ServoFit® TigerLine Gearheads

Introduction and Table of Contents

To truly lead means to constantly improve, even if you're already ahead of the competition.

At STOBER we are continuously seeking ways to bring you new solutions to solve your drive problems. This on-going process has resulted in the redesign of STOBER's planetary gearheads making them even more robust than before....wider planet gears, stronger bearings, improved tooth profile....and adding output options.

The ClassicLine "P" Series has become a real "tiger" with the changes that have been made – we're calling it the "TigerLine" for this powerful introduction. These extremely efficient gearheads continue to use the proven HeliCamber gear technology. They provide continuous low backlash while running with a smoothness unparalleled in the industry. Friction, especially on the fast running input shafts, has been held to a minimum, allowing trouble free use in continuous duty applications. With the addition of options that can be selected to suit any application, you can get made-to-order technology in off-the-shelf components.

Based on the "P" Series ClassicLine, the AdvancedLine "PA" Series provides the best features available in a very low backlash unit. The motor coupling will compensate for thermal expansion and still provide the torsional stiffness needed for servo applications. These units are available in five sizes, seventeen ratios, and backlash as low as one arcminute.

The "PKX" Series is a combination of the "P" Series with a right angle to provide an extremely compact planetary gear unit in ratios from 3 to 300.

We are very pleased to introduce the TigerLine of planetary units in this catalog and on behalf of the worldwide family of STÖBER employees, we thank you for choosing our products and pledge to continue to meet your product needs with the newest solutions in the future.

Sincerely,

Bernd Stöber, President
Stober Drives, Inc.

Peter Feil, VP/General Manager
Stober Drives, Inc.

"P" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Performance Specification Overview

				P321	P421	P422	P521	P522	P721	P722	P821	P822
Permissible Acceleration Torque	T_{2B}		in.lbs. Nm	575 65	1052 120		2,655 300		6,195 700		14,160 1,600	
Nominal Output Torque [1]	T_{2N}		in.lbs. Nm	398 45	752 85		1,858 210		3,894 440		8,850 1,000	
Input Speed Maximum [2]	n_{1MAX}		Continuous Cyclic	4,500 8,000	4,000 7,000	4,500 8,000	3,700 6,500	4,000 7,000	3,300 6,000	3,700 6,500	2,800 4,500	3,300 6,000
Torsional Backlash [3]	$\Delta\varphi$		arcmin	≤4	≤4	≤5	≤3	≤4	≤3	≤4	≤3	≤4
Torsional Stiffness	C_2		in.lbs./arcmin Nm/arcmin	44 5	100 11		266 33		486 55		1,557 176	
Axial Load Max.	F_{2AMAX}	R	lbs. N	225 1,000	337 1,500		518 2,300		653 2,900		1,058 4,700	
See Page 22 for BEARING OPTIONS		D	lbs. N	315 1,400	506 2,250		788 3,500		1,013 4,500		1,688 7,500	
		Z	lbs. N	135 600	225 1,000		360 1,600		450 2,000		675 3,000	
Radial Load Max. [4]	F_{2RMAX}	R	lbs. N	563 2,500	900 4,000		1,463 6,500		1,800 8,000		2,925 13,000	
See Page 22 for BEARING OPTIONS		D	lbs. N	619 2,750	1,013 4,500		1,575 7,000		2,025 9,000		3,375 15,000	
		Z	lbs. N	675 3,000	1,125 5,000		1,800 8,000		2,250 10,000		4,050 18,000	
Tilting Moment Max.[4]	T_{2Kmax}	R	in.lbs. Nm	1,859 210	3,451 390		6,956 786		10,337 1,168		20,364 2,301	
See Page 22 for BEARING OPTIONS		D	in.lbs. Nm	2,044 231	3,885 439		7,496 847		11,629 1,314		23,497 2,655	
		Z	in.lbs. Nm	2,230 252	4,319 488		8,567 968		12,921 1,460		28,196 3,186	
Efficiency (at Nom. Torque)	η		%	97%	97%	95%	97%	95%	97%	95%	97%	95%
Weight	m		pounds kg	6 2.6	9 4.0	12 5.3	14 6.5	19 8.5	27 12	33 15	57 26	71 32
Noise Level	L_{PA}		dB(A) [5]	≤61	≤62	≤60	≤63	≤61	≤64	≤62	≤65	≤63
Balance Quality				Q 2.5 (Quality Class-2.5 millimeters per second)								
Lubrication				Synthetic Oil – Lubricated for Life								
Degree of Protection				IP65 - FKM Shaft Seals								
Mounting Position				Unrestricted								
Direction of Rotation				(See Page 24)								
Ambient Temperature				0°C to +40°C (104° F) Other temperatures, contact Stober Drives.								
Finish				Black (Standard), Washdown, Food and Beverage Options Available								
Lifetime.[6]	L_h		hours	L_h > 10,000 hours if T_{2K}/T_{2A} < 1.25 and > 1.00 L_h > 20,000 hours if T_{2K}/T_{2A} > 1.25 and < 1.50 L_h > 30,000 hours if T_{2K}/T_{2A} > 1.5								
Warranty				5 Year Limited (2 Years on normal wear items: bearings, seals, etc.)								

1) Ratings based on input speed (n_1) of 2000 RPM.
For torque at higher input speeds (T_{2NX}) solve the formula, where n1 = Actual Input Speed. $T_{2NX} = \frac{T_{2N}}{\sqrt[3]{\frac{n_1}{2000}}}$

2) For speeds higher than given above, contact Stober Technical Support.

3) Tested at 1.5% of nominal torque and recorded on the input side of the gearhead.

4) Rating based on output speed (n2) of 100 RPM. For values at other speeds see Page 21.

5) Measurement at one (1) meter distance with input speed (n1) of 2000 RPM.

6) T_{2A} equals actual tilting moment of the application. See Page 22 for calculation details.

Refer to Page 27 for ServoFit Precision Planetary Gearhead Selection Procedure.

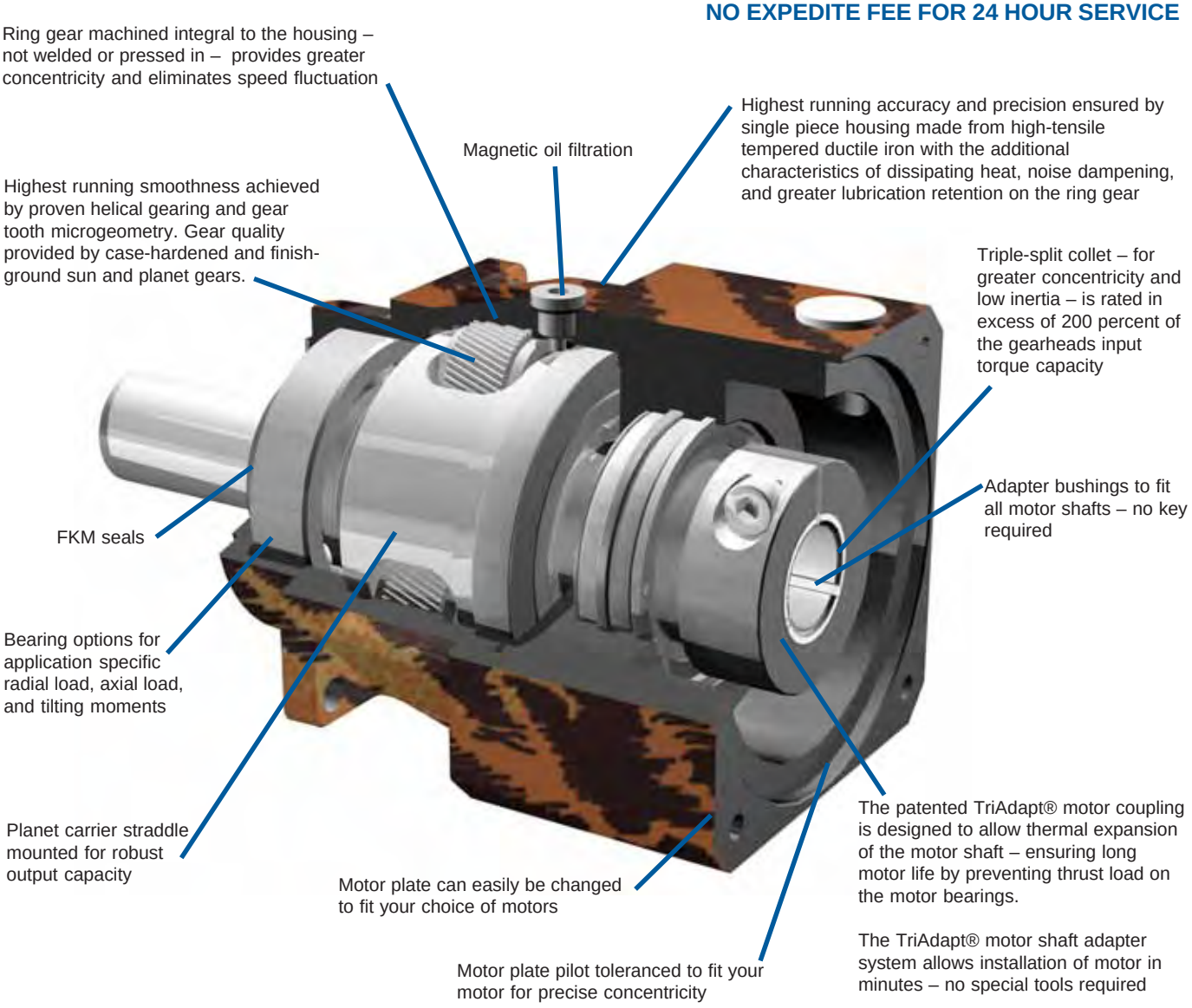
"P" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Features

The "P" Series–TigerLine of ServoFit Precision Planetary Gearheads feature HeliCamber® gearing, TriAdapt® motor adapter system and many other components which make them the most accurate and efficient planetary gearheads available. HeliCamber® gear technology provides minimum wear, low backlash and low noise

Some of these features are:

- Readily Attaches to Any Servo Motor (IEC, NEMA, or customized motor plates*)
- 5 Year Limited Warranty (2 years on bearings, seals, etc.)
- Lowest Standard Backlash
- High Torsional Stiffness
- Advanced Gear Technology
- 95 to 97% Efficiency
- Quiet Running
- Assembled in the U.S.A.

NO EXPEDITE FEE FOR 24 HOUR SERVICE



Lubricated for life with synthetic oil and sealed to IP65 standards to prevent lubricant contamination for long life.

* Maximum 10 working days for custom motor plates.

"P" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Selection Data

Part Number (Gearhead + Input)		Exact Ratio	Maximum Input Speed [1]		Max. Motor Shaft	Mass Moment of Inertia		Torsional Stiffness C_2		Output Torque					
										Nominal [2]		Acceleration		Peak [3]	
Gearhead	**MT AW**	i	Continuous RPM (n_1)	Cyclic RPM (n_1)	øD[6] mm	J_1 lb-in-s²	J_1 kgcm²	in.lbs. per arcmin	Nm per arcmin	T_{2N} in.lbs.	Nm	T_{2B} in.lbs.	Nm	T_{2PEAK} in.lbs.	Nm
P321 with Motor Mounting Plate or Input Shaft															
P321S_ _0030	_	3.00	3,500	6,000	19	0.0005	0.584	44.2	5.0	266	30	443	50	1,082	122
P321S_ _0040	_	4.00	3,700	6,500	19	0.0004	0.502	43.7	4.9	398	45	575	65	1,151	130
P321S_ _0050	_	5.00	4,000	7,000	19	0.0004	0.455	43.2	4.9	398	45	575	65	1,151	130
P321S_ _0070	_	7.00	4,500	8,000	19	0.0004	0.412	38.0	4.3	398	45	531	60	1,151	130
P321S_ _0080	_	8.00	4,500	8,000	19	0.0004	0.404	36.5	4.1	354	40	443	50	885	100
P321S_ _0100	_	10.00	4,500	8,000	19	0.0004	0.396	35.0	4.0	266	30	443	50	885	100
P421 with Motor Mounting Plate or Input Shaft															
P421S_ _0030	_	3.00	3,000	5,500	24	0.0014	1.564	100.6	11.4	443	50	885	100	2,124	240
P421S_ _0040	_	4.00	3,300	6,000	24	0.0010	1.171	100.8	11.4	752	85	1,062	120	2,124	240
P421S_ _0050	_	5.00	3,700	6,500	24	0.0009	1.065	100.2	11.3	752	85	1,062	120	2,124	240
P421S_ _0070	_	7.00	4,000	7,000	24	0.0008	0.933	87.7	9.9	752	85	974	110	2,124	240
P421S_ _0080	_	8.00	4,000	7,000	24	0.0008	0.914	83.0	9.4	708	80	885	100	1,770	200
P421S_ _0100	_	10.00	4,000	7,000	24	0.0008	0.895	79.0	8.9	531	60	885	100	1,770	200
P422 with Motor Mounting Plate or Input Shaft															
P422S_ _0150	_	15.00	3,700	6,500	19	0.0005	0.519	92.2	10.4	443	50	885	100	2,124	240
P422S_ _0160	_	16.00	3,700	6,500	19	0.0005	0.519	92.2	10.4	752	85	1,062	120	2,124	240
P422S_ _0200	_	20.00	4,000	7,000	19	0.0004	0.467	92.1	10.4	752	85	1,062	120	2,124	240
P422S_ _0250	_	25.00	4,000	7,000	19	0.0004	0.463	94.5	10.7	752	85	1,062	120	2,124	240
P422S_ _0280	_	28.00	4,500	8,000	19	0.0004	0.422	90.4	10.2	752	85	1,062	120	2,124	240
P422S_ _0320	_	32.00	3,700	6,500	19	0.0004	0.505	81.6	9.2	708	80	885	100	1,770	200
P422S_ _0350	_	35.00	4,500	8,000	19	0.0004	0.420	93.4	10.6	752	85	1,062	120	2,124	240
P422S_ _0400	_	40.00	4,500	8,000	19	0.0004	0.401	89.3	10.1	752	85	1,062	120	2,124	240
P422S_ _0500	_	50.00	4,500	8,000	19	0.0004	0.400	92.6	10.5	752	85	1,062	120	2,124	240
P422S_ _0700	_	70.00	4,500	8,000	19	0.0004	0.398	85.0	9.6	752	85	974	110	2,124	240
P422S_ _1000	_	100.00	4,500	8,000	19	0.0004	0.398	77.9	8.8	531	60	885	100	1,770	200
P521 with Motor Mounting Plate or Input Shaft															
P521S_ _0030	_	3.00	2,500	4,500	32	0.0033	3.756	271.5	30.7	1,062	120	1,770	200	3,683	416
P521S_ _0040	_	4.00	3,000	5,000	32	0.0031	3.544	260.3	29.4	1,859	210	2,655	300	4,910	555
P521S_ _0050	_	5.00	3,500	6,000	32	0.0028	3.134	260.5	29.4	1,859	210	2,655	300	5,310	600
P521S_ _0070	_	7.00	3,700	6,500	32	0.0025	2.825	240.2	27.1	1,859	210	2,390	270	5,310	600
P521S_ _0080	_	8.00	3,700	6,500	32	0.0024	2.758	225.0	25.4	1,770	200	2,213	250	4,425	500
P521S_ _0100	_	10.00	3,700	6,500	32	0.0024	2.694	218.2	24.7	1,239	140	2,213	250	4,425	500
P522 with Motor Mounting Plate or Input Shaft															
P522S_ _0150	_	15.00	3,300	6,000	24	0.0011	1.221	241.5	27.3	1,062	120	1,770	200	3,683	416
P522S_ _0160	_	16.00	3,300	6,000	24	0.0011	1.221	241.5	27.3	1,859	210	2,655	300	4,910	555
P522S_ _0200	_	20.00	3,700	6,500	24	0.0010	1.100	241.3	27.3	1,859	210	2,655	300	4,910	555
P522S_ _0250	_	25.00	3,700	6,500	24	0.0010	1.084	248.0	28.0	1,859	210	2,655	300	5,310	600
P522S_ _0280	_	28.00	4,000	7,000	24	0.0009	0.963	236.3	26.7	1,859	210	2,655	300	4,910	555
P522S_ _0320	_	32.00	3,300	6,000	24	0.0010	1.168	222.2	25.1	1,770	200	2,213	250	4,425	500
P522S_ _0350	_	35.00	4,000	7,000	24	0.0008	0.954	244.6	27.6	1,859	210	2,655	300	5,310	600
P522S_ _0400	_	40.00	4,000	7,000	24	0.0008	0.909	232.0	26.2	1,859	210	2,655	300	4,910	555
P522S_ _0500	_	50.00	4,000	7,000	24	0.0008	0.905	241.6	27.3	1,859	210	2,655	300	5,310	600
P522S_ _0700	_	70.00	4,000	7,000	24	0.0008	0.902	232.9	26.3	1,859	210	2,390	270	5,310	600
P522S_ _1000	_	100.00	4,000	7,000	24	0.0008	0.900	215.2	24.3	1,239	140	2,213	250	4,425	500

[1] For higher speeds than shown, contact Stober.

[2] Based on input speed: n1 = 2000 RPM
For torque at higher input speeds (T_{2NX}) solve the formula, where n1 = Actual Input Speed.

$$T_{2NX} = \frac{T_{2N}}{\sqrt[3]{\frac{n_1}{2000}}}$$

[3] Maximum momentary torque for emergency stops or heavy shock load. Admissible stops per life of gearhead = 1,000 stops maximum.

"P" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Selection Data

Part Number (Gearhead + Input)		Exact Ratio	Maximum Input Speed [1]		Max. Motor Shaft	Mass Moment of Inertia		Torsional Stiffness C_2		Output Torque					
										Nominal [2] T_{2N}		Acceleration T_{2B}		Peak [3] T_{2PEAK}	
Gearhead	**MT AW**	i	Continuous RPM (n_1)	Cyclic RPM (n_1)	øD[6] mm	J_1 lb-in-s^2	J_1 kgcm^2	in.lbs. per arcmin	Nm per arcmin	in.lbs.	Nm	in.lbs.	Nm	in.lbs.	Nm
P721 with Motor Mounting Plate or Input Shaft															
P721S_ _0030	_	3.00	2,200	3,700	38	0.0115	13.012	484.1	54.7	2,478	280	4,425	500	9,168	1,036
P721S_ _0040	_	4.00	2,500	4,500	38	0.0073	8.294	485.5	54.9	3,894	440	6,195	700	12,224	1,381
P721S_ _0050	_	5.00	3,000	5,500	38	0.0060	6.760	481.2	54.4	3,894	440	6,195	700	12,390	1,400
P721S_ _0070	_	7.00	3,300	6,000	38	0.0066	7.447	470.3	53.1	3,894	440	5,753	650	11,117	1,256
P721S_ _0080	_	8.00	3,300	6,000	38	0.0064	7.186	457.2	51.7	3,540	400	4,425	500	8,850	1,000
P721S_ _0100	_	10.00	3,300	6,000	38	0.0061	6.938	431.4	48.7	2,655	300	4,425	500	8,850	1,000
P722 with Motor Mounting Plate or Input Shaft															
P722S_ _0150	_	15.00	3,000	5,000	32	0.0027	3.035	470.0	53.1	2,478	280	4,425	500	9,168	1,036
P722S_ _0160	_	16.00	3,000	5,000	32	0.0032	3.631	471.0	53.2	3,894	440	6,195	700	12,224	1,381
P722S_ _0200	_	20.00	3,500	6,000	32	0.0028	3.204	471.0	53.2	3,894	440	6,195	700	12,224	1,381
P722S_ _0250	_	25.00	3,500	6,000	32	0.0028	3.142	472.0	53.3	3,894	440	6,195	700	12,390	1,400
P722S_ _0280	_	28.00	3,700	6,500	32	0.0026	2.919	466.5	52.7	3,894	440	6,195	700	12,224	1,381
P722S_ _0320	_	32.00	3,000	5,000	32	0.0031	3.456	456.2	51.5	3,540	400	4,425	500	8,850	1,000
P722S_ _0350	_	35.00	3,700	6,500	32	0.0026	2.887	469.1	53.0	3,894	440	6,195	700	12,390	1,400
P722S_ _0400	_	40.00	3,700	6,500	32	0.0024	2.740	460.9	52.1	3,894	440	6,195	700	12,224	1,381
P722S_ _0500	_	50.00	3,700	6,500	32	0.0024	2.724	465.5	52.6	3,894	440	6,195	700	12,390	1,400
P722S_ _0700	_	70.00	3,700	6,500	32	0.0024	2.714	465.6	52.6	3,894	440	5,753	650	11,117	1,256
P722S_ _1000	_	100.00	3,700	6,500	32	0.0024	2.709	429.5	48.5	2,655	300	4,425	500	8,850	1,000
P821 with Motor Mounting Plate or Input Shaft															
P821S_ _0030	_	3.00	1,800	3,000	48	0.0507	57.292	1,463.5	165.4	7,080	800	10,620	1,200	17,049	1,926
P821S_ _0040	_	4.00	2,200	3,500	48	0.0296	33.450	1,546.5	174.7	7,080	800	14,160	1,600	22,732	2,569
P821S_ _0050	_	5.00	2,500	4,000	48	0.0236	26.626	1,553.9	175.6	8,850	1,000	14,160	1,600	28,320	3,200
P821S_ _0070	_	7.00	2,800	4,500	48	0.0176	19.836	1,477.5	167.0	8,850	1,000	12,390	1,400	24,878	2,811
P821S_ _0080	_	8.00	2,800	4,500	48	0.0165	18.598	1,412.6	159.6	7,080	800	10,620	1,200	21,240	2,400
P821S_ _0100	_	10.00	2,800	4,500	48	0.0154	17.429	1,321.9	149.4	6,195	700	10,620	1,200	21,240	2,400
P822 with Motor Mounting Plate or Input Shaft															
P822S_ _0150	_	15.00	2,500	4,500	38	0.0078	8.854	1,470.7	166.2	7,080	800	10,620	1,200	17,049	1,926
P822S_ _0160	_	16.00	2,500	4,500	38	0.0078	8.854	1,470.7	166.2	7,080	800	14,160	1,600	28,320	3,200
P822S_ _0200	_	20.00	3,000	5,500	38	0.0065	7.312	1,468.3	165.9	7,080	800	14,160	1,600	28,320	3,200
P822S_ _0250	_	25.00	3,000	5,500	38	0.0062	7.040	1,502.5	169.8	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _0280	_	28.00	3,300	6,000	38	0.0068	7.703	1,461.8	165.2	7,080	800	14,160	1,600	28,320	3,200
P822S_ _0320	_	32.00	2,500	4,500	38	0.0071	8.057	1,404.4	158.7	7,080	800	10,620	1,200	21,240	2,400
P822S_ _0350	_	35.00	3,300	6,000	38	0.0067	7.564	1,498.1	169.3	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _0400	_	40.00	3,300	6,000	38	0.0063	7.064	1,436.6	162.3	7,080	800	14,160	1,600	28,320	3,200
P822S_ _0500	_	50.00	3,300	6,000	38	0.0062	6.995	1,481.1	167.4	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _0700	_	70.00	3,300	6,000	38	0.0061	6.949	1,454.6	164.4	8,850	1,000	12,390	1,400	24,878	2,811
P822S_ _1000	_	100.00	3,300	6,000	38	0.0061	6.925	1,312.8	148.3	6,195	700	10,620	1,200	21,240	2,400

