b>	797 [7052] <b>197</b>					234
	83 [22]		84 [747] <b>258</b>	236 [2091] <b>255</b>	400 [3540] <b>249</b>	562 [4973] <b>240</b>	641 [5676] <b>234</b>	720 [6368] <b>227</b>	781 [6913] <b>222</b>					257
91 [24]		75 [667] <b>282</b>	215 [1900] <b>279</b>	380 [3365] <b>273</b>	543 [4804] <b>264</b>	623 [5510] <b>258</b>	701 [6202] <b>251</b>	763 [6756] <b>246</b>				280		
95 [25]		70 [616] <b>293</b>	207 [1828] <b>290</b>	370 [3272] <b>285</b>	533 [4716] <b>276</b>	613 [5423] <b>270</b>	698 [6175] <b>261</b>	758 [6711] <b>257</b>				292		
114 [30]			153 [1353] <b>350</b>	315 [2789] <b>344</b>	478 [4230] <b>335</b>	559 [4943] <b>329</b>	639 [5653] <b>322</b>	704 [6233] <b>318</b>				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]
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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 in<sup>3</sup>/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] <b>4</b>	173 [1534] <b>4</b>	356 [3148] <b>2</b>								5	Theoretical rpm
	4 [1]	85 [752] <b>9</b>	181 [1605] <b>8</b>	369 [3263] <b>7</b>	460 [4074] <b>6</b>	550 [4865] <b>5</b>	638 [5648] <b>4</b>	724 [6404] <b>3</b>	816 [7222] <b>2</b>			10	
	8 [2]	86 [762] <b>18</b>	187 [1654] <b>18</b>	387 [3422] <b>16</b>	483 [4274] <b>15</b>	575 [5090] <b>13</b>	662 [5861] <b>11</b>	747 [6613] <b>10</b>	826 [7310] <b>7</b>			19	
	15 [4]	82 [724] <b>38</b>	185 [1635] <b>37</b>	391 [3460] <b>35</b>	493 [4361] <b>34</b>	592 [5240] <b>31</b>	688 [6086] <b>27</b>	776 [6871] <b>23</b>	866 [7667] <b>17</b>	942 [8337] <b>12</b>		38	
	23 [6]	75 [663] <b>57</b>	178 [1573] <b>56</b>	383 [3393] <b>54</b>	486 [4301] <b>52</b>	588 [5201] <b>50</b>	686 [6074] <b>46</b>	783 [6926] <b>40</b>	876 [7750] <b>33</b>	963 [8524] <b>27</b>	1056 [9345] <b>24</b>	57	
	30 [8]	66 [585] <b>76</b>	168 [1490] <b>75</b>	374 [3306] <b>73</b>	476 [4216] <b>72</b>	578 [5119] <b>69</b>	679 [6007] <b>65</b>	776 [6868] <b>57</b>	872 [7716] <b>50</b>	966 [8545] <b>43</b>	1055 [9341] <b>36</b>	76	
	38 [10]		154 [1365] <b>95</b>	361 [3197] <b>93</b>	464 [4110] <b>91</b>	567 [5015] <b>88</b>	664 [5880] <b>82</b>	764 [6764] <b>76</b>	862 [7626] <b>69</b>	956 [8463] <b>61</b>	1050 [9289] <b>52</b>	95	
	45 [12]		140 [1237] <b>114</b>	346 [3066] <b>112</b>	450 [3978] <b>110</b>	551 [4880] <b>107</b>	649 [5744] <b>101</b>	750 [6638] <b>95</b>	848 [7503] <b>88</b>	945 [8361] <b>80</b>	1039 [9195] <b>71</b>	114	
	53 [14]		125 [1104] <b>133</b>	330 [2924] <b>131</b>	434 [3838] <b>129</b>	536 [4745] <b>126</b>	634 [5609] <b>119</b>	735 [6504] <b>112</b>	833 [7369] <b>102</b>	929 [8217] <b>97</b>	1024 [9058] <b>88</b>	133	
	61 [16]		106 [934] <b>151</b>	311 [2755] <b>150</b>	415 [3672] <b>148</b>	518 [4580] <b>145</b>	617 [5456] <b>138</b>	718 [6357] <b>131</b>	817 [7228] <b>123</b>	913 [8079] <b>114</b>	1007 [8913] <b>104</b>	152	
	68 [18]			291 [2578] <b>169</b>	395 [3493] <b>167</b>	498 [4405] <b>165</b>	597 [5279] <b>158</b>	699 [6185] <b>151</b>	798 [7065] <b>143</b>	896 [7931] <b>134</b>	991 [8774] <b>122</b>	171	
	76 [20]			269 [2379] <b>189</b>	371 [3286] <b>187</b>	475 [4205] <b>184</b>	575 [5084] <b>177</b>	678 [5997] <b>171</b>	777 [6879] <b>163</b>	876 [7754] <b>154</b>	972 [8606] <b>143</b>	190	
	83 [22]			246 [2174] <b>207</b>	348 [3076] <b>205</b>	451 [3987] <b>202</b>	555 [4911] <b>198</b>	654 [5789] <b>192</b>	754 [6671] <b>184</b>	852 [7543] <b>175</b>	951 [8413] <b>165</b>	209	
91 [24]			226 [2000] <b>226</b>	322 [2850] <b>224</b>	424 [3756] <b>221</b>	528 [4668] <b>217</b>	629 [5571] <b>211</b>	728 [6446] <b>204</b>	828 [7332] <b>195</b>	926 [8197] <b>184</b>	228		
99 [26]			197 [1739] <b>246</b>	294 [2600] <b>244</b>	397 [3515] <b>241</b>	500 [4421] <b>236</b>	602 [5323] <b>231</b>	702 [6214] <b>224</b>	801 [7093] <b>215</b>	900 [7963] <b>205</b>	247		
114 [30]			131 [1162] <b>284</b>	237 [2100] <b>282</b>	338 [2991] <b>279</b>	441 [3901] <b>275</b>	542 [4798] <b>269</b>	643 [5687] <b>263</b>	743 [6574] <b>254</b>	843 [7458] <b>245</b>	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]
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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 in<sup>3</sup>/rev.] **Intermittent Ratings are below and to the right of the BOLD line.** Intermittent Ratings - 10% of Operation

