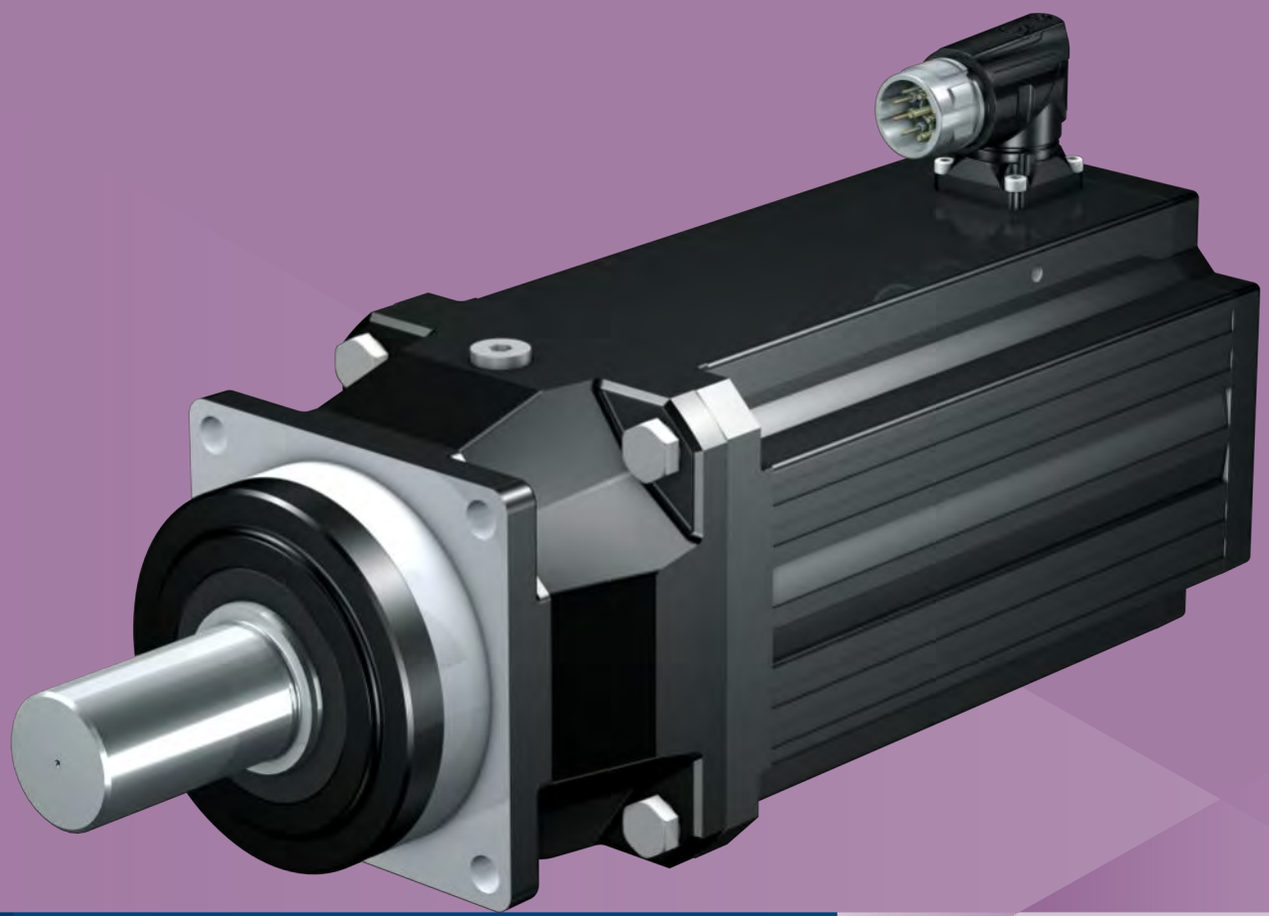


6 Planetary geared motors P

6.1 Overview

Helical-geared precision planetary geared motors

Features

Power density	★★★★☆
Backlash	★★★★☆
Price category	€€
Shaft load	★★★★☆
Smooth operation	★★★★☆
Torsional stiffness	★★★☆☆
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free	✓
Any installation position	✓
Continuous operation without cooling	✓
(FKM sealing ring at the input)	
Reinforced output bearing	✓ (optional)
Compact and dynamic due to direct motor attachment	✓

Key: ★☆☆☆☆ good | ★★★★★ excellent
€ Economy | €€€€€ Premium

Technical data

i	3 – 56
M_{2acc}	13 – 1600 Nm
$\Delta\phi_2$	3 – 5 arcmin
η_{get}	≤ 97 %

6.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors

An explanation of the formula symbols can be found in the Chapter [▷ 15.1].