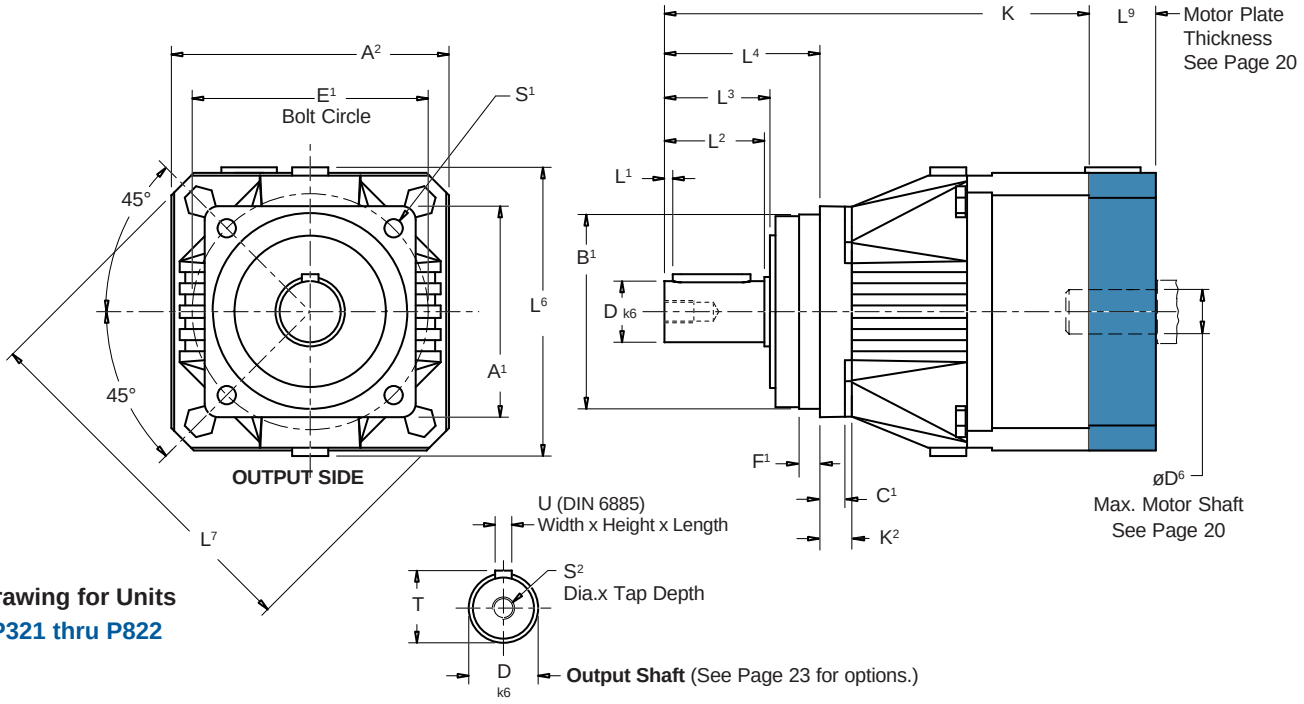
See web site . . . . . for drawings.

Index of Symbols

MT	Motor adapter with TriAdapt coupling	C_2	Torsional Stiffness
AW	Input shaft	T_{2N}	Nominal Torque
i	Ratio - Exact	T_{2B}	Acceleration Torque Maximum
n_1	Maximum input speed RPM	T_{2PEAK}	Peak Torque
J_1	Mass moment of inertia (input)		

"P" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Dimensional Data

Dimension shown in millimeters over inches.



Drawing for Units
P321 thru P822

Table No. 1 **"P" Series – Precision Planetary Gearhead Dimensions (mm/inches)**

Unit	A^1	A^2	B^1 h6	C^1	D k6	E^1	F^1	K^2	L^1	L^2	L^3	L^4	L^6	L^7	S^1	S^2	T	U
P321	72	72	60 +.000/-.019	7	16 +.012/+.001	75	7.5	–	2	28	30	48	79	92	5.5	M5x12.5	18	A5x5x22
	2.83	2.83	2.362 +.0000/-.0007	.28		2.95	.30	–	.08	1.10	1.18	1.89	3.11	3.62	.22		.71	
P421/P422	98	76	70 +.000/-.019	9	22 +.015/+.002	85	7.5	12	3	36	38	56	98	130	6.6	M8x19	24.5	A6x6x28
	3.86	2.99	2.756 +.0000/-.0007	.35		3.35	.30	.47	.12	1.42	1.50	2.20	3.86	5.12	.26		.96	
P521/P522	115	101	90 +.000/-.022	10	32 +.018/+.002	120	15	14	3	58	60	88	121	149	9	M12x28	35	A10x8x50
	4.53	3.98	3.543 +.0000/-.0009	.39		4.42	.59	.55	.12	14.09	2.36	3.46	4.76	5.87	.35		1.38	
P721/P722	145	145	130 +.000/-.025	15	40 +.018/+.002	165	3.5	–	4	82	85	112	145	190	11	M16x36	43	A12x8x70
	5.71	5.71	5.118 +.000/-.001	.59		6.50	.14	–	.16	3.23	3.35	4.41	5.71	7.48	.43		1.69	
P821/P822	190	190	160 +.000/-.025	15	55 +.021/+.002	215	10	–	6	82	85	112	190	250	13.5	M20x42	59	A12x8x70
	7.48	7.48	6.299 +.000/-.001	.59		8.46	.39	–	.24	3.23	3.35	4.41	7.48	9.84	.53		2.32	

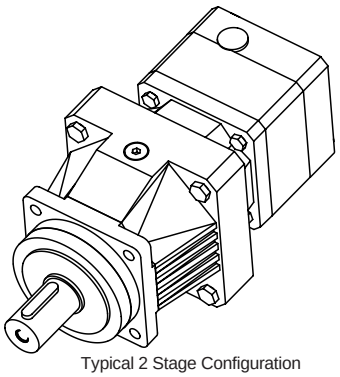
Table No. 2

Unit	K	
	mm	inches
P321	135	5.31
P421	153	6.02
P422	200.5	7.89
P521	193	7.60
P522	242.5	9.55
P721	242	9.53
P722	294	11.57
P821	283	11.14
P822	350.5	13.80

Part No. Explanation

P 4 2 1 S P R 0030 MT

- Motor Plate with TriAdapt Coupling
- Ratio (**0030** = 3.0:1)
- **R –** Normal Bearing
- **D –** Reinforced Bearings-Axial
- **Z –** Reinforced Bearings-Radial
- **G –** Shaft – no Key
- **P –** Output Shaft with Key
- **V –** Splined Shaft
- Standard Housing
- No. of Gear Stages (**1** = 1 Stage, **2** = 2 Stages)
- Generation Number
- Unit No.
- TigerLine ServoFit Precision Planetary Gearhead



Typical 2 Stage Configuration

When ordering a planetary gearhead, specify the motor manufacturer and part number, provide the motor drawing with dimensions, or specify the motor mounting dimensions. (See Page 20)

"P" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Dimensional Data

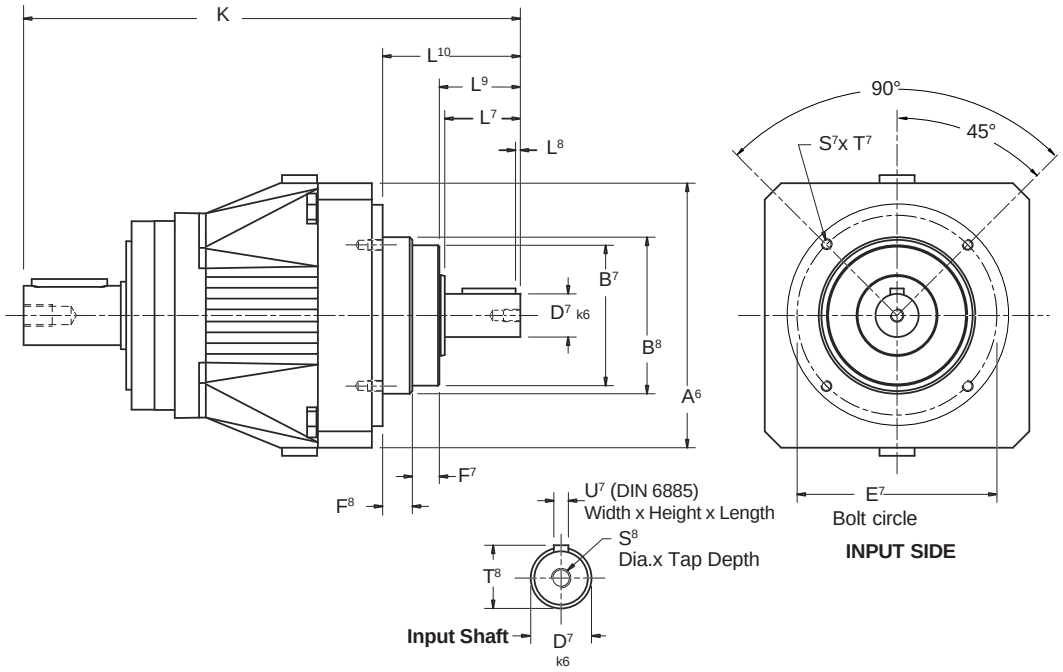
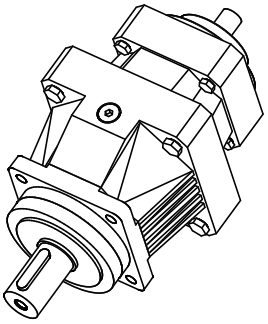


Table No. 3 **"P" Series – Precision Planetary Gearhead Dimensions (mm/inches)**

Unit	A^6	B^7 h6	B^8 g6	D^7 k6	E^7	F^7	F^8	K	L^7	L^8	L^9	L^{10}	S^7	S^8	T^7	T^8	U^7
P321	72	45 -.009/-.025	–	12 +.012/+.001	55.5	10.5	–	148	18	2	18.5	29	M4	M4x10	8	13.5	A4x4x14
	2.83	1.772 -.0004/-.0010	–		2.19	.41	–	5.83	.71	.08	.73	1.14			.31	.53	
P421	98	52 -.010/-.029	58 -.012/-.034	16 +.012/+.001	74	10	11	184	28	2	30	51	M4	M5x12.5	6	18	A5x5x22
	3.86	2.047 -.0004/-.0011	2.283 -.0005/-.0013		2.91	.39	.43	7.24	1.10	.08	1.18	2.01			.24	.71	
P422	72	45 -.010/-.029	–	12 +.012/+.001	55.5	10.5	–	213.5	18	2	18.5	29	M4	M4x10	8	13.5	A4x4x14
	2.83	1.772 -.0004/-.0011	–		2.19	.41		8.41	.71	.08	.73	1.14			.31	.53	
P521	115	60 -.010/-.029	66 -.010/-.029	22 +.015/+.002	97	13	10	232	36	2	38	61	M5	M8x19	9	24.5	A6x6x30
	4.53	2.362 -.0004/-.0011	2.598 -.0004/-.0011		3.82	.51	.39	9.13	1.42	.08	1.50	2.40			.35	.96	
P522	98	52 -.010/-.029	58 -.012/-.034	16 +.012/+.001	74	10	11	273.5	28	2	30	51	M4	M5x12.5	6	18	A5x5x22
	3.86	2.047 -.0004/-.0011	2.283 -.0005/-.0013		2.91	.39	.43	10.77	1.10	.08	1.18	2.01			.24	.71	
P721	144	80 -.010/-.029	93 -.012/-.034	32 +.018/+.002	123	18	12	302	58	3	60	90	M6	M12x28	9	35	A10x8x50
	5.67	3.150 -.0004/-.0011	3.661 -.0005/-.0013		4.84	.71	.47	11.89	2.28	.12	2.36	3.54			.35	1.38	
P722	114	60 -.010/-.029	66 -.010/-.029	22 +.015/+.002	97	13	10	333	36	2	38	61	M5	M8x19	9	24.5	A6x6x30
	4.49	2.362 -.0004/-.0011	2.598 -.0004/-.0011		3.82	.51	.39	13.11	1.42	.08	1.50	2.40			.35	.96	
P821	190	110 -.012/-.034	134 -.014/-.039	40 +.018/+.002	179	21	15	367	82	4	84	120	M8	M16x36	12	43	A12x8x70
	7.48	4.331 -.0005/-.0013	5.276 -.0006/-.0015		7.05	.83	.59	14.45	3.23	.16	3.31	4.72			.47	1.69	
P822	144	80 -.010/-.029	93 -.012/-.034	32 +.018/+.022	123	18	12	410.5	58	3	60	90	M6	M12x28	9	35	A10x8x50
	5.67	3.150 -.0004/-.0011	3.661 -.0005/-.0013		4.84	.71	.47	16.16	2.28	.12	2.36	3.54			.35	1.38	



Typical 2 Stage Configuration

Part No. Explanation

P 4 2 2 S P R 0150 AW

- **AW** – Input Shaft
- **0150** – Ratio (**0150** = 15.0:1)
- **R** – Normal Bearing
- **D** – Reinforced Bearings-Axial
- **Z** – Reinforced Bearings-Radial
- **G** – Shaft – no Key
- **P** – Output Shaft with Key
- **V** – Splined Shaft
- **S** – Standard Housing
- **2** – No. of Gear Stages (**1** = 1 Stage, **2** = 2 Stages)
- **2** – Generation Number
- **4** – Unit No.
- **P** – TigerLine ServoFit Precision Planetary Gearhead

"PA" Series–Advanced TigerLine ServoFit® Precision Planetary Gearhead Performance Specification Overview

			PA321	PA421 PA422	PA521 PA522	PA721 PA722	P821 P822
Permissible Acceleration Torque	T_{2B}	in.lbs. Nm	575 65	1052 120	2,655 300	6,195 700	14,160 1,600
Nominal Output Torque [1]	T_{2N}	in.lbs. Nm	398 45	752 85	1,858 210	3,894 440	8,850 1,000
Input Speed Maximum [2]	n_{1MAX}	Continuous Cyclic	4,500 8,000	4,000 4,500 7,000 8,000	3,700 4,000 6,500 7,000	3,300 3,700 6,000 6,500	2,800 3,300 4,500 6,000
Torsional Backlash [3]	$\Delta\varphi$	arcmin	≤2	≤2 ≤3	≤1 ≤2	≤1 ≤2	≤1 ≤2
Torsional Stiffness	C_2	in.lbs./arcmin Nm/arcmin	44 5	100 11	266 33	486 55	1,557 176
Axial Load Max.	F_{2AMAX}	lbs. N	315 1,400	506 2,250	788 3,500	1,013 4,500	1,688 7,500
Radial Load Max. [4]	F_{2RMAX}	lbs. N	619 2,750	1,012 4,500	1,575 7,000	2,025 9,000	3,375 15,000
Tilting Moment Max.[4]	T_{2KMAX}	in.lbs. Nm	2,044 231	3,885 439	7,496 847	11,629 1,314	23,497 2,655
Efficiency (at Nominal Torque)	η	%	97% 97%	95% 97%	95% 97%	95% 97%	95%
Weight	m	pounds kg	6 2.6	9 12 4.0 5.3	14 19 6.5 8.5	27 33 12 15	57 71 26 32
Noise Level	L_{PA}	dB(A) [5]	≤61	≤62 ≤60	≤63 ≤61	≤64 ≤62	≤65 ≤63
Balance Quality			Q 2.5 (Quality Class-2.5 millimeters per second)				
Lubrication			Synthetic Oil – Lubricated for Life				
Degree of Protection			IP65 - FKM Shaft Seals				
Mounting Position			Unrestricted				
Direction of Rotation			(See Page 24)				
Ambient Temperature			0°C to +40°C (104° F) Other temperatures, contact Stober Drives.				
Finish			Black (Standard), Washdown, Food and Beverage Options Available				
Lifetime.[6]	L_h	hours	L_h > 10,000 hours if T_{2K}/T_{2A} < 1.25 and > 1.00 L_h > 20,000 hours if T_{2K}/T_{2A} > 1.25 and < 1.50 L_h > 30,000 hours if T_{2K}/T_{2A} > 1.5				
Warranty			5 Year Limited (2 Years on normal wear items: bearings, seals, etc.)				

1) Ratings based on input speed (n_1) of 2000 RPM.
For torque at higher input speeds (T_{2NX}) solve the formula, where n1 = Actual Input Speed.

$$T_{2NX} = \frac{T_{2N}}{\sqrt[3]{\frac{n_1}{2000}}}$$

2) For speeds higher than given above, contact Stober Technical Support.

3) Tested at 1.5% of nominal torque and recorded on the input side of the gearhead.

4) Rating based on output speed (n2) of 100 RPM. For values at other speeds see Page 21.

5) Measurement at one (1) meter distance with input speed (n1) of 2000 RPM.

6) T_{2A} equals actual tilting moment of the application. See Page 22 for calculation details.

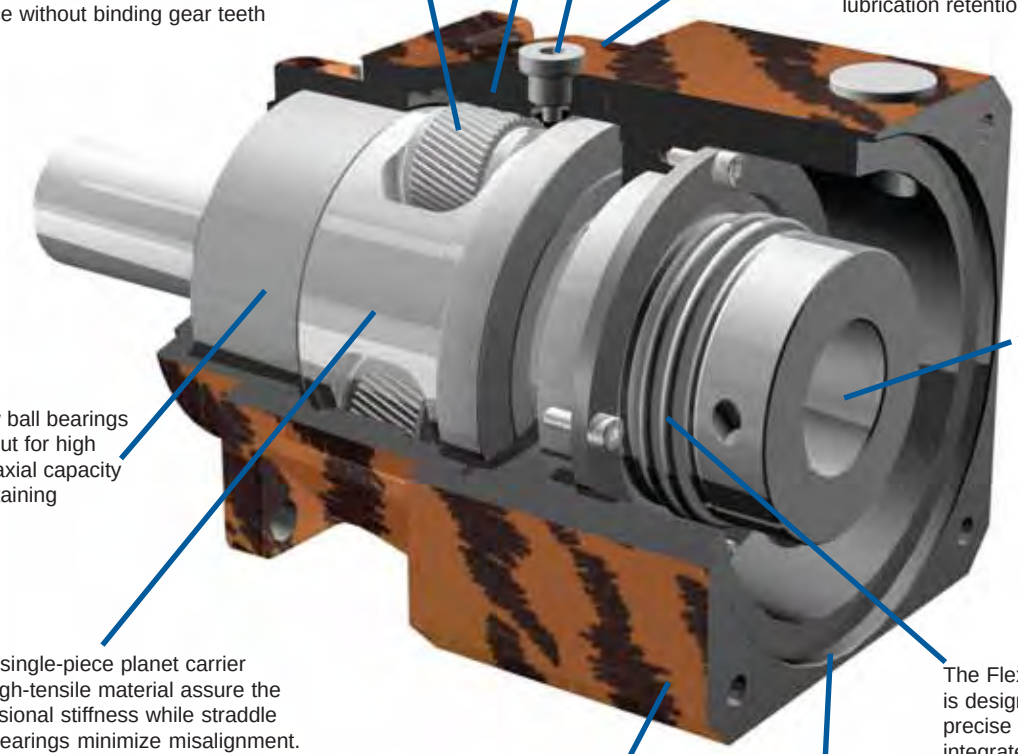
Refer to Page 27 for ServoFit Precision Planetary Gearhead Selection Procedure.