Flow - lpm [gpm]	Intermittent Ratings										Theoretical rpm
	94 [832]	210 [1861]	323 [2859]	435 [3853]	542 [4797]	652 [5766]	777 [6876]	879 [7779]	917 [8118]	1012 [8956]	
2 [0.5]	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>							4
4 [1]	<b>7</b>	<b>7</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>5</b>	<b>4</b>				8
8 [2]	<b>15</b>	<b>15</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>11</b>	<b>9</b>				16
15 [4]	<b>31</b>	<b>30</b>	<b>30</b>	<b>29</b>	<b>28</b>	<b>25</b>	<b>21</b>	<b>16</b>	<b>13</b>		31
23 [6]	<b>46</b>	<b>46</b>	<b>45</b>	<b>44</b>	<b>43</b>	<b>41</b>	<b>36</b>	<b>28</b>	<b>22</b>		46
30 [8]	<b>62</b>	<b>61</b>	<b>61</b>	<b>60</b>	<b>58</b>	<b>56</b>	<b>50</b>	<b>43</b>	<b>34</b>		62
38 [10]	<b>77</b>	<b>77</b>	<b>76</b>	<b>75</b>	<b>74</b>	<b>71</b>	<b>66</b>	<b>59</b>	<b>50</b>		77
45 [12]	<b>92</b>	<b>92</b>	<b>91</b>	<b>89</b>	<b>86</b>	<b>82</b>	<b>75</b>	<b>68</b>	<b>58</b>		92
53 [14]	<b>108</b>	<b>107</b>	<b>106</b>	<b>104</b>	<b>101</b>	<b>96</b>	<b>89</b>	<b>80</b>	<b>68</b>		107
61 [16]	<b>123</b>	<b>122</b>	<b>121</b>	<b>120</b>	<b>116</b>	<b>111</b>	<b>104</b>	<b>95</b>	<b>80</b>		123
68 [18]	<b>139</b>	<b>138</b>	<b>137</b>	<b>135</b>	<b>132</b>	<b>127</b>	<b>120</b>	<b>111</b>	<b>95</b>		138
76 [20]	<b>154</b>	<b>153</b>	<b>152</b>	<b>151</b>	<b>147</b>	<b>143</b>	<b>136</b>	<b>127</b>	<b>111</b>		153
83 [22]	<b>169</b>	<b>168</b>	<b>167</b>	<b>164</b>	<b>161</b>	<b>155</b>	<b>148</b>	<b>136</b>	<b>127</b>		168
91 [24]	<b>184</b>	<b>184</b>	<b>182</b>	<b>182</b>	<b>179</b>	<b>175</b>	<b>170</b>	<b>162</b>	<b>148</b>		184
99 [26]	<b>200</b>	<b>199</b>	<b>198</b>	<b>196</b>	<b>193</b>	<b>188</b>	<b>181</b>	<b>162</b>	<b>148</b>		199
114 [30]	<b>230</b>	<b>229</b>	<b>227</b>	<b>224</b>	<b>222</b>	<b>219</b>	<b>213</b>	<b>193</b>	<b>162</b>		229

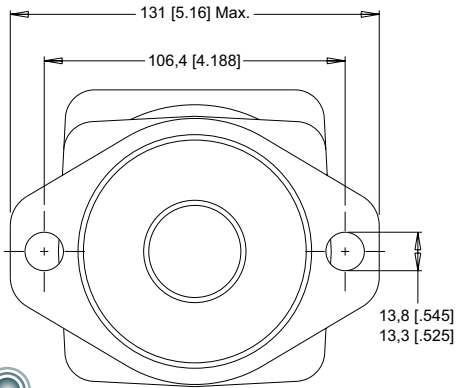
Torque - Nm [lb-in], Speed rpm **Overall Efficiency** - 70 - 100%  40 - 69%  0 - 39%

136 [1205]	272 [2410]	409 [3616]	545 [4821]	681 [6026]	817 [7231]	953 [8436]	1090 [9642]	1226 [10847]
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Theoretical Torque - Nm [lb-in] Displacement tested at 54°C [129°F] with an oil viscosity of 46cSt [213 SUS]

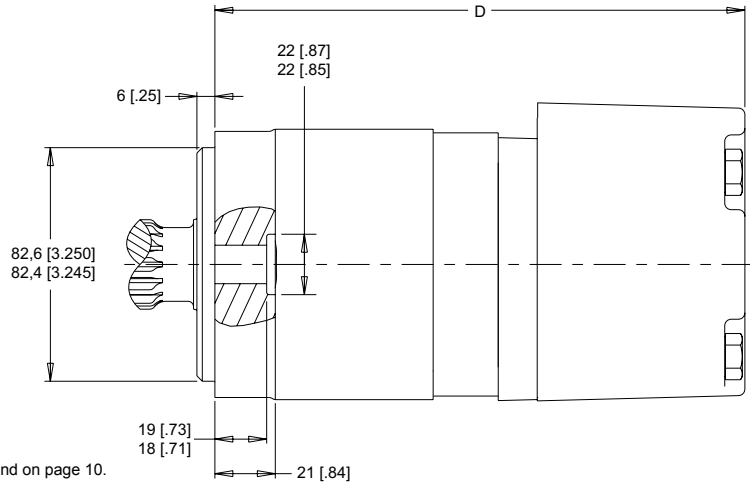


**A0** 2-Hole SAE A Mount with End Ports

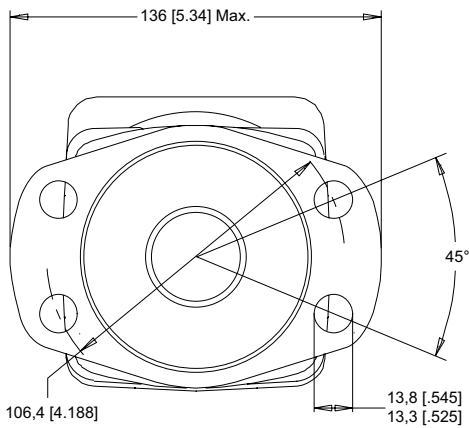


**NOTE:** Overall motor length varies depending on the displacement. Dimension D is found on page 10.

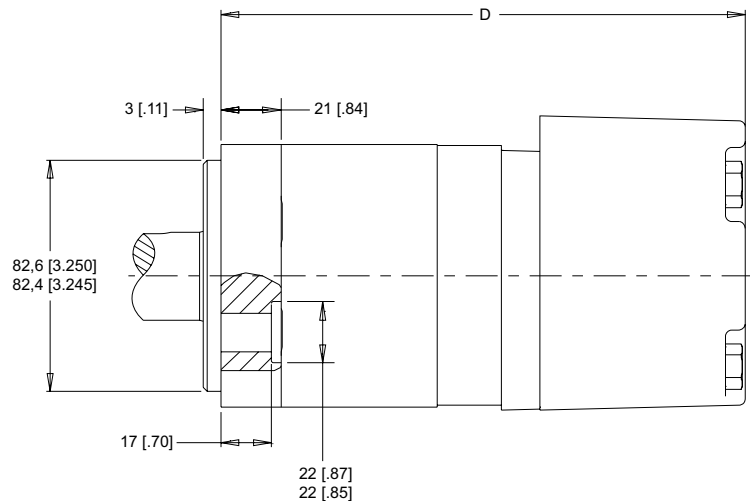
**A7** 2-Hole SAE A Mount with Side Ports



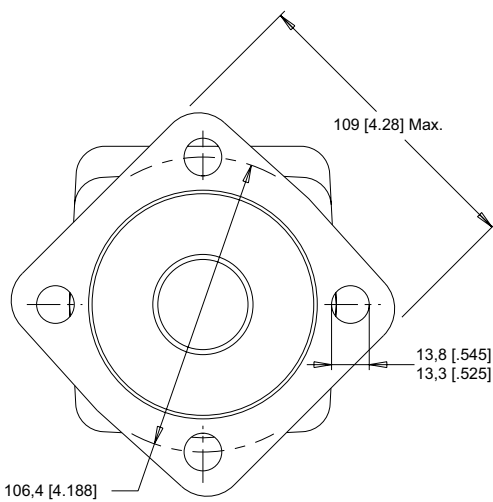
**A2** 4-Hole Magneto with End Ports



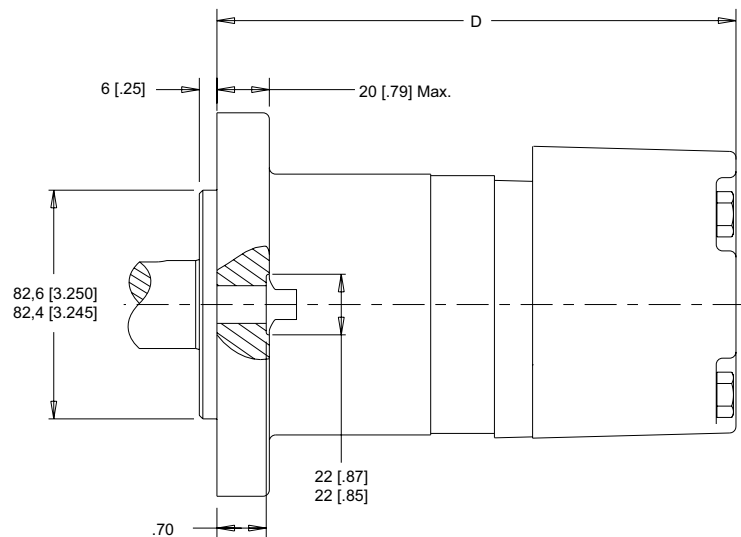
**A8** 4-Hole Magneto with Side Ports



**AG** 4-Hole Square SAE A Mount with End Ports



**AH** 4-Hole Square SAE A Mount with Side Ports

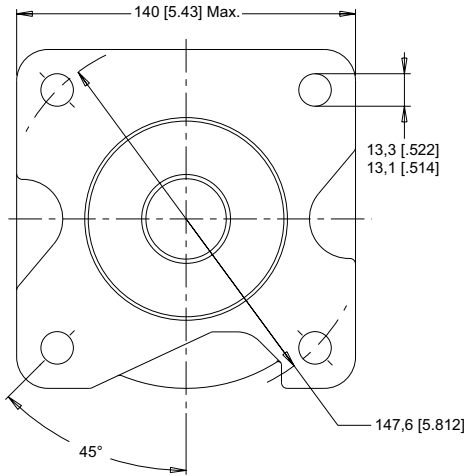




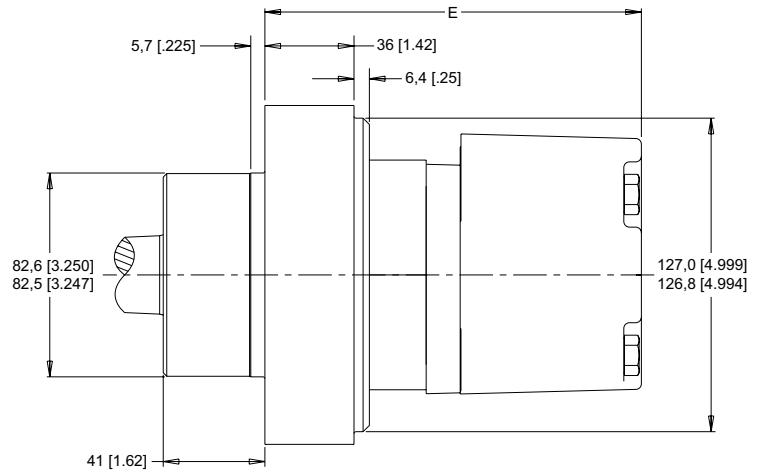


## 355 & 356 SERIES HOUSINGS

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

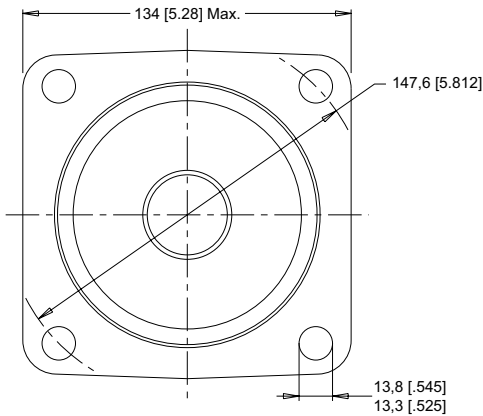


**W8** 4-Hole 3.25" Wheel Mount with Side Ports

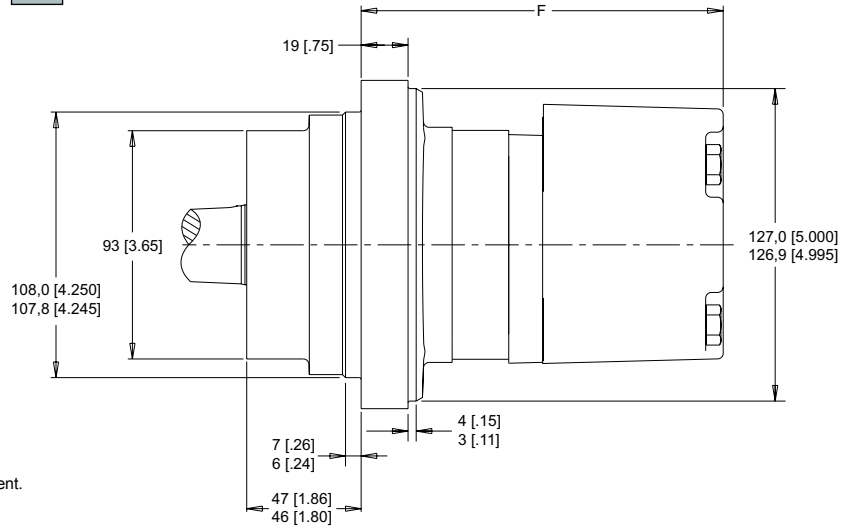


**NOTE:** Overall motor length varies depending on the displacement. Dimension E is found on page 10.

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