"PA" Series–Advanced TigerLine ServoFit® Precision Planetary Gearhead Features

The "PA" Series–TigerLine of ServoFit Precision Planetary Gearheads feature HeliCamber® gearing, FlexiAdapt® motor adapter system and other features which make them the most accurate, efficient, and lowest backlash planetary gearheads available.

Some of these features are:

- Readily Attaches to Any Servo Motor (IEC, NEMA, or customized motor plates*)
- 5 Year Limited Warranty (2 years on bearings, seals, etc.)
- Lowest Backlash on the Market
- High Torsional Stiffness
- Advanced Gear Technology
- 95 to 97% Efficiency
- Quiet Running



Ring gear machined integral to the housing – not welded or pressed in – provides greater concentricity and eliminates speed fluctuation

High quality gearing provided by case-hardened and finish ground sun and planet gears and honed ring gear.

Magnetic oil filtration

Highest running accuracy and precision ensured by single piece housing made from high-tensile tempered ductile iron with the additional characteristics of dissipating heat, noise dampening, and greater lubrication retention on the ring gear

Backlash ≤ 1 arcminute – Precision selection of parts ensure optimal performance without binding gear teeth

Adapter bushings to fit all motor shafts – no key required

Double row ball bearings on the output for high radial and axial capacity while maintaining efficiency

Oversized single-piece planet carrier made of high-tensile material assure the highest torsional stiffness while straddle mounted bearings minimize misalignment.

The FlexiAdapt® motor coupling is designed for accurate and precise motor installation. The integrated thermal expansion feature in the shape of a bellows compensates for linear expansion of the motor shaft.

The FlexiAdapt® motor shaft adapter system allows installation of motor in minutes without special tools.

Motor plate can easily be changed to fit your choice of motors

FKM seals for the smallest possible diameter–reducing friction and heat buildup, increasing efficiency, and allowing continuous duty without addition cooling.

Motor plate pilot toleranced to fit your motor for precise concentricity

HeliCamber® gear technology provides minimum wear, low backlash and low noise
Lubricated for life with synthetic oil and sealed to IP65 standards to prevent lubricant contamination.
Wide selection of IEC, NEMA, or customized motor adapters

* Maximum 10 working days for custom motor plates.

"PA" Series–Advanced TigerLine ServoFit® Precision Planetary Gearhead Selection Data

Part Number (Gearhead + Input)		Exact Ratio	Maximum Input Speed [1]		Max. Motor Shaft	Mass Moment of Inertia		Torsional Stiffness C_2		Output Torque					
										Nominal [2] T_{2N}		Acceleration T_{2B}		Peak [3] T_{2PEAK}	
Gearhead	**MF AW**	i	Continuous RPM (n_1)	Cyclic RPM (n_1)	øD[6] mm	J_1 lb-in-s^2	J_1 kgcm^2	in.lbs. per arcmin	Nm per arcmin	in.lbs.	Nm	in.lbs.	Nm	in.lbs.	Nm
PA321 with Motor Mounting Plate or Input Shaft															
PA321S_ _0030	_	3.00	3,500	6,000	19	0.0006	0.694	44.2	5.0	266	30	443	50	1,082	122
PA321S_ _0040	_	4.00	3,700	6,500	19	0.0005	0.613	43.7	4.9	398	45	575	65	1,151	130
PA321S_ _0050	_	5.00	4,000	7,000	19	0.0005	0.565	43.2	4.9	398	45	575	65	1,151	130
PA321S_ _0070	_	7.00	4,500	8,000	19	0.0005	0.511	38.0	4.3	398	45	531	60	1,151	130
PA321S_ _0080	_	8.00	4,500	8,000	19	0.0004	0.503	36.5	4.1	354	40	443	50	885	100
PA321S_ _0100	_	10.0	4,500	8,000	19	0.0004	0.495	35.0	4.0	266	30	443	50	885	100
PA421 with Motor Mounting Plate or Input Shaft															
PA421S_ _0030	_	3.00	3,000	5,500	24	0.0020	2.251	100.6	11.4	443	50	885	100	2,124	240
PA421S_ _0040	_	4.00	3,300	6,000	24	0.0016	1.858	100.8	11.4	752	85	1,062	120	2,124	240
PA421S_ _0050	_	5.00	3,700	6,500	24	0.0016	1.752	100.2	11.3	752	85	1,062	120	2,124	240
PA421S_ _0070	_	7.00	4,000	7,000	24	0.0014	1.619	87.7	9.9	752	85	974	110	2,124	240
PA421S_ _0080	_	8.00	4,000	7,000	24	0.0014	1.599	83.0	9.4	708	80	885	100	1,770	200
PA421S_ _0100	_	10.00	4,000	7,000	24	0.0014	1.580	79.0	8.9	531	60	885	100	1,770	200
PA422 with Motor Mounting Plate or Input Shaft															
PA422S_ _0150	_	15.00	3,700	6,500	19	0.0006	0.630	92.2	10.4	443	50	885	100	2,124	240
PA422S_ _0160	_	16.00	3,700	6,500	19	0.0006	0.630	92.2	10.4	752	85	1,062	120	2,124	240
PA422S_ _0200	_	20.00	4,000	7,000	19	0.0005	0.578	92.1	10.4	752	85	1,062	120	2,124	240
PA422S_ _0250	_	25.00	4,000	7,000	19	0.0005	0.574	94.5	10.7	752	85	1,062	120	2,124	240
PA422S_ _0280	_	28.00	4,500	8,000	19	0.0005	0.521	90.4	10.2	752	85	1,062	120	2,124	240
PA422S_ _0320	_	32.00	3,700	6,500	19	0.0005	0.616	81.6	9.2	708	80	885	100	1,770	200
PA422S_ _0350	_	35.00	4,500	8,000	19	0.0005	0.519	93.4	10.6	752	85	1,062	120	2,124	240
PA422S_ _0400	_	40.00	4,500	8,000	19	0.0004	0.500	89.3	10.1	752	85	1,062	120	2,124	240
PA422S_ _0500	_	50.00	4,500	8,000	19	0.0004	0.499	92.6	10.5	752	85	1,062	120	2,124	240
PA422S_ _0700	_	70.00	4,500	8,000	19	0.0004	0.497	85.0	9.6	752	85	974	110	2,124	240
PA422S_ _1000	_	100.00	4,500	8,000	19	0.0004	0.497	77.9	8.8	531	60	885	100	1,770	200
PA521 with Motor Mounting Plate or Input Shaft															
PA521S_ _0030	_	3.00	2,500	4,500	32	0.0053	6.037	271.5	30.7	1,062	120	1,770	200	3,683	416
PA521S_ _0040	_	4.00	3,000	5,000	32	0.0052	5.825	260.3	29.4	1,859	210	2,655	300	4,910	555
PA521S_ _0050	_	5.00	3,500	6,000	32	0.0048	5.415	260.5	29.4	1,859	210	2,655	300	5,310	600
PA521S_ _0070	_	7.00	3,700	6,500	32	0.0044	4.968	240.2	27.1	1,859	210	2,390	270	5,310	600
PA521S_ _0080	_	8.00	3,700	6,500	32	0.0043	4.901	225.0	25.4	1,770	200	2,213	250	4,425	500
PA521S_ _0100	_	10.00	3,700	6,500	32	0.0043	4.837	218.2	24.7	1,239	140	2,213	250	4,425	500
PA522 with Motor Mounting Plate or Input Shaft															
PA522S_ _0150	_	15.00	3,300	6,000	24	0.0017	1.908	241.5	27.3	1,062	120	1,770	200	3,683	416
PA522S_ _0160	_	16.00	3,300	6,000	24	0.0017	1.908	241.5	27.3	1,859	210	2,655	300	4,910	555
PA522S_ _0200	_	20.00	3,700	6,500	24	0.0016	1.787	241.3	27.3	1,859	210	2,655	300	4,910	555
PA522S_ _0250	_	25.00	3,700	6,500	24	0.0016	1.771	248.0	28.0	1,859	210	2,655	300	5,310	600
PA522S_ _0280	_	28.00	4,000	7,000	24	0.0015	1.648	236.3	26.7	1,859	210	2,655	300	4,910	555
PA522S_ _0320	_	32.00	3,300	6,000	24	0.0016	1.855	222.2	25.1	1,770	200	2,213	250	4,425	500
PA522S_ _0350	_	35.00	4,000	7,000	24	0.0015	1.639	244.6	27.6	1,859	210	2,655	300	5,310	600
PA522S_ _0400	_	40.00	4,000	7,000	24	0.0014	1.594	232.0	26.2	1,859	210	2,655	300	4,910	555
PA522S_ _0500	_	50.00	4,000	7,000	24	0.0014	1.590	241.6	27.3	1,859	210	2,655	300	5,310	600
PA522S_ _0700	_	70.00	4,000	7,000	24	0.0014	1.587	232.9	26.3	1,859	210	2,390	270	5,310	600
PA522S_ _1000	_	100.00	4,000	7,000	24	0.0014	1.585	215.2	24.3	1,239	140	2,213	250	4,425	500

[1] For higher speeds than shown, contact Stober.

[2] Based on input speed: n1 = 2000 RPM
For torque at higher input speeds (T_{2NX}) solve the formula, where n1 = Actual Input Speed. $T_{2NX} = \frac{T_{2N}}{\sqrt[3]{\frac{n_1}{2000}}}$

[3] Maximum momentary torque for emergency stops or heavy shock load. Admissible stops per life of gearhead = 1,000 stops maximum.

"PA" Series–Advanced TigerLine ServoFit® Precision Planetary Gearhead Selection Data

Part Number (Gearhead + Input)		Exact Ratio	Maximum Input Speed [1]		Max. Motor Shaft	Mass Moment of Inertia		Torsional Stiffness C_2		Output Torque					
										Nominal [2] T_{2N}		Acceleration T_{2B}		Peak [3] T_{2PEAK}	
Gearhead	MF AW	i	Continuous RPM (n_1)	Cyclic RPM (n_1)	øD[6] mm	J_1 lb-in-s²	J_1 kgcm²	in.lbs. per arcmin	Nm per arcmin	in.lbs.	Nm	in.lbs.	Nm	in.lbs.	Nm
PA721 with Motor Mounting Plate or Input Shaft															
PA721S_ _0030	_	3.00	2,200	3,700	38	0.0179	20.248	484.1	54.7	2,478	280	4,425	500	9,168	1,036
PA721S_ _0040	_	4.00	2,500	4,500	38	0.0137	15.530	485.5	54.9	3,894	440	6,195	700	12,224	1,381
PA721S_ _0050	_	5.00	3,000	5,500	38	0.0124	13.996	481.2	54.4	3,894	440	6,195	700	12,390	1,400
PA721S_ _0070	_	7.00	3,300	6,000	38	0.0112	12.663	470.3	53.1	3,894	440	5,753	650	11,117	1,256
PA721S_ _0080	_	8.00	3,300	6,000	38	0.0110	12.402	457.2	51.7	3,540	400	4,425	500	8,850	1,000
PA721S_ _0100	_	10.00	3,300	6,000	38	0.0108	12.154	431.4	48.7	2,655	300	4,425	500	8,850	1,000
PA722 with Motor Mounting Plate or Input Shaft															
PA722S_ _0150	_	15.00	3,000	5,000	32	0.0052	5.912	471.0	53.2	2,478	280	4,425	500	9,168	1,036
PA722S_ _0160	_	16.00	3,000	5,000	32	0.0052	5.912	471.0	53.2	3,894	440	6,195	700	12,224	1,381
PA722S_ _0200	_	20.00	3,500	6,000	32	0.0049	5.485	471.0	53.2	3,894	440	6,195	700	12,224	1,381
PA722S_ _0250	_	25.00	3,500	6,000	32	0.0048	5.423	472.0	53.3	3,894	440	6,195	700	12,390	1,400
PA722S_ _0280	_	28.00	3,700	6,500	32	0.0045	5.062	466.5	52.7	3,894	440	6,195	700	12,224	1,381
PA722S_ _0320	_	32.00	3,000	5,000	32	0.0051	5.737	456.2	51.5	3,540	400	4,425	500	8,850	1,000
PA722S_ _0350	_	35.00	3,700	6,500	32	0.0045	5.030	469.1	53.0	3,894	440	6,195	700	12,390	1,400
PA722S_ _0400	_	40.00	3,700	6,500	32	0.0043	4.883	460.9	52.1	3,894	440	6,195	700	12,224	1,381
PA722S_ _0500	_	50.00	3,700	6,500	32	0.0043	4.867	465.5	52.6	3,894	440	6,195	700	12,390	1,400
PA722S_ _0700	_	70.00	3,700	6,500	32	0.0043	4.857	465.6	52.6	3,894	440	5,753	650	11,117	1,256
PA722S_ _1000	_	100.00	3,700	6,500	32	0.0043	4.852	429.5	48.5	2,655	300	4,425	500	8,850	1,000
PA821 with Motor Mounting Plate or Input Shaft															
PA821S_ _0030	_	3.00	1,800	3,000	48	0.0479	54.182	1,463.5	165.4	7,080	800	10,620	1,200	17,049	1,926
PA821S_ _0040	_	4.00	2,200	3,500	48	0.0268	30.340	1,546.5	174.7	7,080	800	14,160	1,600	22,732	2,569
PA821S_ _0050	_	5.00	2,500	4,000	48	0.0208	23.516	1,553.9	175.6	8,850	1,000	14,160	1,600	28,320	3,200
PA821S_ _0070	_	7.00	2,800	4,500	48	0.0167	18.856	1,477.5	167.0	8,850	1,000	12,390	1,400	24,878	2,811
PA821S_ _0080	_	8.00	2,800	4,500	48	0.0156	17.618	1,412.6	159.6	7,080	800	10,620	1,200	21,240	2,400
PA821S_ _0100	_	10.00	2,800	4,500	48	0.0146	16.449	1,321.9	149.4	6,195	700	10,620	1,200	21,240	2,400
PA822 with Motor Mounting Plate or Input Shaft															
PA822S_ _0150	_	15.00	2,500	4,500	38	0.0142	16.090	1,470.7	166.2	7,080	800	10,620	1,200	17,049	1,926
PA822S_ _0160	_	16.00	2,500	4,500	38	0.0142	16.090	1,470.7	166.2	7,080	800	14,160	1,600	28,320	3,200
PA822S_ _0200	_	20.00	3,000	5,500	38	0.0129	14.548	1,468.3	165.9	7,080	800	14,160	1,600	28,320	3,200
PA822S_ _0250	_	25.00	3,000	5,500	38	0.0126	14.276	1,502.5	169.8	8,850	1,000	14,160	1,600	28,320	3,200
PA822S_ _0280	_	28.00	3,300	6,000	38	0.0114	12.919	1,461.8	165.2	7,080	800	14,160	1,600	28,320	3,200
PA822S_ _0320	_	32.00	2,500	4,500	38	0.0135	15.293	1,404.4	158.7	7,080	800	10,620	1,200	21,240	2,400
PA822S_ _0350	_	35.00	3,300	6,000	38	0.0113	12.780	1,498.1	169.3	8,850	1,000	14,160	1,600	28,320	3,200
PA822S_ _0400	_	40.00	3,300	6,000	38	0.0109	12.280	1,436.6	162.3	7,080	800	14,160	1,600	28,320	3,200
PA822S_ _0500	_	50.00	3,300	6,000	38	0.0108	12.211	1,481.1	167.4	8,850	1,000	14,160	1,600	28,320	3,200
PA822S_ _0700	_	70.00	3,300	6,000	38	0.0108	12.165	1,454.6	164.4	8,850	1,000	12,390	1,400	24,878	2,811
PA822S_ _1000	_	100.00	3,300	6,000	38	0.0107	12.141	1,312.8	148.3	6,195	700	10,620	1,200	21,240	2,400

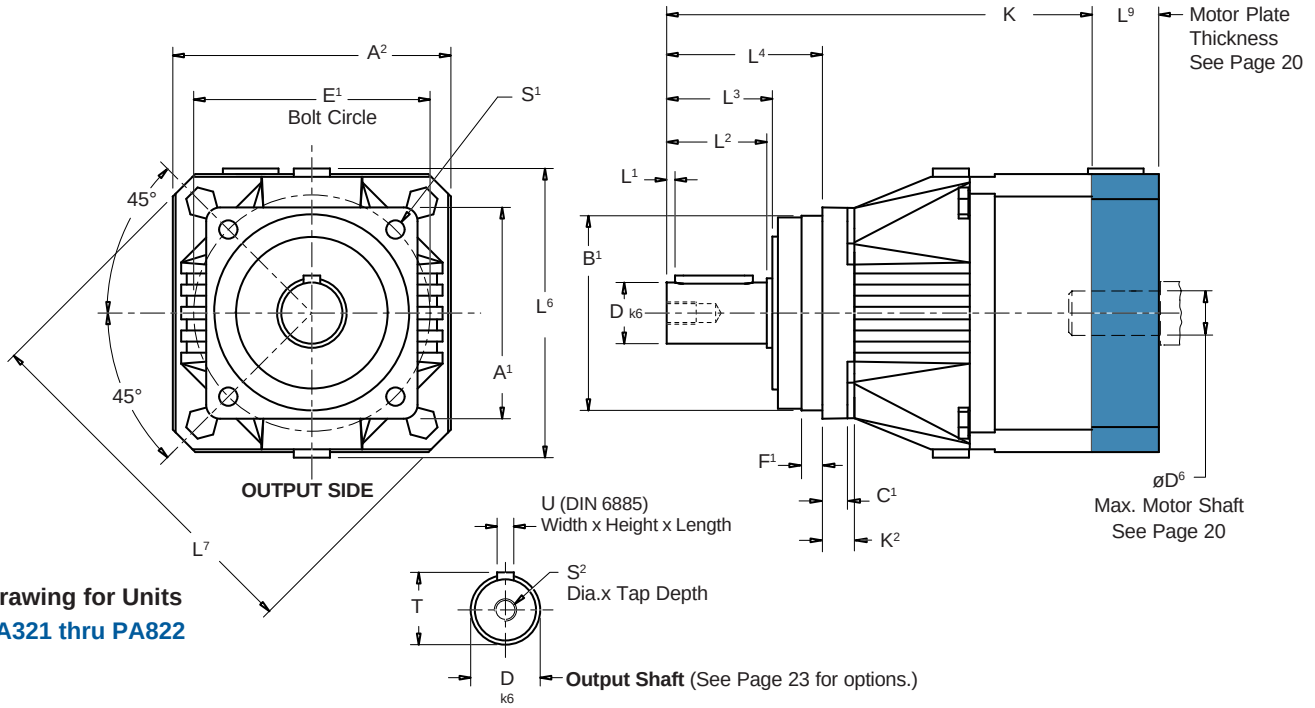
See web site . . . . . for drawings.

Index of Symbols

MF ..... Motor adapter with FlexiAdapt® coupling	C_2 ..... Torsional Stiffness
AW ..... Input shaft	T_{2N} ..... Nominal Torque
i ..... Ratio - Exact	T_{2B} ..... Acceleration Torque Maximum
n_1 ..... Maximum input speed RPM	T_{2PEAK} ..... Peak Torque
J_1 ..... Mass moment of inertia (input)	

"PA" Series–Advanced TigerLine ServoFit® Precision Planetary Gearhead Dimensional Data

Dimension shown in millimeters over inches.