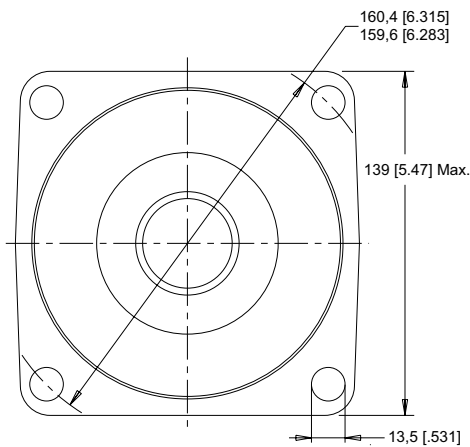


**Y8** 4-Hole 4.25" Wheel Mount with Side Ports

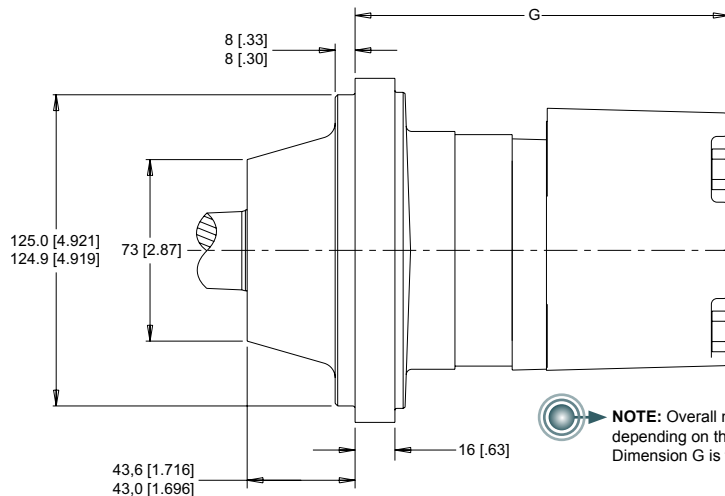


**NOTE:** Overall motor length varies depending on the displacement. Dimension F is found on page 11.

**Z2** 4-Hole Euro Wheel Mount with End Ports



**Z8** 4-Hole Euro Wheel Mount with Side Ports



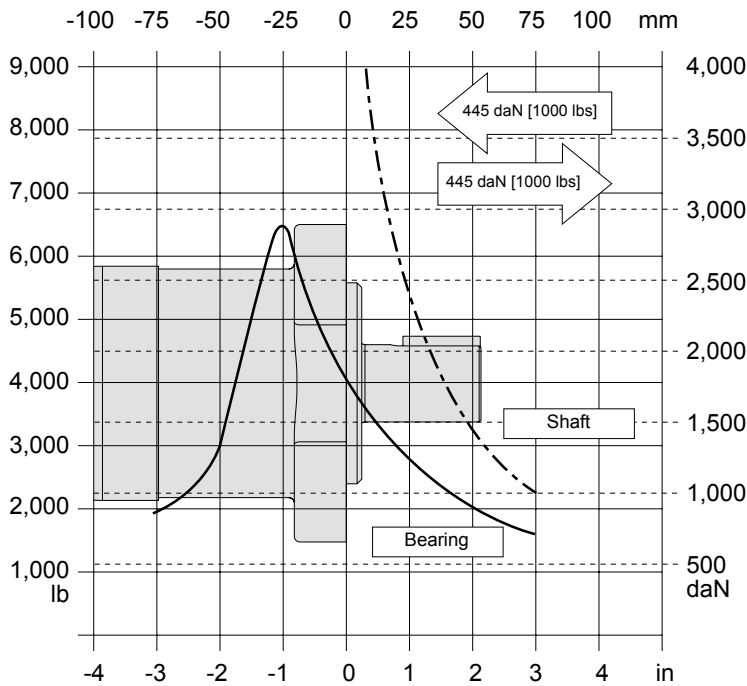
**NOTE:** Overall motor length varies depending on the displacement. Dimension G is found on page 11.



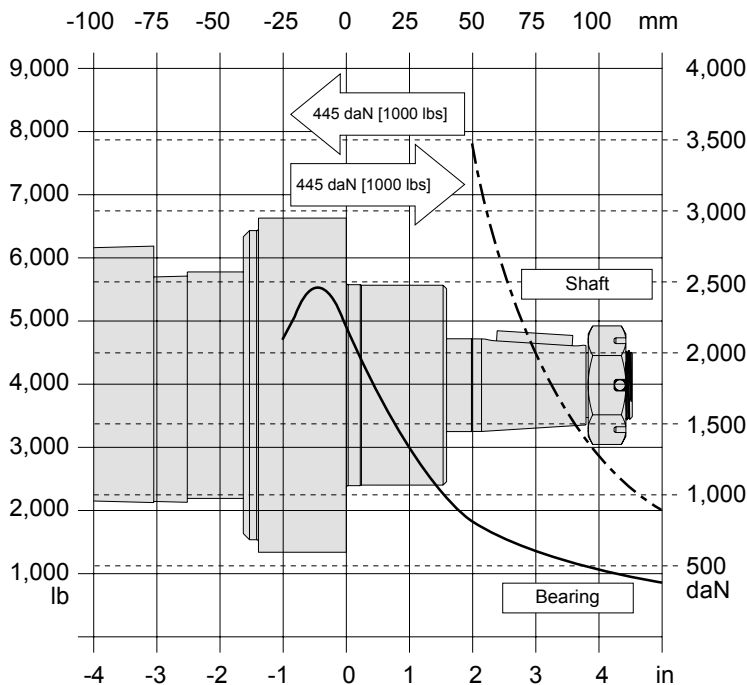
## 355 & 356 SERIES TECHNICAL INFORMATION

**Bearing Curve:** The bearing curve represents allowable bearing loads for a B10 life of 2,000 hours at 100 rpm. The curve includes effects 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.