Drawing for Units
PA321 thru PA822

Table No. 1 **"PA" Series – Advanced Precision Planetary Gearhead Dimensions (mm/inches)**

Unit	A1	A2	B1 h6	C1	D k6	E1	F1	K2	L1	L2	L3	L4	L6	L7	S1	S2	T	U
PA321	72	72	60 +.000/-.019	7	16 +.012/+.001	75	7.5	–	2	28	30	48	79	92	5.5	M5x12.5	18	A5x5x22
	2.83	2.83	2.362 +.0000/-.0007	.28		2.95	.30	–	.08	1.10	1.18	1.89	3.11	3.62	.22		.71	
PA421/PA422	98	76	70 +.000/-.019	9	22 +.015/+.002	85	7.5	12	3	36	38	56	98	130	6.6	M8x19	24.5	A6x6x28
	3.86	2.99	2.756 +.0000/-.0007	.35		3.35	.30	.47	.12	1.42	1.50	2.20	3.86	5.12	.26		.96	
PA521/PA522	115	101	90 +.000/-.022	10	32 +.018/+.002	120	15	14	3	58	60	88	121	149	9	M12x28	35	A10x8x50
	4.53	3.98	3.543 +.0000/-.0009	.39		4.42	.59	.55	.12	14.09	2.36	3.46	4.76	5.87	.35		1.38	
PA721/PA722	145	145	130 +.000/-.025	15	40 +.018/+.002	165	3.5	–	4	82	85	112	145	190	11	M16x36	43	A12x8x70
	5.71	5.71	5.118 +.000/-.001	.59		6.50	.14	–	.16	3.23	3.35	4.41	5.71	7.48	.43		1.69	
PA821/PA822	190	190	160 +.000/-.025	15	55 +.021/+.002	215	10	–	6	82	85	112	190	250	13.5	M20x42	59	A12x8x70
	7.48	7.48	6.299 +.000/-.001	.59		8.46	.39	–	.24	3.23	3.35	4.41	7.48	9.84	.53		2.32	

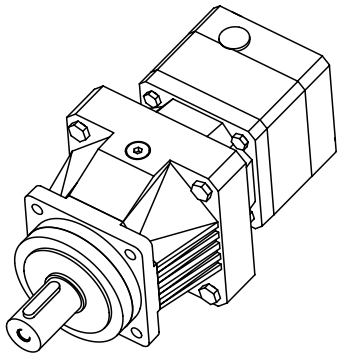
Table No. 2

Unit	K	
	mm	inches
P321	135	5.31
P421	153	6.02
P422	200.5	7.89
P521	193	7.60
P522	242.5	9.55
P721	242	9.53
P722	294	11.57
P821	283	11.14
P822	350.5	13.80

Part No. Explanation

PA 4 2 1 S P D 0030 MF

- Motor Plate with FlexiAdapt® Coupling
- Ratio (**0030** = 3.0:1)
- **D –** Reinforced Bearings-Axial
- **G –** Shaft – no Key
- **P –** Output Shaft with Key
- **V –** Splined Shaft
- Standard Housing
- No. of Gear Stages (**1** = 1 Stage, **2** = 2 Stages)
- Generation Number
- Unit No.
- Advanced TigerLine ServoFit Precision Planetary Gearhead



Typical 2 Stage Configuration

When ordering a planetary gearhead, specify the motor manufacturer and part number, provide the motor drawing with dimensions, or specify the motor mounting dimensions. (See Page 20)

"PA" Series–Advanced TigerLine ServoFit® Precision Planetary Gearhead Dimensional Data

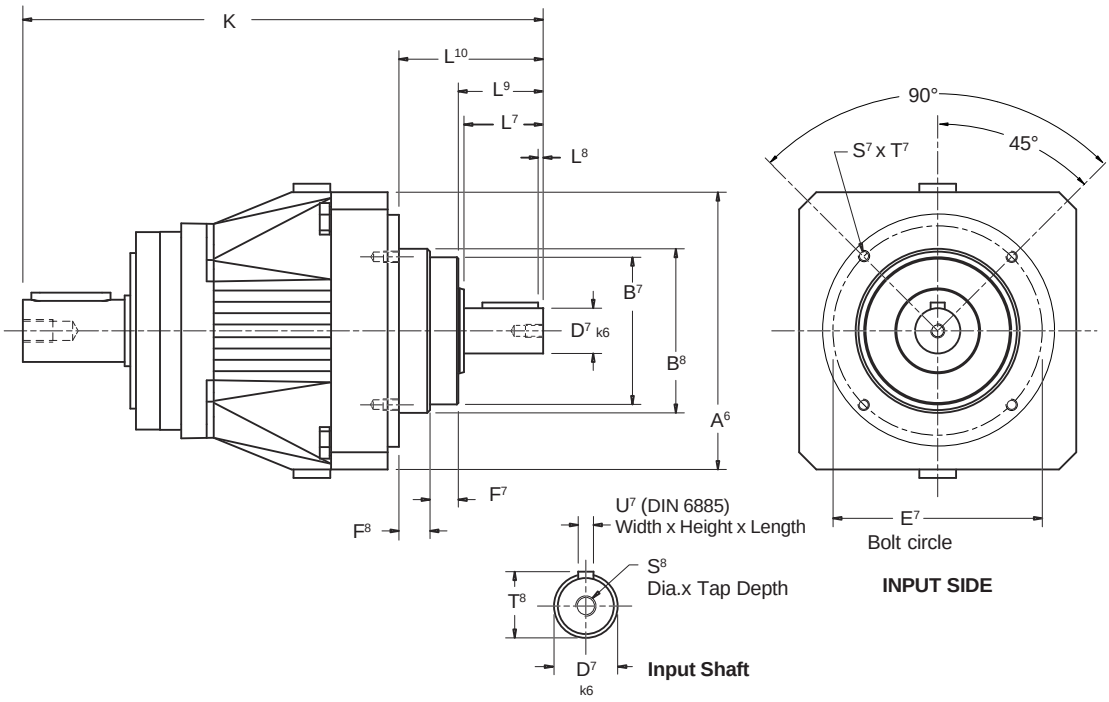
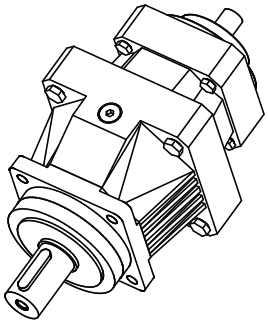


Table No. 3 **"PA" Series – Advanced Precision Planetary Gearhead Dimensions (mm/inches)**

Unit	A^6	B^7 h6	B^8 g6	D^7 k6	E^7	F^7	F^8	K	L^7	L^8	L^9	L^{10}	S^7	S^8	T^7	T^8	U^7
PA321	72	45 -.009/-.025	–	12 +.012/+.001	55.5	10.5	–	148	18	2	18.5	29	M4	M4x10	8	13.5	A4x4x14
	2.83	1.772 -.0004/-.0010	–		2.19	.41	–	5.83	.71	.08	.73	1.14			.31	.53	
PA421	98	52 -.010/-.029	58 -.012/-.034	16 +.012/+.001	74	10	11	184	28	2	30	51	M4	M5x12.5	6	18	A5x5x22
	3.86	2.047 -.0004/-.0011	2.283 -.0005/-.0013		2.91	.39	.43	7.24	1.10	.08	1.18	2.01			.24	.71	
PA422	72	45 -.010/-.029	–	12 +.012/+.001	55.5	10.5	–	213.5	18	2	18.5	29	M4	M4x10	8	13.5	A4x4x14
	2.83	1.772 -.0004/-.0011	–		2.19	.41		8.41	.71	.08	.73	1.14			.31	.53	
PA521	115	60 -.010/-.029	66 -.010/-.029	22 +.015/+.002	97	13	10	232	36	2	38	61	M5	M8x19	9	24.5	A6x6x30
	4.53	2.362 -.0004/-.0011	2.598 -.0004/-.0011		3.82	.51	.39	9.13	1.42	.08	1.50	2.40			.35	.96	
PA522	98	52 -.010/-.029	58 -.012/-.034	16 +.012/+.001	74	10	11	273.5	28	2	30	51	M4	M5x12.5	6	18	A5x5x22
	3.86	2.047 -.0004/-.0011	2.283 -.0005/-.0013		2.91	.39	.43	10.77	1.10	.08	1.18	2.01			.24	.71	
PA721	144	80 -.010/-.029	93 -.012/-.034	32 +.018/+.002	123	18	12	302	58	3	60	90	M6	M12x28	9	35	A10x8x50
	5.67	3.150 -.0004/-.0011	3.661 -.0005/-.0013		4.84	.71	.47	11.89	2.28	.12	2.36	3.54			.35	1.38	
PA722	114	60 -.010/-.029	66 -.010/-.029	22 +.015/+.002	97	13	10	333	36	2	38	61	M5	M8x19	9	24.5	A6x6x30
	4.49	2.362 -.0004/-.0011	2.598 -.0004/-.0011		3.82	.51	.39	13.11	1.42	.08	1.50	2.40			.35	.96	
PA821	190	110 -.012/-.034	134 -.014/-.039	40 +.018/+.002	179	21	15	367	82	4	84	120	M8	M16x36	12	43	A12x8x70
	7.48	4.331 -.0005/-.0013	5.276 -.0006/-.0015		7.05	.83	.59	14.45	3.23	.16	3.31	4.72			.47	1.69	
PA822	144	80 -.010/-.029	93 -.012/-.034	32 +.018/+.022	123	18	12	410.5	58	3	60	90	M6	M12x28	9	35	A10x8x50
	5.67	3.150 -.0004/-.0011	3.661 -.0005/-.0013		4.84	.71	.47	16.16	2.28	.12	2.36	3.54			.35	1.38	



Typical 2 Stage Configuration

Part No. Explanation

PA 4 2 2 S P D 0150 AW

- Input Shaft
- Ratio (**0150** = 15.0:1)
- **D –** Reinforced Bearings-Axial
- **G –** Shaft – no Key
- **P –** Output Shaft with Key
- **V –** Splined Shaft
- Standard Housing
- No. of Gear Stages (**1** = 1 Stage, **2** = 2 Stages)
- Generation Number
- Unit No.
- Advanced TigerLine ServoFit Precision Planetary Gearhead

"PKX" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Performance Specification Overview

				P321 KX3	P421 KX4	P422 KX3	P521 KX5	P522 KX4	P721 KX7	P722 KX5	P821 KX8	P822 KX7
Permissible Acceleration Torque	T_{2B}		in.lbs. Nm	575 65	1052 120		2,655 300		6,195 700		14,160 1,600	
Nominal Output Torque [1]	T_{2N}		in.lbs. Nm	398 45	752 85		1,858 210		3,894 440		8,850 1,000	
Input Speed Maximum [2]	n_{1MAX}		Continuous Cyclic	3,000 6,000	3,000 6,000		3,000 4,500		2,500 4,500		1,800 4,000	2,500 4,500
Torsional Backlash [3]	$\Delta\varphi$		arcmin 1 Stage 2 Stage	 5 - 7.5 –	 5 - 7.5 5 - 5.5		 4 - 6.5 4 - 5.5		 4 - 5.5 4 - 5.5		 4 - 5.5 4 - 5.5	
Torsional Stiffness	C_2		in.lbs./arcmin Nm/arcmin	44 5	100 11		266 33		486 55		1,557 176	
Axial Load Max.	F_{2AMAX}	R	lbs. N	225 1,000	337 1,500		518 2,300		653 2,900		1,058 4,700	
See Page 22 for BEARING OPTIONS		D	lbs. N	315 1,400	506 2,250		788 3,500		1,013 4,500		1,688 7,500	
		Z	lbs. N	135 600	225 1,000		360 1,600		450 2,000		675 3,000	
Radial Load Max. [4]	F_{2RMAX}	R	lbs. N	563 2,500	900 4,000		1,463 6,500		1,800 8,000		2,925 13,000	
See Page 22 for BEARING OPTIONS		D	lbs. N	619 2,750	1,013 4,500		1,575 7,000		2,025 9,000		3,375 15,000	
		Z	lbs. N	675 3,000	1,125 5,000		1,800 8,000		2,250 10,000		4,050 18,000	
Tilting Moment Max.[4]	T_{2Kmax}	R	in.lbs. Nm	1,859 210	3,451 390		6,956 786		10,337 1,168		20,364 2,301	
See Page 22 for BEARING OPTIONS		D	in.lbs. Nm	2,044 231	3,885 439		7,496 847		11,629 1,314		23,497 2,655	
		Z	in.lbs. Nm	2,230 252	4,319 488		8,567 968		12,921 1,460		28,196 3,186	
Weight	m		pounds kg	9.5 4.3	15 6.8	16 7.0	28.5 12.8	25 11.3	51 23.2	47 21.3	105 47.4	95 43.2
Noise Level	L_{PA}		dB(A) [5]	≤69	≤70	≤69	≤71	≤70	≤73	≤71	≤75	≤73
Efficiency (at Nom. Torque)	η		%	93-95								
Balance Quality				Q 2.5 (Quality Class-2.5 millimeters per second)								
Lubrication				Synthetic Oil – Lubricated for Life								
Degree of Protection				IP65 - FKM Shaft Seals								
Mounting Position				Must be Specified (See Page 25)								
Direction of Rotation				(See Page 24)								
Ambient Temperature				0°C to +40°C (104° F) Other temperatures, contact Stober Drives.								
Finish				Black								
Lifetime.[6]	L_h		hours	L_h > 10,000 hours if T_{2K}/T_{2A} < 1.25 and > 1.00 L_h > 20,000 hours if T_{2K}/T_{2A} > 1.25 and < 1.50 L_h > 30,000 hours if T_{2K}/T_{2A} > 1.5								
Warranty				5 Year Limited (2 Years on normal wear items: bearings, seals, etc.)								

1) Ratings based on input speed (n_1) of 2000 RPM.
For torque at higher input speeds (T_{2NX}) solve the formula, where n1 = Actual Input Speed. $T_{2NX} = \frac{T_{2N}}{\sqrt[3]{\frac{n_1}{2000}}}$

2) For speeds higher than given above, contact Stober Technical Support.

3) Lower than standard backlash is available upon request. Contact Stober Technical Support.
(Tested at 1.5% of nominal torque and recorded on the input side of the gearhead.)

4) Rating based on output speed (n2) of 100 RPM. For values at other speeds see Page 21.

5) Measurement at one (1) meter distance with input speed (n1) of 3000 RPM.

6) T_{2A} equals actual tilting moment of the application. See Page 22 for calculation details.

Refer to Page 27 for ServoFit Precision Planetary Gearhead Selection Procedure.

"PKX" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Features

The "PKX" Series–TigerLine of ServoFit Precision Planetary Gearheads units are a combination of the "P" Series gearhead and a right angle which uses the FlexiAdapt® motor coupling. HeliCamber® gear technology provides minimum wear, low backlash, and low noise. "PKX" Series units are lubricated for life with synthetic oil and sealed to IP65 standards to prevent lubricant contamination for long life. They have all the great features of the "P" Series unit plus the compact design of a right angle.

Some of these features are:

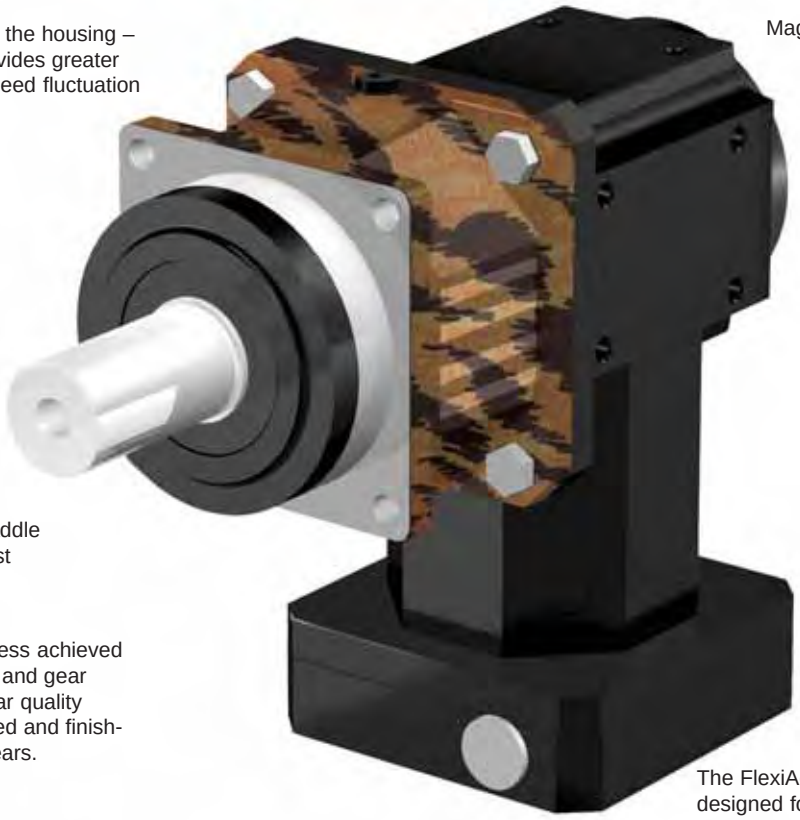
- Readily Attaches to Any Servo Motor (IEC, NEMA, or customized motor plates*)
- 5 Year Limited Warranty (2 years on bearings, seals, etc.)
- Lowest Standard Backlash
- High Torsional Stiffness
- Advanced Gear Technology
- 93 to 95% Efficiency
- Quiet Running
- Assembled in the U.S.A.

NO EXPEDITE FEE FOR 24 HOUR SERVICE

Highest running accuracy and precision ensured by single piece housing made from high-tensile tempered ductile iron with the additional characteristics of dissipating heat, noise dampening, and greater lubrication retention on the ring gear

Ring gear machined integral to the housing – not welded or pressed in – provides greater concentricity and eliminates speed fluctuation

Magnetic oil filtration



Bearing options for application specific radial load, axial load, and tilting moments

FKM seals

Planet carrier straddle mounted for robust output capacity

Adapter bushings to fit all motor shafts – no key required

Highest running smoothness achieved by proven helical gearing and gear tooth microgeometry. Gear quality provided by case-hardened and finish-ground sun and planet gears.

Motor plate pilot toleranced to fit your motor for precise concentricity

Motor plate can easily be changed to fit your choice of motors

The FlexiAdapt® motor coupling is designed for accurate and precise motor installation. The integrated thermal expansion feature in the shape of a bellows compensates for linear expansion of the motor shaft.

The FlexiAdapt® motor shaft adapter system allows installation of motor in minutes without special tools.

* Maximum 10 working days for custom motor plates.

"PKX" Series–TigerLine Right Angle ServoFit® Precision Planetary Gearhead Selection Data

Part Number (Gearhead + Input)	Exact Ratio i	Maximum Input Speed RPM (n_1) [1] Continuous EL 1,2,5,6	Maximum Input Speed RPM (n_1) [1] Continuous EL 3,4	Maximum Input Speed RPM (n_1) [1] Cyclic All	Max. Motor Shaft øD[6] mm	Mass Moment of Inertia J_1 lb-in-s²	Mass Moment of Inertia J_1 kgcm²	Torsional Stiffness C_2 in.lbs. per arcmin	Torsional Stiffness C_2 Nm per arcmin	Output Torque Nominal [2] T_{2N} in.lbs.	Output Torque Nominal [2] T_{2N} Nm	Output Torque Acceleration T_{2B} in.lbs.	Output Torque Acceleration T_{2B} Nm	Output Torque Peak [3] T_{2PEAK} in.lbs.	Output Torque Peak [3] T_{2PEAK} N
P321S_ _KX3 with Motor Mounting Plate															
P321S_ _0030 KX301VF0010MF	3.00	3,000	2,500	4,000	19	0.0011	1.210	22.3	2.5	258	29	335	38	567	64
P321S_ _0040 KX301VF0010MF	4.00	3,000	2,500	4,000	19	0.0010	1.128	28.2	3.2	343	39	446	50	755	85
P321S_ _0050 KX301VF0010MF	5.00	3,000	2,500	4,000	19	0.0010	1.081	32.1	3.6	398	45	558	63	944	107
P321S_ _0030 KX301VF0020MF	6.00	3,500	3,000	5,000	19	0.0008	0.853	22.3	2.5	258	29	335	38	644	73
P321S_ _0070 KX301VF0010MF	7.00	3,000	2,500	4,000	19	0.0009	1.038	33.0	3.7	398	45	531	60	1,151	130
P321S_ _0040 KX301VF0020MF	8.00	3,500	3,000	5,000	19	0.0007	0.833	28.2	3.2	343	39	446	50	858	97
P321S_ _0050 KX301VF0020MF	10.00	3,500	3,000	5,000	19	0.0007	0.821	32.1	3.6	398	45	558	63	1,073	121
P321S_ _0040 KX301VF0030MF	12.00	3,500	3,000	6,000	19	0.0007	0.759	28.2	3.2	343	39	446	50	858	97
P321S_ _0050 KX301VF0030MF	15.00	3,500	3,000	6,000	19	0.0007	0.753	32.1	3.6	398	45	558	63	1,073	121
P321S_ _0100 KX301VF0020MF	20.00	3,500	3,000	5,000	19	0.0007	0.806	32.8	3.7	266	30	443	50	885	100
P321S_ _0100 KX301VF0030MF	30.00	3,500	3,000	6,000	19	0.0007	0.747	32.8	3.7	266	30	443	50	885	100
P421S_ _KX4 with Motor Mounting Plate															
P421S_ _0030 KX401VF0010MF	3.00	2,500	2,000	3,500	24	0.0027	3.045	46.3	5.2	443	50	644	73	1,288	146
P421S_ _0040 KX401VF0010MF	4.00	2,500	2,000	3,500	24	0.0023	2.651	60.7	6.9	687	78	858	97	1,717	194
P421S_ _0050 KX401VF0010MF	5.00	2,500	2,000	3,500	24	0.0023	2.545	70.5	8.0	752	85	1,062	120	2,124	240
P421S_ _0030 KX401VF0020MF	6.00	2,500	2,500	4,000	24	0.0016	1.794	46.3	5.2	443	50	644	73	1,288	146
P421S_ _0070 KX401VF0010MF	7.00	2,500	2,000	3,500	24	0.0022	2.435	74.1	8.4	752	85	974	110	2,124	240
P421S_ _0040 KX401VF0020MF	8.00	2,500	2,500	4,000	24	0.0015	1.696	60.7	6.9	687	78	858	97	1,717	194
P421S_ _0050 KX401VF0020MF	10.00	2,500	2,500	4,000	24	0.0015	1.669	70.5	8.0	752	85	1,062	120	2,124	240
P421S_ _0040 KX401VF0030MF	12.00	3,000	3,000	4,500	24	0.0013	1.465	60.7	6.9	687	78	858	97	1,717	194
P421S_ _0050 KX401VF0030MF	15.00	3,000	3,000	4,500	24	0.0013	1.453	70.5	8.0	752	85	1,062	120	2,124	240
P421S_ _0100 KX401VF0020MF	20.00	2,500	2,500	4,000	24	0.0014	1.632	73.1	8.3	531	60	885	100	1,770	200
P421S_ _0100 KX401VF0030MF	30.00	3,000	3,000	4,500	24	0.0013	1.436	73.1	8.3	531	60	885	100	1,770	200
P422S_ _KX3 with Motor Mounting Plate															
P422S_ _0350 KX301VF0010MF	35.00	3,500	2,500	4,000	19	0.0009	1.046	92.0	10.4	752	85	1,062	120	2,124	240
P422S_ _0200 KX301VF0020MF	40.00	3,000	3,000	5,000	19	0.0007	0.824	88.0	9.9	752	85	1,062	120	2,124	240
P422S_ _0250 KX301VF0020MF	50.00	3,500	3,000	5,000	19	0.0007	0.823	91.7	10.4	752	85	1,062	120	2,124	240
P422S_ _0200 KX301VF0030MF	60.00	3,500	3,000	6,000	19	0.0007	0.755	88.0	9.9	752	85	1,062	120	2,124	240
P422S_ _0700 KX301VF0010MF	70.00	3,500	2,500	4,000	19	0.0009	1.024	84.7	9.6	752	85	974	110	2,124	240
P422S_ _0250 KX301VF0030MF	75.00	3,500	3,000	6,000	19	0.0007	0.754	91.7	10.4	752	85	1,062	120	2,124	240
P422S_ _0500 KX301VF0020MF	100.00	3,500	3,000	5,000	19	0.0007	0.807	91.9	10.4	752	85	1,062	120	2,124	240
P422S_ _0500 KX301VF0030MF	150.00	3,500	3,000	6,000	19	0.0007	0.747	91.9	10.4	752	85	1,062	120	2,124	240
P422S_ _1000 KX301VF0020MF	200.00	3,500	3,000	5,000	19	0.0007	0.807	77.8	8.8	531	60	885	100	1,770	200
P422S_ _1000 KX301VF0030MF	300.00	3,500	3,000	6,000	19	0.0007	0.747	77.8	8.8	531	60	885	100	1,770	200
P521S_ _KX5 with Motor Mounting Plate															
P521S_ _0030 KX501VF0010MF	3.00	2,500	2,000	3,000	32	0.0077	8.734	119.8	13.5	1,062	120	1,622	183	3,219	364
P521S_ _0040 KX501VF0010MF	4.00	2,500	2,000	3,000	32	0.0075	8.522	154.7	17.5	1,717	194	2,163	244	4,292	485
P521S_ _0050 KX501VF0010MF	5.00	2,500	2,000	3,000	32	0.0072	8.112	181.3	20.5	1,859	210	2,655	300	5,310	600
P521S_ _0030 KX501VF0020MF	6.00	2,500	2,500	3,500	32	0.0049	5.588	119.8	13.5	1,062	120	1,622	183	3,219	364
P521S_ _0070 KX501VF0010MF	7.00	2,500	2,000	3,000	32	0.0068	7.736	200.1	22.6	1,859	210	2,390	270	5,310	600
P521S_ _0040 KX501VF0020MF	8.00	2,500	2,500	3,500	32	0.0049	5.535	154.7	17.5	1,717	194	2,163	244	4,292	485
P521S_ _0050 KX501VF0020MF	10.00	2,500	2,500	3,500	32	0.0048	5.432	181.3	20.5	1,859	210	2,655	300	5,310	600
P521S_ _0040 KX501VF0030MF	12.00	3,000	3,000	4,000	32	0.0043	4.892	154.7	17.5	1,717	194	2,163	244	4,292	485
P521S_ _0050 KX501VF0030MF	15.00	3,000	3,000	4,000	32	0.0043	4.847	181.3	20.5	1,859	210	2,655	300	5,310	600
P521S_ _0100 KX501VF0020MF	20.00	2,500	2,500	3,500	32	0.0047	5.305	200.4	22.6	1,239	140	2,213	250	4,425	500
P521S_ _0100 KX501VF0030MF	30.00	3,000	3,000	4,000	32	0.0042	4.790	200.4	22.6	1,239	140	2,213	250	4,425	500
P522S_ _KX4 with Motor Mounting Plate Continued Next Page															
P522S_ _0350 KX401VF0010MF	35.00	2,500	2,000	3,500	24	0.0022	2.456	239.6	27.1	1,859	210	2,655	300	5,310	600
P522S_ _0200 KX401VF0020MF	40.00	2,500	2,500	4,000	24	0.0015	1.678	226.9	25.6	1,859	210	2,655	300	4,910	555
P522S_ _0250 KX401VF0020MF	50.00	2,500	2,500	4,000	24	0.0015	1.674	238.1	26.9	1,859	210	2,655	300	5,310	600

[1] For higher speeds than shown, contact Stober.

[2] Based on input speed: n1 = 2000 RPM
For torque at higher input speeds (T_{2NX}) solve the formula, where n1 = Actual Input Speed. $T_{2NX} = \frac{T_{2N}}{\sqrt[3]{\frac{n_1}{2000}}}$

[3] Maximum momentary torque for emergency stops or heavy shock load. Admissible stops per life of gearhead = 1,000 stops maximum.

"PKX" Series–TigerLine Right Angle ServoFit® Precision Planetary Gearhead Selection Data

See web site . . . . for drawings.

Part Number (Gearhead + Input)	Exact Ratio i	Maximum Input Speed RPM (n_1) [1] Continuous EL 1,2,5,6	Continuous EL 3,4	Cyclic All	Max. Motor Shaft øD[6] mm	Mass Moment of Inertia J_1 lb-in-s²	kgcm²	Torsional Stiffness C_2 in.lbs. per arcmin	Nm	Output Torque Nominal [2] T_{2N} in.lbs.	Nm	Acceleration T_{2B} in.lbs.	Nm	Peak [3] T_{2PEAK} in.lbs.	N
P522S_ _KX4 with Motor Mounting Plate Continued															
P522S_ _0200 KX401VF0030MF	60.00	3,000	3,000	4,500	24	0.0013	1.457	226.9	25.6	1,859	210	2,655	300	4,910	555
P522S_ _0700 KX401VF0010MF	70.00	2,500	2,000	3,500	24	0.0021	2.404	231.8	26.2	1,859	210	2,390	270	5,310	600
P522S_ _0250 KX401VF0030MF	75.00	3,000	3,000	4,500	24	0.0013	1.455	238.1	26.9	1,859	210	2,655	300	5,310	600
P522S_ _0500 KX401VF0020MF	100.00	2,500	2,500	4,000	24	0.0014	1.635	239.2	27.0	1,859	210	2,655	300	5,310	600
P522S_ _0500 KX401VF0030MF	150.00	2,500	3,000	4,500	24	0.0013	1.438	239.2	27.0	1,859	210	2,655	300	5,310	600
P522S_ _1000 KX401VF0020MF	200.00	2,500	2,500	4,000	24	0.0014	1.633	214.7	24.3	1,239	140	2,213	250	4,425	500
P522S_ _1000 KX401VF0030MF	300.00	3,000	3,000	4,500	24	0.0013	1.437	214.7	24.3	1,239	140	2,213	250	4,425	500
P721S_ _KX7 with Motor Mounting Plate															
P721S_ _0030 KX701VF0010MF	3.00	1,800	1,600	2,250	38	0.0294	33.167	325.4	36.8	2,478	280	3,219	364	5,666	640
P721S_ _0040 KX701VF0010MF	4.00	1,800	1,600	2,250	38	0.0252	28.449	380.7	43.0	3,434	388	4,292	485	7,554	854
P721S_ _0050 KX701VF0010MF	5.00	1,800	1,600	2,250	38	0.0238	26.915	409.7	46.3	3,894	440	5,365	606	9,443	1,067
P721S_ _0030 KX701VF0020MF	6.00	1,800	1,800	3,000	38	0.0149	16.788	325.4	36.8	2,478	280	3,219	364	6,438	728
P721S_ _0070 KX701VF0010MF	7.00	1,800	1,600	2,250	38	0.0229	25.916	435.3	49.2	3,894	440	5,753	650	11,117	1,256
P721S_ _0040 KX701VF0020MF	8.00	1,800	1,800	3,000	38	0.0138	15.609	380.7	43.0	3,434	388	4,292	485	8,585	970
P721S_ _0050 KX701VF0020MF	10.00	1,800	1,800	3,000	38	0.0135	15.225	409.7	46.3	3,894	440	5,365	606	10,731	1,213
P721S_ _0040 KX701VF0030MF	12.00	2,100	2,100	3,500	38	0.0113	12.818	380.7	43.0	3,434	388	4,292	485	8,585	970
P721S_ _0050 KX701VF0030MF	15.00	2,100	2,100	3,500	38	0.0112	12.648	409.7	46.3	3,894	440	5,365	606	10,731	1,213
P721S_ _0100 KX701VF0020MF	20.00	1,800	1,800	3,000	38	0.0131	14.848	416.4	47.0	2,655	300	4,425	500	8,850	1,000
P721S_ _0100 KX701VF0030MF	30.00	2,100	2,100	3,500	38	0.0110	12.480	416.4	47.0	2,655	300	4,425	500	8,850	1,000
P722S_ _KX5 with Motor Mounting Plate															
P722S_ _0350 KX501VF0010MF	35.00	2,500	2,000	3,000	32	0.0069	7.798	461.9	52.2	3,894	440	6,195	700	12,390	1,400
P722S_ _0200 KX501VF0020MF	40.00	2,500	2,500	3,500	32	0.0048	5.450	448.8	50.7	3,894	440	6,195	700	12,224	1,381
P722S_ _0250 KX501VF0020MF	50.00	2,500	2,500	3,500	32	0.0048	5.434	457.5	51.7	3,894	440	6,195	700	12,390	1,400
P722S_ _0200 KX501VF0030MF	60.00	3,000	3,000	4,000	32	0.0043	4.854	448.8	50.7	3,894	440	6,195	700	12,224	1,381
P722S_ _0700 KX501VF0010MF	70.00	2,500	2,000	3,000	32	0.0067	7.625	463.8	52.4	3,894	440	5,753	650	11,117	1,256
P722S_ _0250 KX501VF0030MF	75.00	3,000	3,000	4,000	32	0.0043	4.847	457.5	51.7	3,894	440	6,195	700	12,390	1,400
P722S_ _0500 KX501VF0020MF	100.00	2,500	2,500	3,500	32	0.0047	5.313	462.0	52.2	3,894	440	6,195	700	12,390	1,400
P722S_ _0500 KX501VF0030MF	150.00	3,000	3,000	4,000	32	0.0042	4.794	462.0	52.2	3,894	440	6,195	700	12,390	1,400
P722S_ _1000 KX501VF0020MF	200.00	2,500	2,500	3,500	32	0.0047	5.309	428.7	48.4	2,655	300	4,425	500	8,850	1,000
P722S_ _1000 KX501VF0030MF	300.00	3,000	3,000	4,000	32	0.0042	4.792	428.7	48.4	2,655	300	4,425	500	8,850	1,000
P821S_ _KX8 with Motor Mounting Plate															
P821S_ _0030 KX801VF0020MF	6.00	1,100	1,100	2,500	48	0.0522	58.975	740.4	83.7	5,151	582	7,082	800	12,877	1,455
P821S_ _0040 KX801VF0020MF	8.00	1,100	1,100	2,500	48	0.0469	53.015	978.5	110.6	6,868	776	9,443	1,067	17,169	1,940
P821S_ _0050 KX801VF0020MF	10.00	1,100	1,100	2,500	48	0.0454	51.309	1,131.5	127.9	8,585	970	11,804	1,334	21,461	2,425
P821S_ _0040 KX801VF0030MF	12.00	1,300	1,300	3,000	48	0.0399	45.063	978.5	110.6	6,868	776	9,443	1,067	17,169	1,940
P821S_ _0050 KX801VF0030MF	15.00	1,300	1,300	3,000	48	0.0392	44.305	1,131.5	127.9	8,585	970	11,804	1,334	21,461	2,425
P821S_ _0100 KX801VF0020MF	20.00	1,100	1,100	2,500	48	0.0438	49.537	1,228.7	138.8	6,195	700	10,620	1,200	21,240	2,400
P821S_ _0100 KX801VF0030MF	30.00	1,300	1,300	3,000	48	0.0385	43.517	1,228.7	138.8	6,195	700	10,620	1,200	21,240	2,400
P822S_ _KX7 with Motor Mounting Plate															
P822S_ _0350 KX701VF0010MF	35.00	1,800	1,600	2,250	38	0.0230	26.033	1,483.0	167.6	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _0200 KX701VF0020MF	40.00	1,800	1,800	3,000	38	0.0136	15.363	1,421.0	160.6	7,080	800	14,160	1,600	28,320	3,200
P822S_ _0250 KX701VF0020MF	50.00	1,800	1,800	3,000	38	0.0135	15.295	1,470.4	166.1	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _0200 KX701VF0030MF	60.00	2,100	2,100	3,500	38	0.0112	12.709	1,421.0	160.6	7,080	800	14,160	1,600	28,320	3,200
P822S_ _0700 KX701VF0010MF	70.00	1,800	1,600	2,250	38	0.0225	25.418	1,450.9	163.9	8,850	1,000	12,390	1,400	24,878	2,811
P822S_ _0250 KX701VF0030MF	75.00	2,100	2,100	3,500	38	0.0112	12.679	1,470.4	166.1	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _0500 KX701VF0020MF	100.00	1,800	1,800	3,000	38	0.0132	14.863	1,473.8	166.5	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _0500 KX701VF0030MF	150.00	2,100	2,100	3,500	38	0.0111	12.487	1,473.8	166.5	8,850	1,000	14,160	1,600	28,320	3,200
P822S_ _1000 KX701VF0020MF	200.00	1,800	1,800	3,000	38	0.0131	14.845	1,311.4	148.2	6,195	700	10,620	1,200	21,240	2,400
P822S_ _1000 KX701VF0030MF	300.00	2,100	2,100	3,500	38	0.0110	12.479	1,311.4	148.2	6,195	700	10,620	1,200	21,240	2,400

Index of Symbols

MT ..... Motor adapter with FlexiAdapt® coupling	C_2 ..... Torsional Stiffness
AW ..... Input shaft	T_{2N} ..... Nominal Torque
i ..... Ratio - Exact	T_{2B} ..... Acceleration Torque Maximum
n_1 ..... Maximum input speed RPM	T_{2PEAK} ..... Peak Torque
J_1 ..... Mass moment of inertia (input)	

"PKX" Series–TigerLine Right Angle ServoFit® Precision Planetary Gearhead Dimensional Data

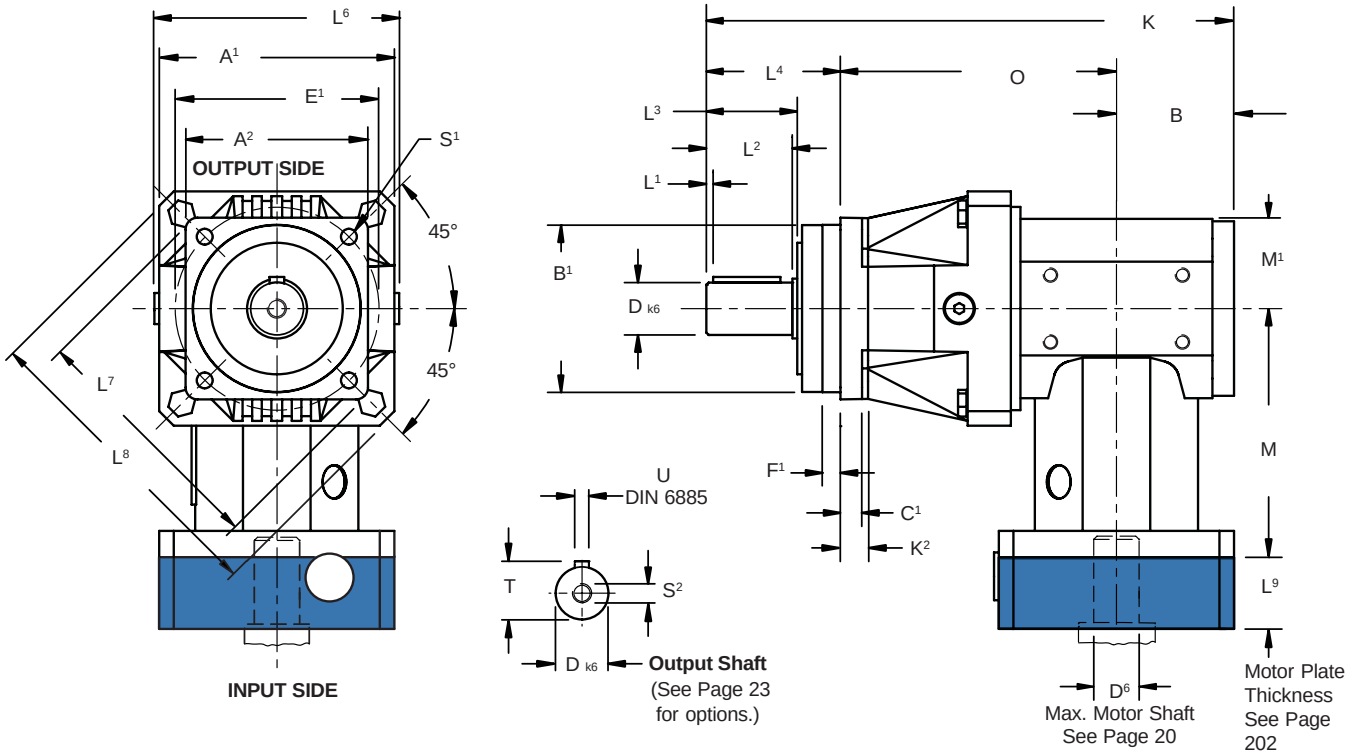


Table No. 1 **"PKX" Series – ServoFit Precision Planetary Gearhead Dimensions (mm/inches)**

Unit	A^1	A^2	B^1 h6	C^1	D k6	E^1	F^1	K^2	L^1	L^2	L^3	L^4	L^6	L^7	L^8	S^1	S^2	T	U
P321S_KX3	72	72	60 +.000/-.019	7	16 +.012/+.001	75	7.5	–	2	28	30	48	79	–	92	5.5	M5x12.5	18	A5x5x22
	2.83	2.83	2.362 +.0000/-.0007	.28		2.95	.30	–	.08	1.10	1.18	1.89	3.11	–	3.62	.22		.71	
P421S_KX4	98	76	70 +.000/-.019	9	22 +.015/+.002	85	7.5	12	3	36	38	56	98	107	130	6.6	M8x19	24.5	A6x6x28
	3.86	2.99	2.756 +.0000/-.0007	.35		3.35	.30	.47	.12	1.42	1.50	2.20	3.86	4.09	5.12	.26		.96	
P521S_KX5	115	101	90 +.000/-.022	10	32 +.018/+.002	120	15	14	3	58	60	88	121	139	149	9	M12x28	35	A10x8x50
	4.53	3.98	3.543 +.0000/-.0009	.39		4.42	.59	.55	.12	2.28	2.36	3.46	4.76	5.47	5.87	.35		1.38	
P721S_KX7	145	145	130 +.000/-.025	15	40 +.018/+.002	165	3.5	–	4	82	85	112	145	–	190	11	M16x36	43	A12x8x70
	5.71	5.71	5.118 +.000/-.001	.59		6.50	.14	–	.16	3.23	3.35	4.41	5.71	–	7.48	.43		1.69	
P821S_KX8	190	190	160 +.000/-.025	15	55 +.021/+.002	215	10	–	6	82	85	112	190	–	250	13.5	M20x42	59	A12x8x70
	7.48	7.48	6.299 +.000/-.001	.59		8.46	.39	–	.24	3.23	3.35	4.41	7.48	–	9.84	.53		2.32	