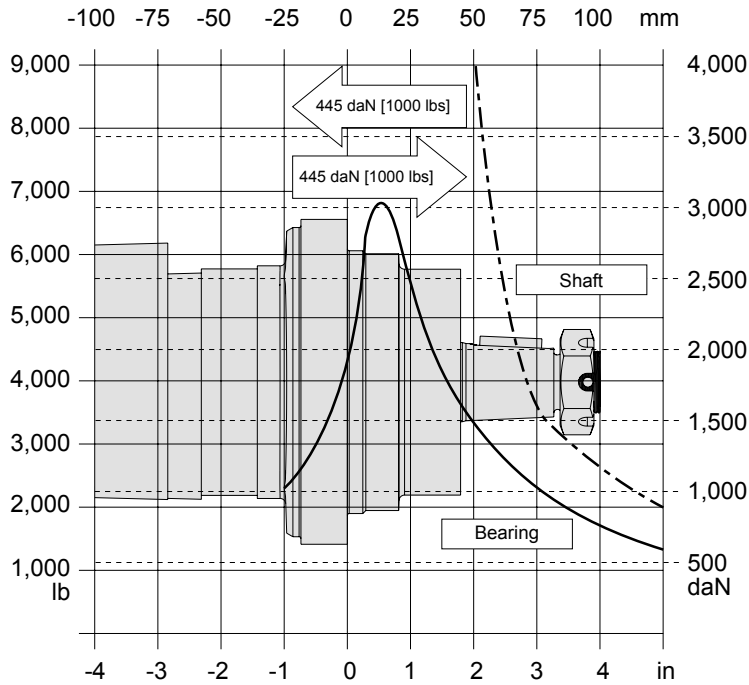
BEARING LOAD Multiplication Factor Table	
RPM	Factor
050	1.23
100	1.00
200	0.81
300	0.72
400	0.66
500	0.62
600	0.58
700	0.56
800	0.50



## 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.

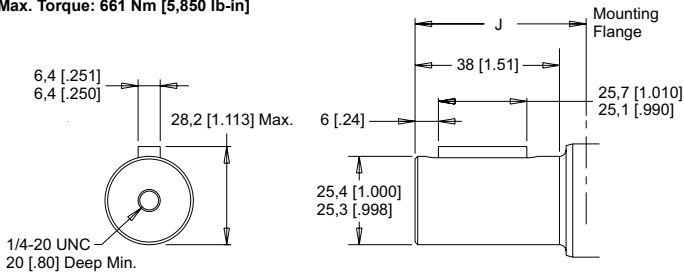
LENGTH / WEIGHT CHART Short Motor - Dimension H		
Code	mm [in]	kg [lb]
100	142 [5.60]	9,6 [21.2]
110	145 [5.70]	9,8 [21.5]
130	148 [5.83]	9,9 [21.8]
160	154 [6.08]	10,4 [22.8]
200	162 [6.38]	10,7 [23.6]
230	168 [6.62]	11,1 [24.5]
320	186 [7.33]	12,0 [26.5]
400	186 [7.33]	12,0 [26.5]
500	201 [7.93]	12,9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

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



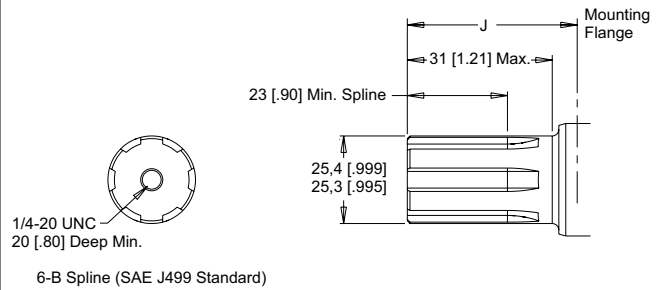
### 10 1" Straight

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



### 02 6-B Spline

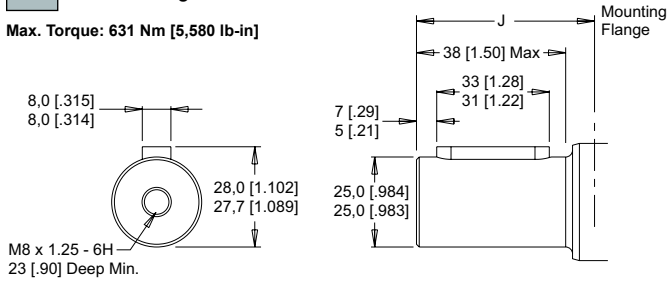
Max. Torque: 429 Nm [3,800 lb-in]



6-B Spline (SAE J499 Standard)

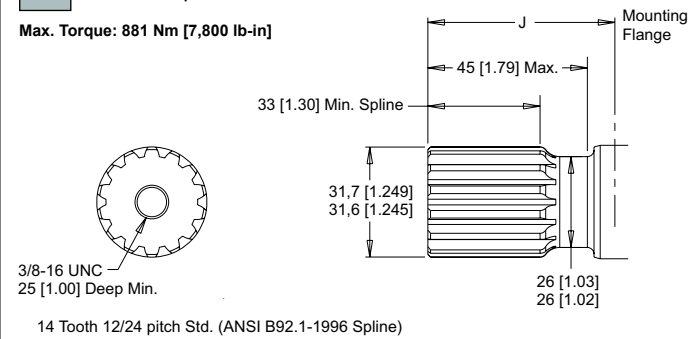
### 12 25mm Straight

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



### 23 14 Tooth Spline

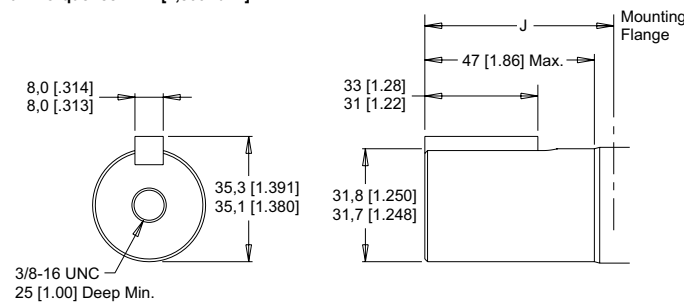
Max. Torque: 881 Nm [7,800 lb-in]



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]

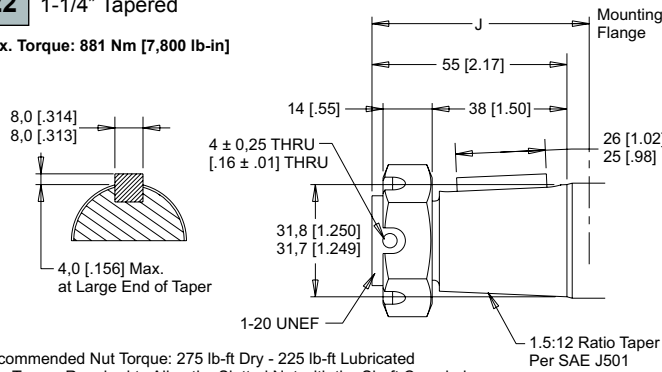
NOTE: Shaft lengths vary ± 0,8 mm [0.030 in.]