Table No. 2 Dimensions (mm/inches)

Unit	B	K	M	M^1	O
P321S_KX3	40	101.5	95.5	31	96
	1.57	4.00	3.76	1.22	3.78
P421S_KX4	49	118	104	37.5	115
	1.93	4.65	4.09	1.48	4.53
P521S_KX5	60	153	132	45	129
	2.36	6.02	5.20	1.77	5.08
P721S_KX7	74	192	172.5	60	157
	2.91	7.56	6.79	2.36	6.18
P821S_KX8	92	224	210	75	213
	3.62	8.82	8.27	2.95	8.39

Part No. Explanation

P 4 2 1 S P R 0100 KX401VF 0030 MF

- **P** – TigerLine ServoFit Precision Planetary Gearhead
- **4** – Unit No.
- **2** – Generation Number
- **1** – No. of Gear Stages (**1** = 1 Stage, **2** = 2 Stages)
- **S** – Standard Housing
- **P** – Output Shaft with Key
- **R** – Reinforced Bearings-Axial
- **0100** – Ratio (**0100** = 10.0:1)
- **KX401VF** – Right Angle Unit, Size **4**, **1** Stage
- **0030** – Ratio (0030 = 3.0:1)
- **MF** – Motor Plate with FlexiAdapt® Coupling

When ordering a planetary gearhead, specify the motor manufacturer and part number, provide the motor drawing with dimensions, or specify the motor mounting dimensions. (See Page 20)

"PKX" Series–TigerLine Right Angle ServoFit® Precision Planetary Gearhead Dimensional Data

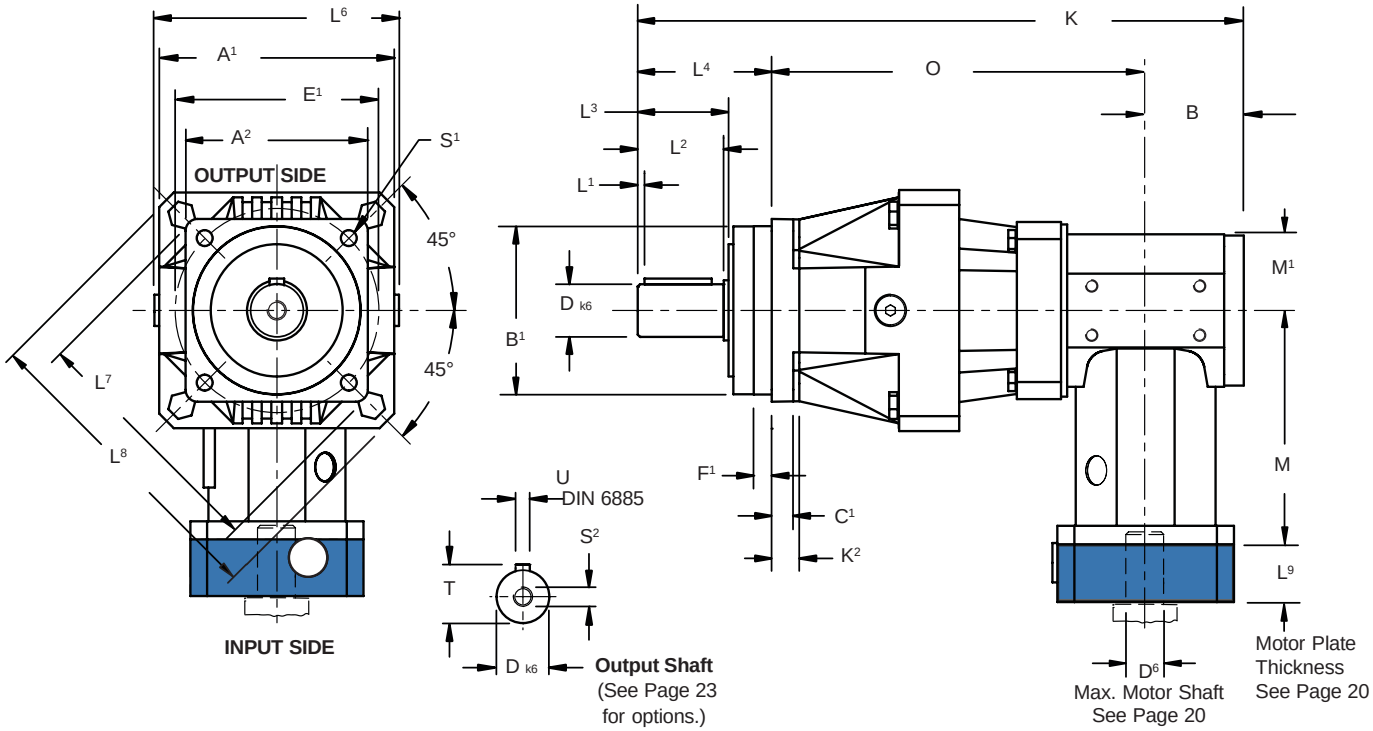


Table No. 3 **"PKX" Series – ServoFit Precision Planetary Gearhead Dimensions (mm/inches)**

Unit	A^1	A^2	B^1 h6	C^1	D k6	E^1	F^1	K^2	L^1	L^2	L^3	L^4	L^6	L^7	L^8	S^1	S^2	T	U
P422S_KX3	98	76	70 +.000/-.019	9	22 +.015/+.002	85	7.5	12	3	36	38	56	98	104	130	6.6	M8x19	24.5	A6x6x28
	3.86	2.99	2.756 +.0000/-.0007	.35		3.35	.30	.47	.12	1.42	1.50	2.20	3.86	4.09	5.12	.26		.96	
P522S_KX4	115	101	90 +.000/-.022	10	32 +.018/+.002	120	15	14	3	58	60	88	121	139	149	9	M12x28	35	A10x8x50
	4.53	3.98	3.543 +.0000/-.0009	.39		4.42	.59	.55	.12	2.28	2.36	3.46	4.76	5.47	5.87	.35		1.38	
P722S_KX5	145	145	130 +.000/-.025	15	40 +.018/+.002	165	3.5	–	4	82	85	112	145	–	190	11	M16x36	43	A12x8x70
	5.71	5.71	5.118 +.000/-.001	.59		6.50	.14	–	.16	3.23	3.35	4.41	5.71	–	7.48	.43		1.69	
P822S_KX7	190	190	160 +.000/-.025	15	55 +.021/+.002	215	10	–	6	82	85	112	190	–	250	13.5	M20x42	59	A12x8x70
	7.48	7.48	6.299 +.000/-.001	.59		8.46	.39	–	.24	3.23	3.35	4.41	7.48	–	9.84	.53		2.32	

Part No. Explanation

P 4 2 2 S P R 0250 KX301VF 0030 MF

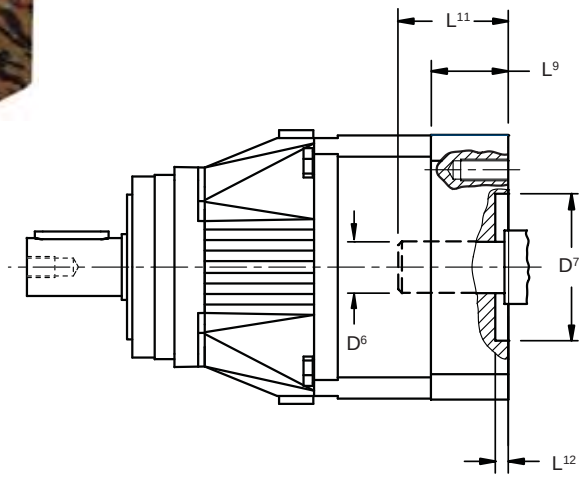
- Motor Plate with FlexiAdapt® Coupling
- Ratio(**0030** = 3.0:1)
- Right Angle Unit, Size **3, 1** Stage
- Ratio (**0250** = 25.0:1)
- **R –** Normal Bearing
- **D –** Reinforced Bearings-Axial
- **Z –** Reinforced Bearings-Radial
- **G –** Shaft – no Key
- **P –** Output Shaft with Key
- **V –** Splined Shaft
- Standard Housing
- No. of Gear Stages (**1** = 1 Stage, **2** = 2 Stages)
- Generation Number
- Unit No.
- TigerLine ServoFit Precision Planetary Gearhead

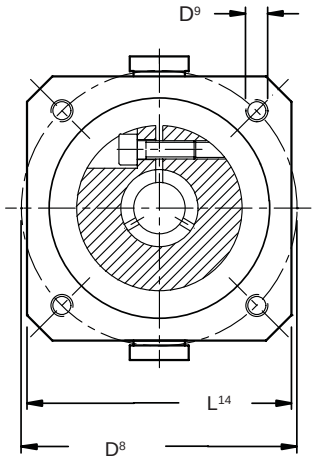
Table No. 4 Dimensions (mm/inches)

Unit	B	K	M	M^1	O
P422S_KX3	40	167	95.5	31	153.5
	1.57	6.57	3.76	1.22	6.04
P522S_KX4	49	207.5	104	37.5	172.5
	1.93	8.17	4.09	1.48	6.79
P722S_KX5	60	254	132	45	206
	2.36	10.00	5.20	1.77	8.11
P822S_KX7	74	300.5	172.5	60	265.5
	2.91	11.83	6.79	2.36	10.45

When ordering a planetary gearhead, specify the motor manufacturer and part number, provide the motor drawing with dimensions, or specify the motor mounting dimensions. (See Page 20)

"P, PA, and PKX" Series–TigerLine ServoFit® Precision Planetary Gearhead Motor Plate Specifications





STOBER ServoFit Precision Planetary Gearheads will fit the motor of your choice by assembling the correct motor mounting plate between the motor and the gearhead. When ordering a planetary gearhead, specify the motor manufacturer and part number, provide the motor drawing with dimensions, or specify the motor mounting dimensions. The motor plate thickness (L^9) dimension will be determined by the motor shaft length. The minimum motor plate thickness is shown in Table No. 1. For a precise dimension on a specific motor, contact Stober Technical Support.

The following dimensions are required to provide the correct motor mounting plate:

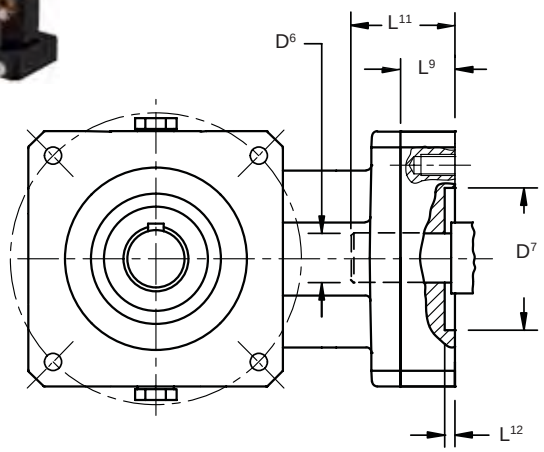
1. D^6 Motor Shaft Diameter (See Table No. 1.)
2. D^7 Pilot Diameter
3. D^8 Bolt Circle Diameter
4. D^9 Bolt Diameter
5. L^{11} Motor Shaft Length
6. L^{12} Pilot Length
7. L^{14} Square Flange
   (Optional–Motor plate will typically be made to match.)

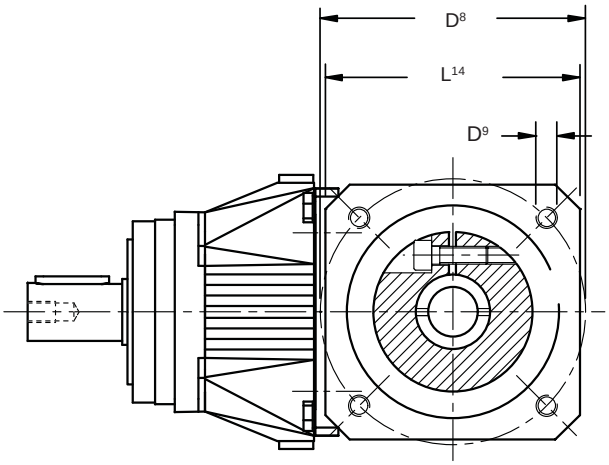
Table No. 1 Motor Plate Thickness - Minimum

Unit	Motor Shaft D^6 Max. [2] mm	Motor Plate [1] L^9 Min. mm	L^9 Min. ins.
P321, PA321 P321_KX3 P422, P422_KX3	19	18	.77
P421, PA421, P522, PA522 P421_KX4, P522_KX4	24 25	21	.83
P521, PA521, P722, PA722 P521_KX5, P722_KX5	32 36	24	.95
P721, PA721, P822, PA822 P721_KX7, P822_KX7	38 43	25	.98
P821, PA821 P821_KX8	48 54	33	1.30

[1] Motor plate thickness (L9) will vary with motor shaft length.

[2] If an adapter bushing is required it will be supplied as a component of the motor mounting plate.





"P, PA, and PKX" Series–TigerLine ServoFit® Precision Planetary Gearhead Shaft Loads

The permissible load and tilting moment values are based on an input speed of 2000 RPM. For higher speeds the following applies, where n_1 is the desired speed:

$$F_{1RX} = \frac{F_{1R}}{\sqrt[3]{\frac{n_1}{2000}}} \qquad T_{1KX} = \frac{T_{1K}}{\sqrt[3]{\frac{n_1}{2000}}}$$

The application input tilting moment should be determined by the following formula: $T_{1A} = \frac{F_{1a} \cdot y_1 + F_{1r} \cdot (x_1 + z_1)}{1000} \leq T_{1K}$

Table No. 1 **INPUT**
Permissible Load and Tilting Moments

Unit No.	z_1 mm	z_1 inches	F_{1A} N	F_{1A} lbs.	F_{1R} N	F_{1R} lbs.	T_{1K} Nm	T_{1K} in.lbs.
P321_AW, PA321_AW P422_AW, PA422_AW	23	0.91	170	38	400	90	12.8	113
P421_AW, PA421_AW P522_AW, PA522_AW	39	1.54	1,150	259	1,300	293	69	611
P521_AW, PA521_AW P722_AW, PA722_AW	47	1.85	1,600	360	1,900	428	124	1,097
P721_AW, PA721_AW P822_AW, PA822_AW	52	2.05	2,700	608	3,000	675	243	2,150
P821_AW, PA821_AW	59	2.32	4,000	900	4,500	1,012	454	4,018

The permissible load values given are valid with the load applied to the center of the shaft (x_1).

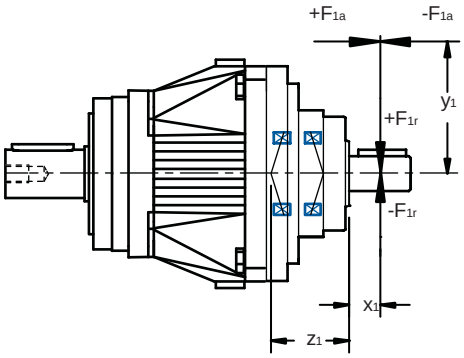


Table No. 2 **"P" Series Input – No Load Running Torque – T_R**

Unit No.	Ratio 3	4	5	7	8	10	15	16	20	25	28	32	35	40	50	70	100
P3 in.lbs.	2.7	1.8	1.8	1.8	1.8	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Nm.	.3	.2	.2	.2	.2	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
P4 in.lbs.	3.5	2.7	2.7	1.8	1.8	1.8	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9	.9
Nm	.4	.3	.3	.2	.2	.2	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
P5 in.lbs.	7.0	5.3	4.4	3.5	2.7	2.7	2.7	2.7	2.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Nm	.8	.6	.5	.4	.3	.3	.3	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2
P7 in.lbs.	8.0	6.2	5.3	4.4	3.5	3.5	2.7	2.7	2.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Nm	.9	.7	.6	.5	.4	.4	.3	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2
P8 in.lbs.	14.2	11.5	9.7	8.0	6.2	6.2	5.3	5.3	4.4	4.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Nm	1.6	1.3	1.1	.9	.7	.7	.3	.6	.5	.5	.4	.4	.4	.4	.4	.4	.4

The torque is measured with the input at 2000 RPM and an ambient temperature of 20° C.

Table No. 3 **"PA" Series Input – No Load Running Torque – T_R**

Unit No.	Ratio 3	4	5	7	8	10	15	16	20	25	28	32	35	40	50	70	100
PA3 in.lbs.	2.7	1.8	1.8	1.8	1.8	1.8	–	1.3	1.3	.9	.9	.9	.9	.9	.9	.9	.9
Nm.	.3	.2	.2	.2	.2	.2	–	.15	.15	.1	.1	.1	.1	.1	.1	.1	.1
PA4 in.lbs.	4.4	3.5	3.5	2.7	2.7	2.7	2.7	2.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Nm	.5	.4	.4	.3	.3	.3	.3	.3	.2	.15	.15	.15	.15	.15	.15	.15	.15
PA5 in.lbs.	7.0	5.3	4.4	3.5	3.5	3.5	3.5	3.5	2.7	2.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Nm	.8	.6	.5	.4	.4	.4	.4	.4	.3	.3	.2	.2	.2	.2	.2	.2	.2
PA7 in.lbs.	8.0	6.2	5.3	4.4	4.4	4.4	6.2	4.4	3.5	1.8	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Nm	.9	.7	.6	.5	.5	.5	.7	.5	.4	.2	.4	.4	.4	.4	.4	.4	.4
PA8 in.lbs.	19.5	17.7	15.9	15.0	15.0	15.0	8.0	5.3	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Nm	2.2	2.0	1.8	1.7	1.7	1.7	.9	.6	.5	.5	.5	.5	.5	.5	.5	.5	.5

The torque is measured with the input at 2000 RPM and an ambient temperature of 20° C.

"P" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Output Shaft Loads

The permissible load and tilting moment values are based on an output speed of 100 RPM.
For higher speeds the following applies, where n_2 is the desired speed:

$$F_{2RX} = \frac{F_{2R}}{\sqrt[3]{\frac{n_2}{100}}} \qquad T_{2KX} = \frac{T_{2K}}{\sqrt[3]{\frac{n_2}{100}}}$$

The application input tilting moment should be determined by the following formula:

$$T_{2A} = \frac{F_{2a} \cdot y_2 + F_{2r} \cdot (x_2 + z_2)}{1000} \leq T_{2K}$$

The hours of life (L_h) of the unit can be determined by the following formula:

L_h > 10,000 hours if T_{2K}/T_{2A} < 1.25 and > 1.00
L_h > 20,000 hours if T_{2K}/T_{2A} > 1.25 and < 1.50
L_h > 30,000 hours if T_{2K}/T_{2A} > 1.5

All formulas shown are based on metric values.

Table No. 1 Permissible Load and Tilting Moments

R – Output Bearing Option, Normal

Unit No.	z_2 mm	z_2 inches	F_{2A} N	F_{2A} lbs.	F_{2R} N	F_{2R} lbs.	T_{2K} Nm	T_{2K} in.lbs.
P3	70	2.76	1,000	225	2,500	563	210	1,859
P4	79.5	3.13	1,500	338	4,000	900	390	3,452
P5	92	3.62	2,300	518	6,500	1,463	786	6,956
P7	105	4.13	2,900	652	8,000	1,800	1,168	10,337
P8	136	5.35	4,700	1,057	13,000	2,925	2,301	20,364

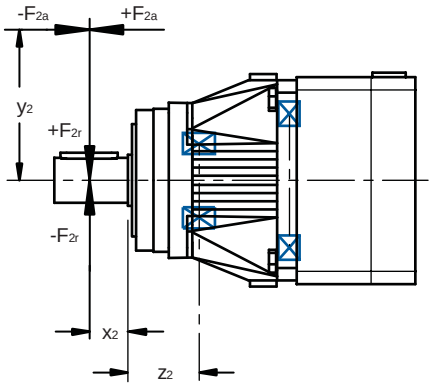
D – Output Bearing Option, Axially Reinforced

Unit No.	z_2 mm	z_2 inches	F_{2A} N	F_{2A} lbs.	F_{2R} N	F_{2R} lbs.	T_{2K} Nm	T_{2K} in.lbs.
P3	70	2.76	1,400	315	2,750	619	231	2,044
P4	79.5	3.13	2,250	506	4,500	1,013	439	3,885
P5	92	3.62	3,500	788	7,000	1,575	847	7,496
P7	105	4.13	4,500	1,013	9,000	2,025	1,314	11,629
P8	136	5.35	7,500	1,688	15,000	3,375	2,655	23,497

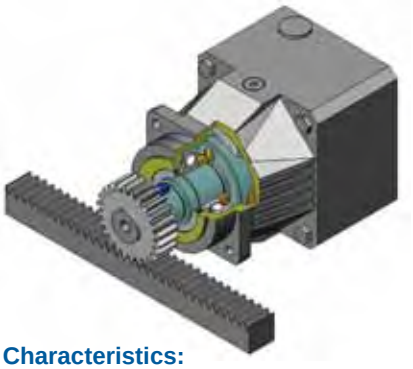
Z – Output Bearing Option, Radially Reinforced

Unit No.	z_2 mm	z_2 inches	F_{2A} N	F_{2A} lbs.	F_{2R} N	F_{2R} lbs.	T_{2K} Nm	T_{2K} in.lbs.
P3	70	2.76	600	135	3,000	675	252	2,230
P4	79.5	3.13	1,000	225	5,000	1,125	488	4,319
P5	92	3.62	1,600	360	8,000	1,800	968	8,567
P7	105	4.13	2,000	450	10,000	2,250	1,460	12,921
P8	136	5.35	3,600	810	18,000	4,050	3,186	28,196

The permissible load values given are valid with the load applied to the center of the output shaft (x_2).



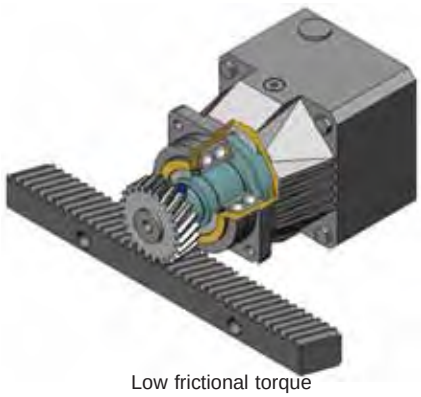
"R"
Deep Groove Ball Bearing



Characteristics:
Minimal frictional torque
Good Radial load capacity
Axial load approx. 35% of radial load

Applications:
Spur geared rack/pinion
Couplings
Belt without / or with light tension

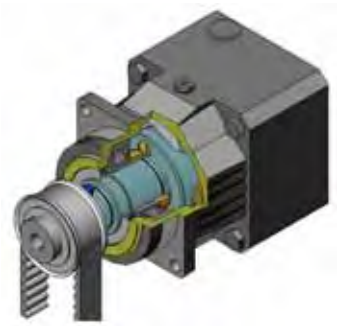
"D"
Double Row Angular Contact Ball Bearing



Low frictional torque
Good radial bearing capacity
Axial load approx. 50% of radial load

Helical geared rack/pinion
Couplings with high axial load
Belt without / or with light tension

"Z"
Cylindrical Roller Bearing



Very good radial load capacity
Axial load approx. 20% of radial load

Prestressed belt drive
Prestressed spur rack drive
Applications with high radial loads
and/or high service requirements

"P and PA" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Output Shaft Options

Table No. 1 **Output Shaft Options**

P – Shaft with Key

Unit No.	d k6 mm		L^1 mm	L^1 inches	L^2 mm	L^2 inches	L^4 mm	L^4 inches	S^2 (1) mm	T mm	T inches	U (2) WDxHTxLG
P3/PA3	16	+.012/+.001	2	.08	28	1.10	48	1.89	M5	18	.71	A5x5x22
P4/PA4	22	+.015/+.002	3	.11	36	1.42	56	2.20	M8	24.5	.96	A6x6x28
P5/PA5	32	+.018/+.002	3	.11	58	2.28	88	3.46	M12	35	1.38	A10x8x50
P7/PA7	40	+.018/+.002	4	.16	82	3.23	112	4.41	M16	43	1.69	A12x8x70
P8/PA8	55	+.021/+.002	6	.24	82	3.23	112	4.41	M20	59	2.32	A16x10x70

G – Shaft without Key

Unit No.	d k6 mm		L^2 mm	L^2 inches	L^4 mm	L^4 inches	S^3 (1) mm
P3/PA3	16	+.012/+.001	28	1.10	48	1.89	R4x8.5
P4/PA4	22	+.015/+.002	36	1.42	56	2.20	R4x8.5
P5/PA5	32	+.018/+.002	58	2.28	88	3.46	R4x8.5
P7/PA7	40	+.018/+.002	82	3.23	112	4.41	R4x8.5
P8/PA8	55	+.021/+.002	82	3.23	112	4.41	R5x10.6

V – Splined Shaft

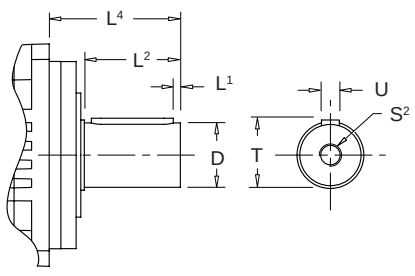
Unit No.	d k6 mm		L^{11} mm	L^{11} inches	L^{12} mm	L^{12} inches	L^{14} mm	L^{14} inches	S^2 (1) mm	V (3)
P3/PA3	16	+.012/+.001	15	.59	26	1.02	46	1.81	M5	W16x.80x30x18x6m
P4/PA4	22	+.015/+.002	15	.59	26	1.02	46	1.81	M8	W22x1.25x30x16x6m
P5/PA5	32	+.018/+.002	15	.59	26	1.02	56	2.20	M12	W32x1.25x30x24x6m
P7/PA7	40	+.018/+.002	20	.79	40	1.57	70	2.76	M16	W40x2.00x30x18x6m
P8/PA8	55	+.021/+.002	21.5	.85	41.5	1.63	71.5	2.81	M20	W55x2.00x30x26x6m

(1) The center hole in shafts with keys (Option "P") are machined to DIN 332 T2 shape DR.
The center hole in shafts without keys (Option "G") are machined to DIN 332 T1.

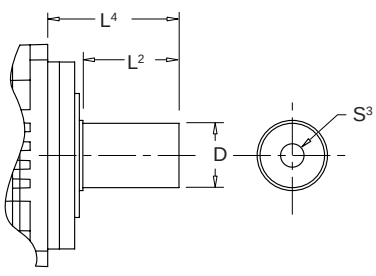
(2) Feather keys are toleranced according to standard DIN 6885.

(3) The recommended hub tolerance is H7. Because of pitch errors due to teeth cutting, this tolerance will provide backlash free operation. The hub should be heated to 100° C for assembly onto the splined shaft.

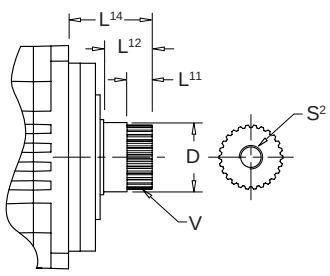
"P"
Shaft with Key



"G"
Shaft without Key



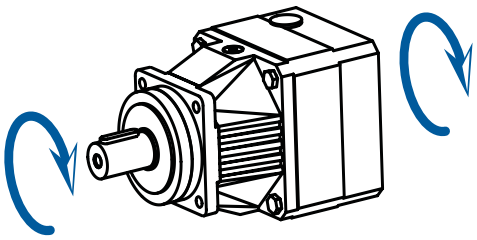
"V"
Splined Shaft



"P, PA and PKX" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Output Rotation

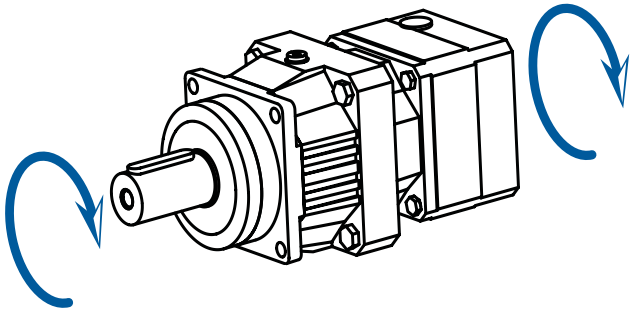
P321 – P821
PA321 – PA821

Input and Output Rotate in the SAME Direction



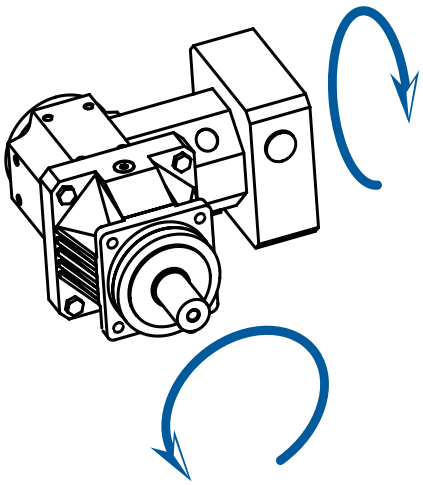
P422 – P822
PA422 – PA822

Input and Output Rotate in the SAME Direction



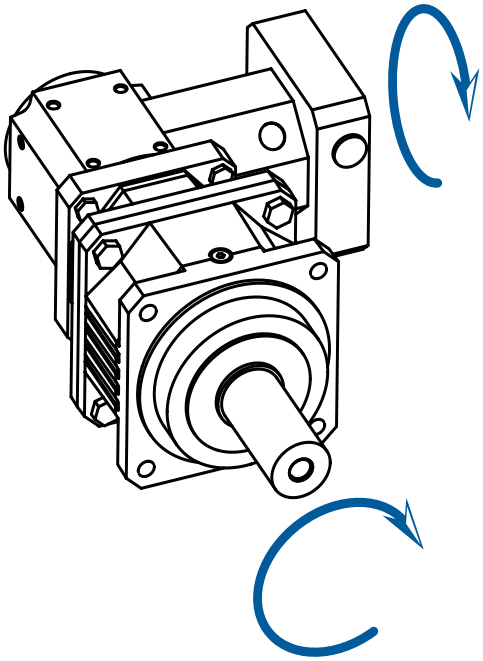
P321KX301 – P521KX501
P422KX301 – P522KX401

Input and Output Rotate in OPPOSITE Directions



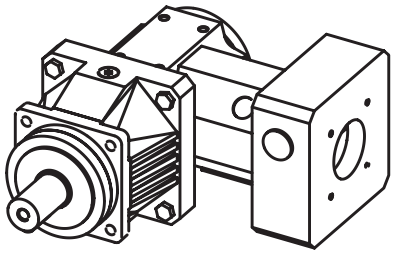
P721KX701 – P821KX801
P722KX501 – P822KX701

Input and Output Rotate in the SAME Direction

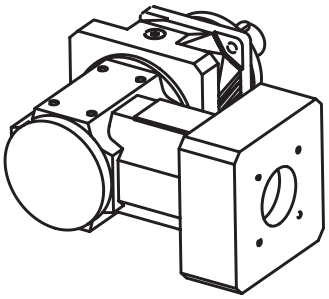


"PKX" Series–TigerLine
ServoFit® Precision Planetary Gearhead
Mounting Positions

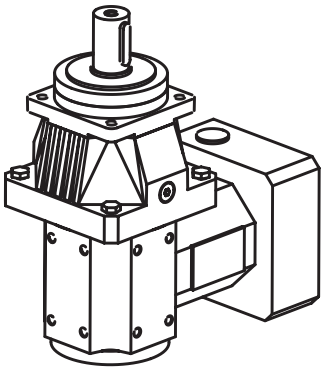
EL1



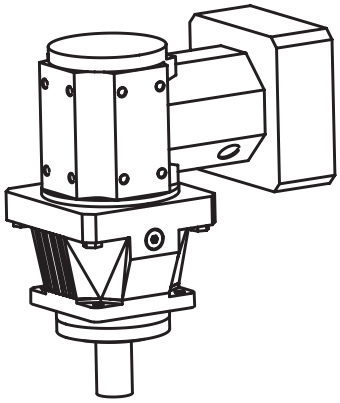
EL2



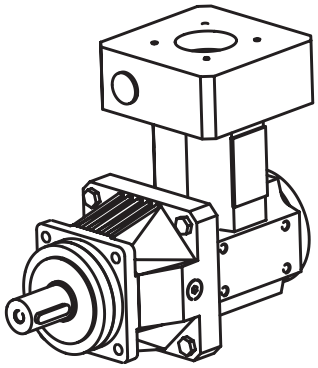
EL3



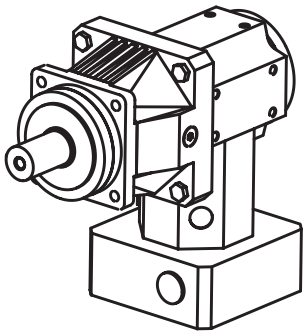
EL4



EL5



EL6



Mounting position must be specified at the time the order is placed.

ServoFit® Precision Planetary Gearhead Symbol Explanation

Table No. 1 Index of Values and Symbols

Symbol	Value Imperial	Value *Multiplier*	Value Metric	Description
F_{2a}	lbs.	4.45	N	Axial Force @ Output Shaft
F_{2A}	lbs.	4.45	N	Permissible Axial Force
F_{2r}	lbs.	4.45	N	Radial Force @ Output Shaft
F_{2R}	lbs.	4.45	N	Permissible Radial Load
i	—	—	—	Reducer Ratio
J_D	lb-in-s^2	1.13×10^3	kgcm^2	Motor + Reducer Inertia @ Motor RPM
J_Z	lb-in-s^2	1.13×10^3	kgcm^2	Total Inertia @ Reducer RPM
n	RPM	—	min^{-1}	Speed
n_b	RPM	—	min^{-1}	Acceleration Speed
n_v	RPM	—	min^{-1}	Deceleration Speed
n_1	RPM	—	min^{-1}	Input Speed
n_2	RPM	—	min^{-1}	Reducer Output Speed
T	in.lbs.	.113	Nm	Torque
T_2	in.lbs.	.113	Nm	Application Torque
T_{2e}	in.lbs.	.113	Nm	Equivalent Torque (Average RMS Torques)
T_{2K}	in.lbs.	.113	Nm	Reducer Tilting Moment
T_L	in.lbs.	.113	Nm	Friction Torque (Losses)
T_{2b}	in.lbs.	.113	Nm	Application Acceleration Torque
T_{2B}	in.lbs.	.113	Nm	Reducer Acceleration Torque
T_{2N}	in.lbs.	.113	Nm	Reducer Output Torque Nom.
T_{2peak}	in.lbs.	.113	Nm	Application Peak Torque
T_{2PEAK}	in.lbs.	.113	Nm	Reducer Peak Torque
T_{2V}	in.lbs.	.113	Nm	Application Deceleration Torque
t	seconds	—	seconds	Time
t_b	seconds	—	seconds	Acceleration Time
t_d	seconds	—	seconds	Duration Time
t_v	seconds	—	seconds	Deceleration Time
t_p	seconds	—	seconds	Pause Time
t_r	seconds	—	seconds	Running Time

Table No. 2 Backlash Comparison Arcminute vs Linear Distance

Arcminute	Degrees	Linear Distance in Inches at 3" R	at 12" R	at 24" R	at 48" R
1	.017	.0009	.0035	.0070	.0140
2	.033	.0017	.0070	.0140	.0279
3	.050	.0026	.0105	.0209	.0419
4	.067	.0035	.0140	.0279	.0558
5	.083	.0044	.0175	.0349	.0698
6	.100	.0052	.0209	.0419	.0838
7	.117	.0061	.0244	.0489	.0977
8	.133	.0070	.0279	.0558	.1117
9	.150	.0079	.0314	.0628	.1257
10	.167	.0087	.0349	.0698	.1396
11	.183	.0096	.0384	.0768	.1536
12	.200	.0105	.0419	.0838	.1675
13	.217	.0113	.0454	.0908	.1815
14	.233	.0122	.0489	.0977	.1955
15	.250	.0131	.0524	.1047	.2094
16	.267	.0140	.0558	.1117	.2234
17	.283	.0148	.0593	.1187	.2373
18	.300	.0157	.0628	.1257	.2513
19	.317	.0166	.0663	.1326	.2653
20	.333	.0175	.0698	.1396	.2792

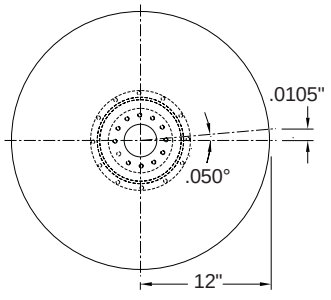
These values can be interpolated for backlash or distances not shown in the table.

Table No. 2 can be used to determine the amount of linear movement that will be realized with a given backlash value.

Example:
A gearhead is vertically mounted under a 24" diameter turntable. The gearhead backlash is 3 arcminutes.

Reading across the table, the angular value of 3 arcminutes is .050 degrees.

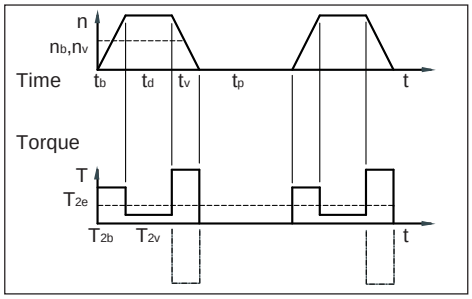
Further determination indicates 3 arcminutes backlash will allow a linear movement of .0105 inches when measured at a 12 inch radius.



ServoFit® Precision Planetary Gearhead Selection Procedures Flow Chart

Continuous Duty – a drive can be considered continuous duty if the running time ($t_r = t_b + t_d + t_v$) is 60% of the complete cycle time ($t_b + t_d + t_v + t_p$) or longer than 20 minutes.

Cyclic Duty – Drive will cycle on and off.



For cyclic operation, the recommended ratio of external (application) inertia to gearhead inertia can be determined by the following equation:

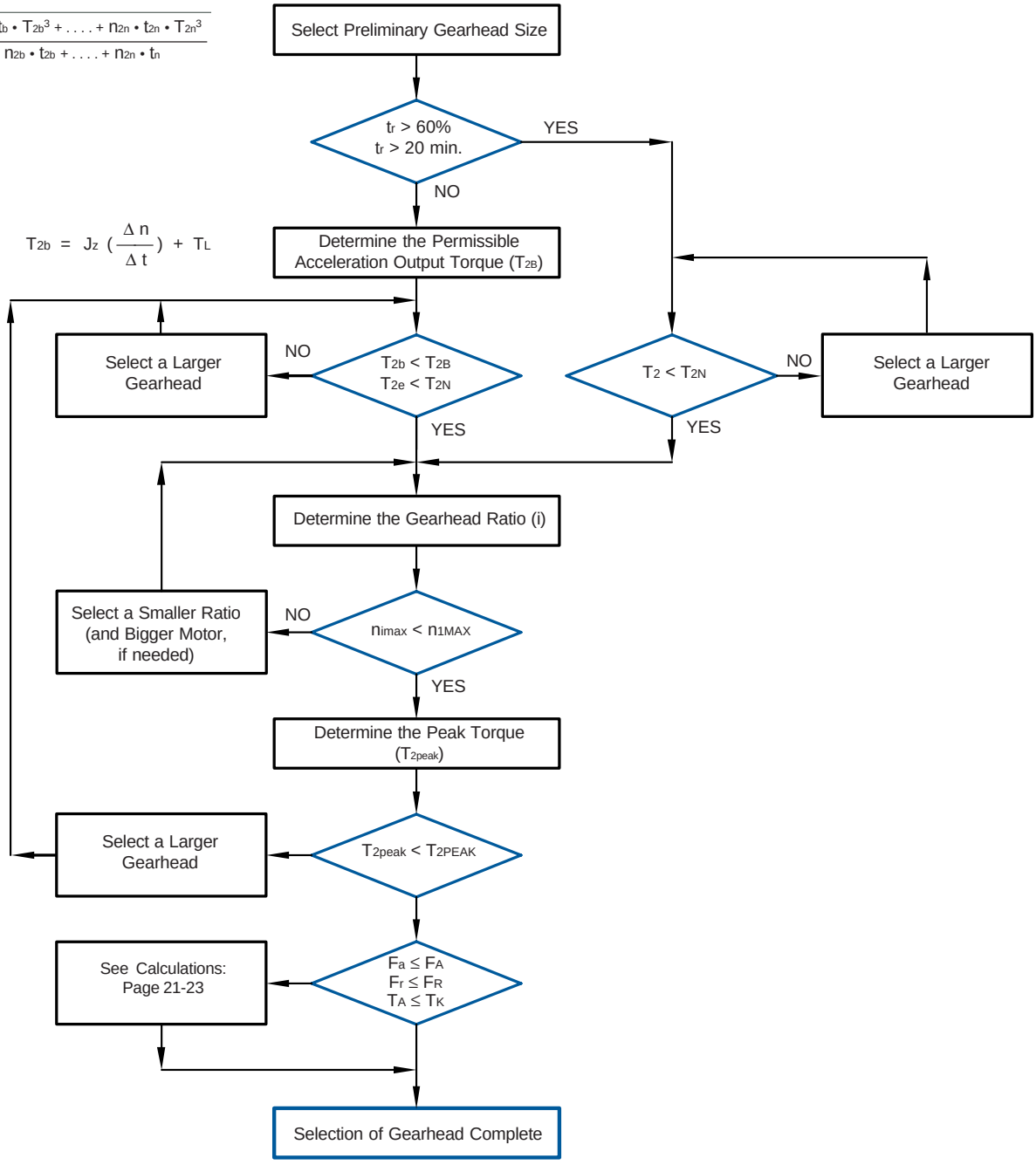
$$\frac{J_Z}{i^2} = 4 \cdot J_D$$

The gearhead selected, using the following equation for inertia ratio, will result in the lowest motor torque demand and the optimum drive selection.