## 355 & 356 SERIES SHAFTS

### 22 1-1/4" Tapered

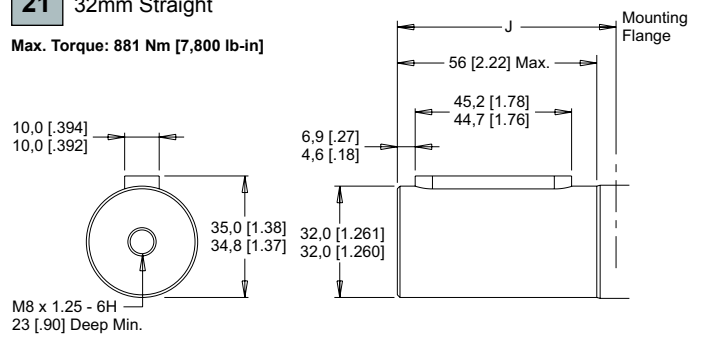
Max. Torque: 881 Nm [7,800 lb-in]



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

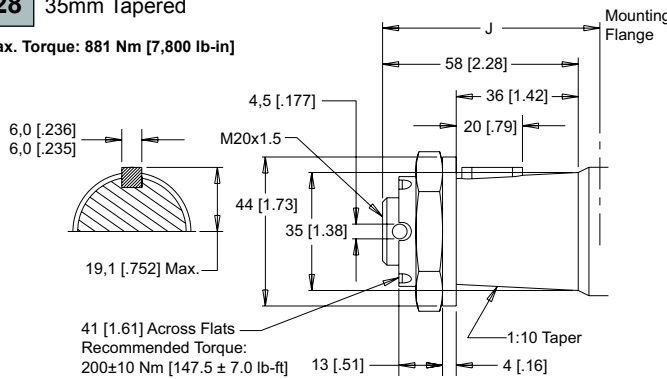
### 21 32mm Straight

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



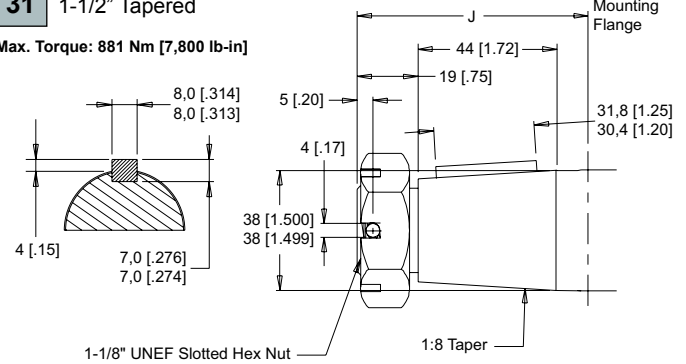
### 28 35mm Tapered

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.

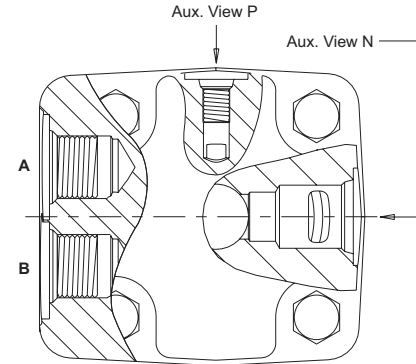
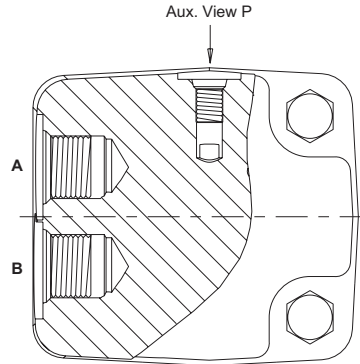
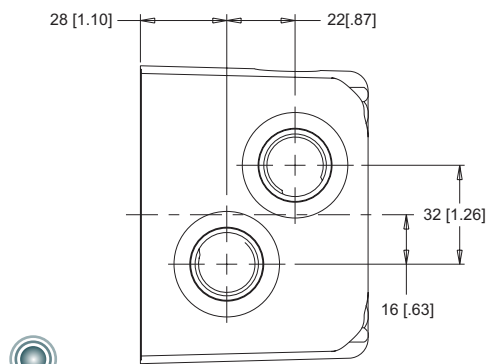


## 355 & 356 SERIES PORTING OPTIONS

### SIDE PORTS

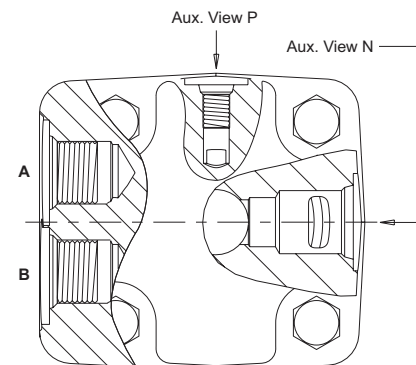
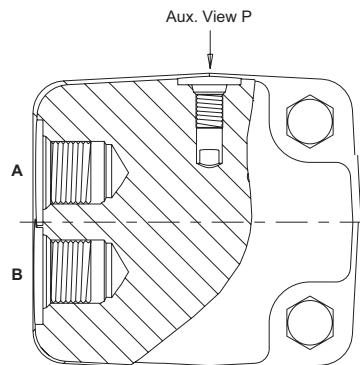
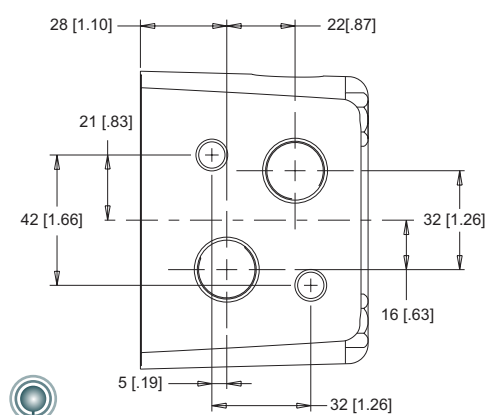
**1** 7/8" O-Ring with 7/16" Drain Port