$$\frac{J_Z}{i^2} = J_D$$

$$T_{2e} = \sqrt[3]{\frac{n_{2b} \cdot t_b \cdot T_{2b}^3 + \ldots + n_{2n} \cdot t_{2n} \cdot T_{2n}^3}{n_{2b} \cdot t_{2b} + \ldots + n_{2n} \cdot t_n}}$$

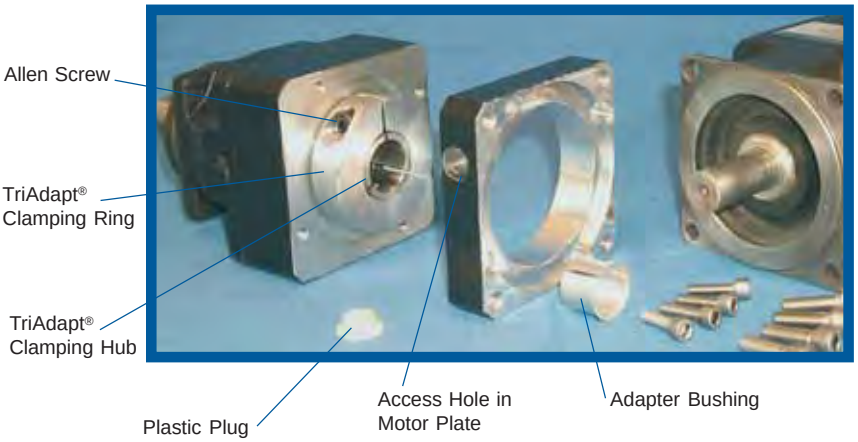
$$T_{2b} = J_Z \left(\frac{\Delta n}{\Delta t}\right) + T_L$$



TigerLine
ServoFit® Precision Planetary Gearhead
Installation Instructions

Table No. 1 Tolerances for Motors

k6 - Shaft Diameter	Metric (µm)	Imperial (ins.)
over 6 - 10	+10 / +1	+.00039 / +.00004
over 10 - 18	+12 / +1	+.00047 / +.00004
over 18 - 30	+15 / +2	+.00059 / +.00008
over 30 - 50	+18 / +2	+.0007 / +.00008
j6 - Pilot Diameter	Metric (µm)	Imperial (ins.)
over 10 - 18	+8 / -3	+.0003 / -.00012
over 18 - 30	+9 / -4	+.00035 / -.00016
over 30 - 50	+11 / -5	+.0004 / -.0002
over 50 - 80	+12 / -7	+.00047 / -.00027
over 80 - 120	+13 / -9	+.0005 / -.00035
over 120 - 180	+14 / -11	+.00055 / -.0004
over 180 - 250	+16 / -13	+.0006 / -.0005
over 250 - 315	+16 / -16	+.0006 / -.0006
over 315 - 400	+18 / -18	+.0007 / -.0007



General Information

Servo motors are mounted to "P" Series ServoFit® Gearheads by using a TriAdapt® motor adapter with a clamp coupling. The "PA" and "PKX" Series use the FlexiAdapt® motor adapter with a bellows shaped thermal expansion feature. These patented adapters require no key but uses a friction locking triple split collet to clamp the shaft. A split bushing is included when the motor shaft is smaller than the input bore in the gearhead. The coupling operates free of backlash and, if installed correctly, requires no maintenance.

Tolerances for the motor must be ISO j6 on the pilot diameter and ISO k6 on the motor shaft, see Table No. 1. The motor shaft does not require a key but shaft runout, pilot concentricity and perpendicularity should meet DIN standard 42955-N when possible.

Important: Clean the motor shaft with degreaser to remove any film of oil or grease.

STEP 1. Remove the access hole plug.

Carefully remove the plastic plug from the access hole in the motor plate.

STEP 2. Align screw with access hole.

Visually align the access hole with the Allen screw in the clamping ring by turning the gearhead output shaft or the input coupling. (Shown with wrench for illustration only.)

STEP 3. Install bushing (when applicable).

If an adapter bushing is needed, degrease the bushing inside and outside. Align the slot in the adapter bushing with the slot in the coupling hub. Slide the bushing into the input bore until the collar of the bushing touches the shaft end.

STEP 4. Carefully mount the motor.

Place the gearhead (with the bushing installed where necessary) onto the motor shaft. (If there is a keyway in the motor shaft, align the slot in the clamping hub with the keyway.) Support the gearhead while sliding it onto the motor shaft.

IT IS VERY IMPORTANT THAT THE GEARHEAD IS NOT FORCED ONTO THE SHAFT AND THE MOTOR IS CONCENTRIC WITH THE GEARHEAD COUPLING.

TigerLine
ServoFit® Precision Planetary Gearhead
Installation Instructions

STEP 5. Bolt the motor to the motor plate.

Bolt the motor flange to the gearhead motor plate.
Tighten the motor bolts to the recommended tightening torque shown in Table No. 2.

STEP 6. Tighten the coupling screw.

With a torque wrench, tighten the Allen screw on the coupling to the recommended torque shown in Table No. 2. A torque wrench extension is provided with each gearhead. If there are two (2) screws, be sure to tighten them equally.

STEP 7. Re-insert the plastic plug.

Table No. 2 Capscrew Tightening Torque

Unit	Allen Wrench Size	Tightening Torque Nm.	Tightening Torque in. lbs.
"P" Series			
P321	5	10	88.5
P421	6	25	221.25
P422	5	10	88.5
P521	6	25	221.25
P522	6	25	221.25
P721	8	45	398.25
P722	6	25	221.25
P821	10	60	531
P822	8	45	398.25
"PA" Series			
PA321	4	10	88.5
PA421	5	18	159.3
PA422	4	10	88.5
PA521	6	43	380.6
PA522	5	18	159.3
PA721	8	84	743.4
PA722	6	43	380.6
PA821	10	145	1,283.3
PA822	8	84	743.4
"PKX" Series			
P321KX3	4	10	88.5
P421KX4	5	18	159.3
P422KX3	4	10	88.5
P521KX5	6	43	380.6
P522KX4	5	18	159.3
P721KX7	8	84	743.4
P722KX5	6	43	380.6
P821KX8	10	145	1,283.3
P822KX7	8	84	743.4

TigerLine
ServoFit® Precision Planetary Gearhead
Ordering Information

Part No. Explanation with OPTIONS and REQUIRED INFORMATION:

P 4 2 2 S P R 0500 MT

- MT – Motor Adapter with TriAdapt® Coupling
- 0500 – Nominal Ratio: (**0500** = 50:1)
- R – OUTPUT BEARING OPTION
  - "**R**" Bearing Option – Normal
  - "**D**" Bearing Option – Reinforced Axially
  - "**Z**" Bearing Option – Reinforced Radially
- P – OUTPUT SHAFT OPTION
  - "**G**" Shaft Option – Shaft without Key
  - "**P**" Shaft Option – Shaft with Key
  - "**V**" Shaft Option – Splined
- S – Standard Housing
- 2 – No. of Stages (**2** = 2 Stage, determined by ratio)
- 2 – Design Generation Number
- 4 – Unit Size No.
- P – ServoFit Precision Planetary Gearhead

PA 4 2 1 S P D 0070 MF

- MF – Motor Adapter with FlexiAdapt® Coupling
- 0070 – Nominal Ratio: (**0070** = 7:1)
- D – "**D**" Bearing Option – Reinforced Axially
- P – OUTPUT SHAFT OPTION
  - "**G**" Shaft Option – Shaft without Key
  - "**P**" Shaft Option – Shaft with Key
  - "**V**" Shaft Option – Splined
- S – Standard Housing
- 1 – No. of Stages (**1** = 1 Stage, determined by ratio)
- 2 – Design Generation Number
- 4 – Unit Size No.
- PA – Advanced ServoFit Precision Planetary Gearhead

P 4 2 2 S P R 0500 KX301VF 0020 MF

- MF – Motor Adapter with FlexiAdapt® Coupling
- 0020 – Nominal Ratio of Right Angle Unit: (**0020** = 2:1)
- KX301VF – Right Angle Unit, Size 3, 1 Stage
- 0500 – Ratio (0500 = 50:1) Total Ratio = 50:1 x 2:1 = 100:1
- R – OUTPUT BEARING OPTION
  - "**R**" Bearing Option – Normal
  - "**D**" Bearing Option – Reinforced Axially
  - "**Z**" Bearing Option – Reinforced Radially
- P – OUTPUT SHAFT OPTION
  - "**G**" Shaft Option – Shaft without Key
  - "**P**" Shaft Option – Shaft with Key
  - "**V**" Shaft Option – Splined
- S – Standard Housing
- 2 – No. of Stages (**2** = 2 Stage, determined by ratio)
- 2 – Design Generation Number
- 4 – Unit Size No.
- P – ServoFit Precision Planetary Gearhesd

THE FOLLOWING INFORMATION IS REQUIRED FOR ANY "PKX" UNIT: Mounting Position – EL1 EL2 EL3 EL4 EL5 EL6

THE FOLLOWING INFORMATION IS REQUIRED FOR ANY UNIT: Motor – Motor Manufacturer and Model Number
Paint Options – Black (Standard), White, Stainless

ServoFit® Gearheads
The Precision Decision

P Series – SPG

- Backlash – ≤ 3 arc/mins
- Ratios – 3:1 to100:1
- Input RPM – up to 6000
- Noise Level – as low as 58 dB(A)**
- Output Torque from 301 to 7,080 in.lbs.

PH Series – SPG

- Backlash – ≤ 3 arc/mins
- Ratios – 5:1 to 400:1
- Input RPM – up to 6,000
- Noise Level – as low as 58 dB(A)**
- Output Torque from 885 to 35,400 in.lbs.

PKX Series – SPG

- Backlash – ≤ 6.5 arc/mins
- Ratios – 3:1 to 300:1
- Input RPM – up to 6,000
- Noise Level – as low as 69 dB(A)**
- Output Torque from 354 to 7,080 in.lbs.

PHKX Series – SPG

- Backlash – ≤ 5 arc/mins
- Ratios – 5:1 to 1,200:1
- Input RPM – up to 6,000
- Noise Level – as low as 69 dB(A)**
- Output Torque from 885 to 22,125 in.lbs.

F Series – SMS

- Backlash:
  - Standard ≤ 11 arc/mins
  - Reduced ≤ 7 arc/mins
- Ratios – 4:1 to 540:1*
- Input RPM – up to 4,500
- Noise Level – as low as 53 dB(A)**
- Output Torque from 200 to 9,700 in.lbs.

"P" Series–TigerLine

K Series – SMS

- Backlash:
  - Standard ≤ 12 arc/mins
  - Reduced ≤ 6 arc/mins
- Ratios – 4:1 to 381:1*
- Input RPM – up to 4,500
- Noise Level – as low as 53 dB(A)**
- Output Torque from 190 to 106,000 in.lbs.

"PA" Series–TigerLine

PE Series – SPG

- Backlash – ≤ 15 arc/mins
- Ratios – 5:1 to 100:1
- Input RPM – up to 8,000
- Noise Level – as low as 60 dB(A)**
- Output Torque from 106 to 1,858 in.lbs.

C Series – SMS

- Backlash – ≤ 20 arc/mins
- Ratios – 2:1 to 276:1*
- Input RPM – up to 4,500
- Noise Level – as low as 53 dB(A)**
- Output Torque from 97 to 62,000 in.lbs.

"PKX" Series–TigerLine

* Ratios standard in one housing. Higher ratios available in compound units.
** dB(A) rating measured at 1 meter distance with 3000 RPM input.

Terms and Conditions of Sale

1. **GENERAL.** All orders for products supplied by STOBER DRIVES INC. ("Stober") shall be subject to these terms and conditions of sales. All transactions shall be governed by the laws of the Commonwealth of Kentucky. No modifications hereto will be binding unless agreed to in writing by Stober.

2. **CUSTOMER.** The term "Customer," as used herein, means the distributor, resale dealer, original equipment manufacturer or first end-user customer that purchases the Stober products.

3. **WARRANTY.** Stober products shall be free from defects in material and workmanship for a maximum of 5-years (single shift operation or 30 months multiple shift operation) for ServoFit products; 3-years (single shift operation or 18 months multiple shift operation) for MGS products; 2-years (single shift operation or 12 months multiple shift operation) for TD products, from the date of shipment to the Customer. For ServoFit products, all normal wear items, including oil seals and bearings, shall be covered for a period of 2-years (single shift operation or 12 months multiple shift operation). In the event that a product proves to be defective, Stober's sole obligation shall be, at its option, to repair or replace the product. The repaired or replacement product will be shipped F.O.B. Stober's facilities, freight prepaid by Stober.

No employee, agent or representative of Stober has the authority to waive, alter, vary or add to the terms hereof without the prior written approval of an officer of Stober. It is expressly agreed that (a) this section constitutes the final expression of the parties' understanding with respect to the warranty and (b) this section is a complete and exclusive statement of the terms of the warranty.

Stober shall have no obligation under the warranty set forth above in the event that:

(a) The Customer fails, within the warranty period to notify Stober in writing and provide Stober with evidence satisfactory to Stober of the alleged defect within five (5) days after it becomes known to the customer;

(b) After inspection of a product, Stober determines, in its sole discretion, that it is not defective in material or workmanship;

(c) Repair or replacement of a product is required through normal wear and tear;

(d) Any part in a product or any ingredient contained in a product requires replacement or repair through routine usage or normal wear and tear;

(e) A product is not maintained or used in accordance with Stober's applicable operating and/or maintenance manuals, whether by the Customer or any third party;

(f) A product has been subject to misuse, misapplication, negligence, neglect (including, but not limited to, improper maintenance or storage), accident, catastrophe, improper installation, modification, adjustment, repair or lubrication, whether by the Customer or any third party, without the prior written consent of Stober. Misuse shall include, but not be limited to, deterioration in a product due to chemical action and wear caused by the presence of abrasive materials;

(g) The system of connected rotating parts into which the product becomes incorporated is not compatible with the product, or it is not free from critical speed or torsional or other type of vibration within the specified operating range, no matter how induced; or

(h) The transmitted load and imposed torsional thrust and overhung loads are not within the published capacity limits for the unit sold.

Items manufactured by other parties but installed in or affixed to Stober's products are not warranted by Stober and bear only those warranties, express or implied, which are given by the manufacturer of such items, if any.

THE WARRANTY SET FORTH ABOVE IS INTENDED SOLELY FOR THE BENEFIT OF THE Customer AND DOES NOT APPLY TO ANY THIRD PARTY. ALL CLAIMS MUST BE MADE BY THE Customer AND MAY NOT BE MADE BY ANY THIRD PARTY. THIS WARRANTY MAY NOT BE TRANSFERRED OR ASSIGNED, IN WHOLE OR IN PART, BY THE Customer FOR ANY REASON WHATSOEVER. ANY SUCH ATTEMPTED TRANSFER OR ASSIGNMENT SHALL BE NULL AND VOID.

THIS WARRANTY TAKES THE PLACE OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH ARE HEREBY DISCLAIMED AND EXCLUDED BY STOBER, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF USE AND ALL OBLIGATIONS OR LIABILITIES ON THE PART OF STOBER FOR DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE USE, REPAIR OR PERFORMANCE OF THE PRODUCTS.

4. **MODIFICATIONS.** Stober reserves the right, without notice to the Customer, to (a) change the specifications of any product, (b) improve a product in any manner that Stober deems necessary or appropriate and (c) discontinue the manufacture of any product.

5. **PURCHASE ORDERS.** The Customer will submit purchase orders for the products to Stober in writing, whether by mail or telefax, which shall set forth, at a minimum: (a) an identification of the products ordered, (b) prices for such products, (c) quantities, (d) requested delivery dates and (e) shipping instructions and shipping addresses.

6. **ACCEPTANCE OF ORDERS.** All purchase orders received from the Customer are subject to acceptance by Stober in writing.

7. **MODIFICATION OF ORDERS.** No accepted purchase order shall be modified or canceled except upon the written agreement of Stober and the Customer. Mutually agreed cancellations shall be subject to reasonable charges based upon expenses already incurred by Stober and commitments made by Stober. Mutually agreed change orders shall be subject to all provisions of these Terms and Conditions of Sale.

8. **PRICE INCREASES.** Stober may increase its prices for the products by providing the original purchaser of the products with at least thirty (30) days' prior written notice. Increased prices for products shall not apply to purchase orders accepted prior to the effective date of the price increase unless such orders provide for delivery more than thirty (30) days after the date of acceptance of the order.

9. **PRICING AND DELIVERY TERMS.** In accordance with KRS 355.2-319(1)(b), all products are delivered F.O.B. Stober's warehouse facility in Maysville, Kentucky, or such other facility as Stober may designate. Orders are then shipped per Customer's shipping instructions as set forth in Customer's purchase order. **CATALOG PRICING DOES NOT INCLUDE SHIPPING, HANDLING AND TAXES.** Once delivered to a common carrier of the Customer's choosing [or of Stober's choosing if Customer has failed to specify a common carrier on or before five (5) days prior to the requested delivery date] Stober shall have no further responsibility for the products and all risk of damage, loss or delay shall pass to the Customer. A handling fee is added to freight costs by Stober to cover the cost of having to pay the carrier within seven (7) days when the terms with the Customer are net 30. The Customer has the option of shipping collect with our carrier or the carrier of choice.

10. **PAYMENT TERMS.** Net 30 days. All orders will be shipped either prepaid by the Customer or C.O.D., at Stober's option, unless the Customer has established a previously approved credit line. If Stober approves a credit line for the Customer, all payments shall be due within thirty (30) days of the date of the invoice. If any invoice is not paid in full within such thirty (30) day period, then finance charges shall be assessed at the rate of one and one-half percent ($1^1/_2$%) per month (eighteen percent (18%) per year). If such rate is deemed to be usurious at any time, it shall be reduced to the maximum rate permitted by applicable law. Stober may stop or withhold shipment of products if the Customer does not fulfill its payment obligations. If Stober is insecure about payment for any reason, Stober may require full or partial payment in advance and as a condition to the continuation of its delivery of products.

11. **SECURITY INTEREST.** Unless and until the products are paid for in full, Stober reserves a security interest in them to secure the unpaid balance of the purchase price. The Customer hereby grants to Stober a power of attorney, coupled with an interest, to execute and file on behalf of the Customer all necessary financing statements and other documents required or appropriate to protect the security interest granted herein.

12. **ACCEPTANCE OF PRODUCTS.** The Customer will conduct any incoming inspection tests as soon as possible upon arrival of the products, but in no event later than ten (10) days after the date of receipt. Any products not rejected by written notice to Stober within such period shall be deemed accepted by the Customer. Stober shall not be liable for any additional costs, expenses or damages incurred by the Customer, directly or indirectly, as a result of any shortage, damage or discrepancy in a shipment.

13. **LIMITATION OF REMEDIES.**

(a) STOBER SHALL NOT BE LIABLE FOR ANY LOSS OR DAMAGE CAUSED BY DELAY IN FURNISHING THE CUSTOMER WITH PRODUCTS.

(b) IN NO EVENT SHALL STOBER'S LIABILITY INCLUDE ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL LOSSES OR DAMAGES, EVEN IF STOBER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH POTENTIAL LOSS OR DAMAGE.

14. **MADE-TO-ORDER PRODUCTS.** Stober reserves the right to revoke and amend any price quotations offered to the Customer for made-to-order products, provided that such price quotations have not been accepted by the Customer prior to the date of revocation or amendment.

15. **DIES, TOOLS AND EQUIPMENT.** Charges incurred by the Customer for dies, tools and other equipment shall not confer ownership or the right to possession therein by the Customer. All such dies, tools and equipment shall remain the property of Stober, and Stober shall have the exclusive right to possession thereof. Stober shall maintain such tools and equipment in good working order.

16. **REGULATORY LAWS AND STANDARDS.** Stober makes no representation that its products conform to state or local laws, ordinances, regulations, codes or standards except as may be otherwise agreed to in writing by Stober.

17. **SIZES AND WEIGHTS.** Stober's products are made only in the sizes and to the specifications set forth in its catalogs and other literature. If any alteration is requested, such altered product will be treated as a made-to-order item. Stober assumes no responsibility for typographical errors which may appear in its catalogs or literature, and cannot accept alteration charges caused by such errors. Since weights shown in Stober's catalogs are approximate, they cannot be used in determining freight allowances set forth in its catalogs and other literature. Freight allowances will be determined at the time of shipment and shall be based on actual shipping weight.

18. **SYSTEM DESIGN.** Responsibility for system design to ensure proper use and application of Stober's products within their published specifications and ratings rests solely with the Customer. This includes, but is not limited to, an analysis of loads created by torsional vibrations within the entire system, regardless of how induced.

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