**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.

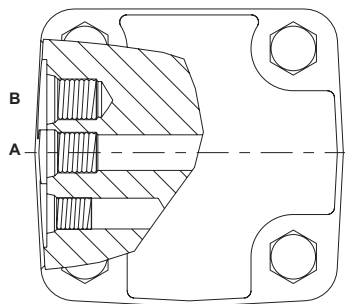
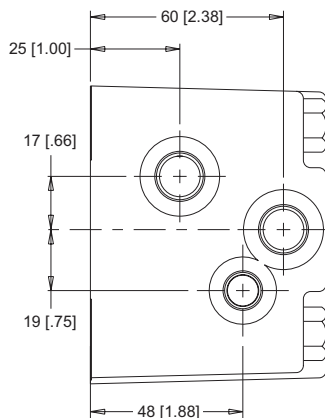
**3** 1/2" BSP.F Offset Manifold with 1/4" Drain Port



**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

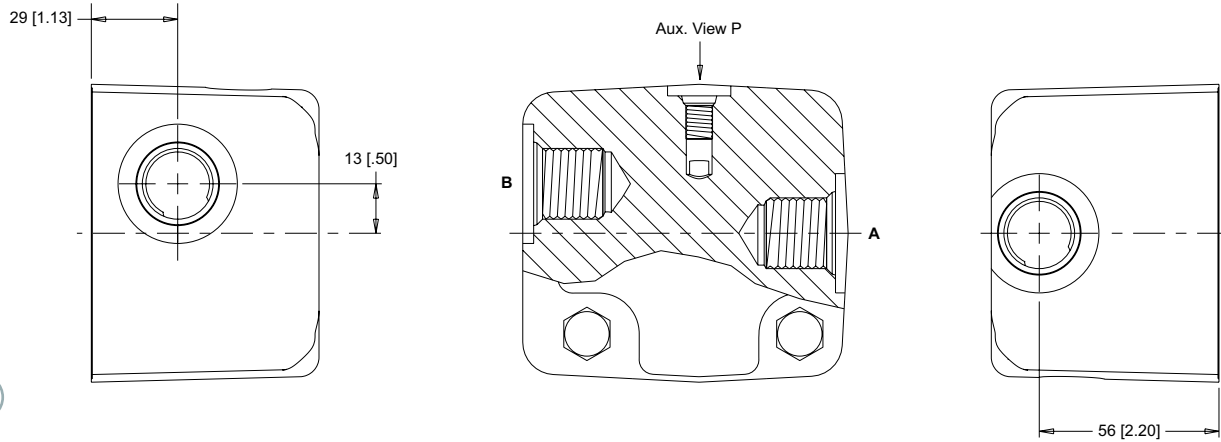






### SIDE PORTS

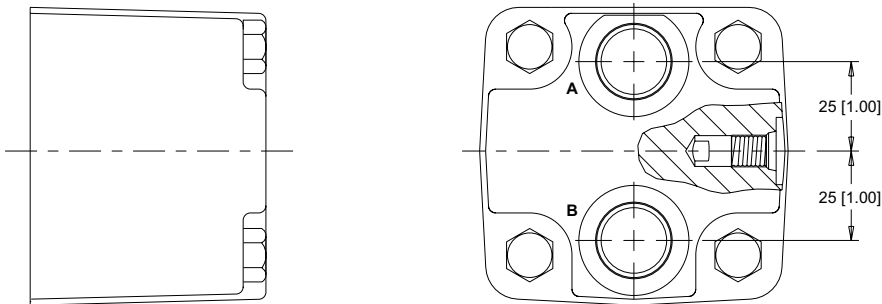
- 6** 1-1/16" O-Ring with 7/16" Drain Port



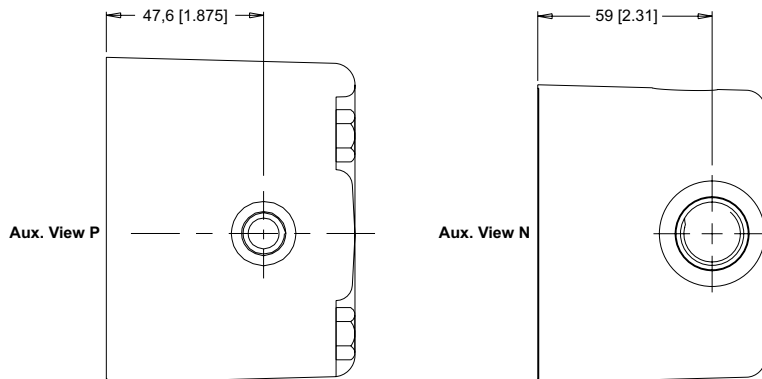
NOTE: See below for Auxillary view P.

### 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

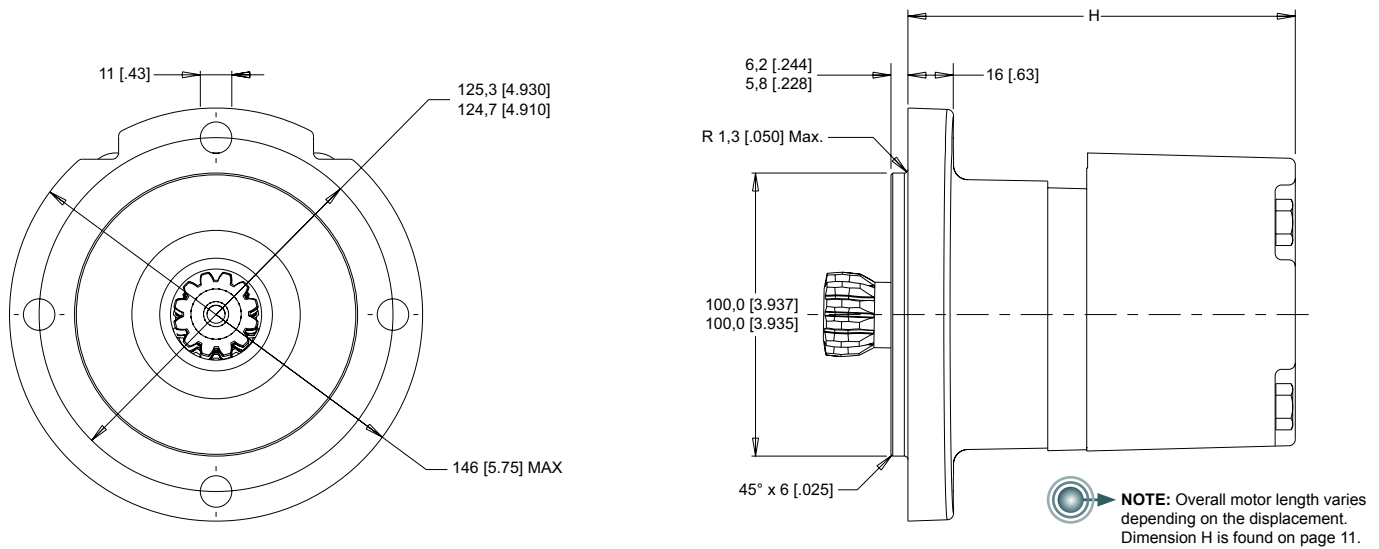
The WS short motor comes without bearings or an output shaft. It is designed for direct mounting onto a gearbox or similar add-on component that provides the internal splined input shaft and bearings. Spline specifications provided below.

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

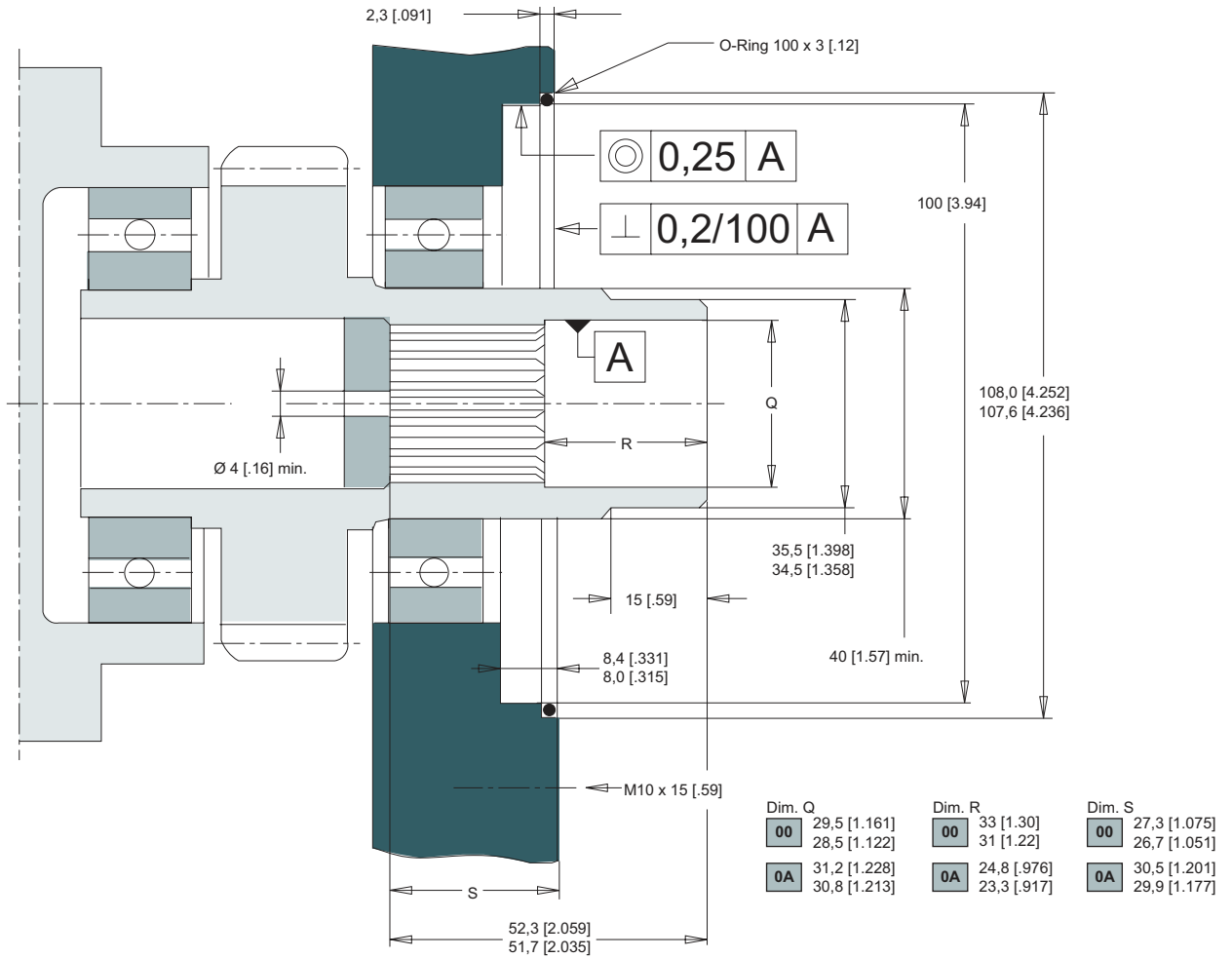
Intermittent Ratings - 10% of Operation    Peak Ratings - 1% of Operation

CODE	Displacement cc [in <sup>3</sup> /rev]	Max. Torque Nm [lb-in]	Max. Pressure bar [psi]		
			Inter.	Cont.	Inter.
100	100 [6.10]	416 [3680]	207 [3000]	310 [4500]	310 [4500]
110	112 [6.85]	468 [4145]	207 [3000]	310 [4500]	310 [4500]
130	129 [7.86]	550 [4865]	207 [3000]	310 [4500]	310 [4500]
160	162 [9.90]	618 [5465]	207 [3000]	276 [4000]	310 [4500]
200	202 [12.31]	768 [6795]	207 [3000]	276 [4000]	310 [4500]
230	228 [13.92]	806 [7135]	207 [3000]	276 [4000]	310 [4500]
320	325 [19.81]	1029 [9105]	190 [2750]	224 [3250]	259 [3750]
400	399 [24.36]	1034 [9150]	155 [2250]	190 [2750]	224 [3250]
500	496 [30.29]	1041 [9210]	121 [1750]	155 [2250]	172 [2500]

**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/mm<sup>2</sup>) 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 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 [.9217]		
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  $m \cdot X = 0.8$ ;  $m = 2.1166$ )

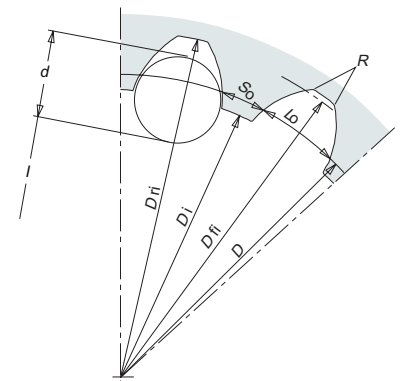
\* Dimensions apply after heat treatment.

**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.



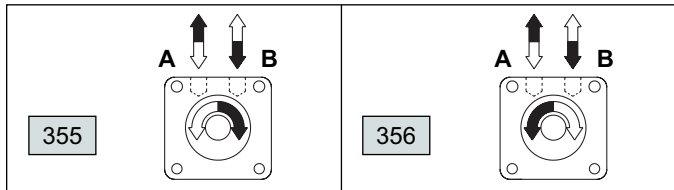


## 355 & 356 SERIES MODEL CODE BUILDER

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

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

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

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

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## WS SERIES HYDRAULIC MOTORS



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