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P3 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 60 Nm)															
300	23	22	1.4	1.1	P321_0100 LM401U	44	100	10.00	10/1	4500	8000	1.7	4	4.0	5.9
375	18	18	1.4	1.9	P321_0080 LM401U	35	100	8.000	8/1	4500	8000	1.7	4	4.2	5.9
375	34	35	2.6	1.0	P321_0080 LM402U	50	100	8.000	8/1	4500	8000	3.0	4	4.2	7.5
429	16	16	1.4	2.5	P321_0070 LM401U	31	130	7.000	7/1	4500	8000	1.7	4	4.4	5.9
429	30	31	2.7	1.3	P321_0070 LM402U	60	130	7.000	7/1	4500	8000	3.0	4	4.4	7.5
600	11	11	2.2	3.4	P321_0050 LM401U	22	110	5.000	5/1	4000	7000	1.7	4	5.1	5.9
600	21	22	4.0	1.8	P321_0050 LM402U	47	110	5.000	5/1	4000	7000	3.1	4	5.1	7.5
750	9.2	8.9	2.8	4.3	P321_0040 LM401U	17	85	4.000	4/1	3700	6500	1.8	4	5.3	5.9
750	17	17	5.3	2.3	P321_0040 LM402U	38	85	4.000	4/1	3700	6500	3.1	4	5.3	7.5
1000	6.9	6.7	6.0	3.8	P321_0030 LM401U	13	64	3.000	3/1	3500	6000	1.9	4	5.7	5.9
1000	13	13	11	2.0	P321_0030 LM402U	28	64	3.000	3/1	3500	6000	3.2	4	5.7	7.5
P4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 120 Nm)															
75	90	87	2.3	0.95	P422_0400 LM401U	120	240	40.00	40/1	4500	8000	1.7	5	10	8.9
86	78	76	2.4	1.1	P422_0350 LM401U	120	240	35.00	35/1	4500	8000	1.7	5	11	8.9
94	72	70	2.7	1.1	P422_0320 LM401U	100	200	32.00	32/1	3700	6500	1.8	5	9.2	8.9
107	63	61	2.7	1.4	P422_0280 LM401U	120	240	28.00	28/1	4500	8000	1.7	5	10	8.9
120	56	54	2.8	1.5	P422_0250 LM401U	110	240	25.00	25/1	4000	7000	1.8	5	11	8.9
120	105	107	5.3	0.81	P422_0250 LM402U	120	240	25.00	25/1	4000	7000	3.1	5	11	11
150	45	44	3.2	1.9	P422_0200 LM401U	86	240	20.00	20/1	3700	6500	1.8	5	11	8.9
150	84	86	6.0	1.0	P422_0200 LM402U	120	240	20.00	20/1	3700	6500	3.1	5	11	11
188	36	35	3.6	2.4	P422_0160 LM401U	69	240	16.00	16/1	3700	6500	1.8	5	11	8.9
188	67	68	6.7	1.3	P422_0160 LM402U	120	240	16.00	16/1	3700	6500	3.2	5	11	11
250	27	26	7.0	1.9	P422_0120 LM401U	51	240	12.00	12/1	3500	6500	1.8	5	9.9	8.9
250	50	51	13	1.0	P422_0120 LM402U	100	240	12.00	12/1	3500	6500	3.2	5	9.9	11
300	43	44	1.6	1.2	P421_0100 LM402U	94	200	10.00	10/1	4000	7000	3.1	4	9.0	8.7
300	59	60	2.2	0.89	P421_0100 LM403U	100	200	10.00	10/1	4000	7000	4.4	4	9.0	10
375	34	35	1.6	2.0	P421_0080 LM402U	75	200	8.000	8/1	4000	7000	3.1	4	9.5	8.7
375	47	48	2.2	1.5	P421_0080 LM403U	100	200	8.000	8/1	4000	7000	4.4	4	9.5	10
429	30	31	1.7	2.5	P421_0070 LM402U	66	240	7.000	7/1	4000	7000	3.1	4	10	8.7
429	41	42	2.4	1.8	P421_0070 LM403U	87	240	7.000	7/1	4000	7000	4.4	4	10	10
600	21	22	2.6	3.5	P421_0050 LM402U	47	240	5.000	5/1	3700	6500	3.2	4	12	8.7
600	29	30	3.6	2.5	P421_0050 LM403U	62	240	5.000	5/1	3700	6500	4.5	4	12	10
600	46	49	5.6	1.6	P421_0050 LM503U	99	240	5.000	5/1	3700	6500	11	4	12	13
600	66	75	8.1	1.1	P421_0050 LM505U	120	240	5.000	5/1	3700	6500	17	4	12	18
750	17	17	3.4	4.3	P421_0040 LM402U	38	240	4.000	4/1	3300	6000	3.3	4	12	8.7
750	24	24	4.7	3.2	P421_0040 LM403U	50	240	4.000	4/1	3300	6000	4.6	4	12	10
750	37	39	7.3	2.0	P421_0040 LM503U	79	240	4.000	4/1	3300	6000	11	4	12	13
750	53	60	11	1.4	P421_0040 LM505U	120	240	4.000	4/1	3300	6000	17	4	12	18
1000	13	13	8.2	3.4	P421_0030 LM402U	28	240	3.000	3/1	3000	5500	3.7	4	13	8.7
1000	18	18	11	2.5	P421_0030 LM403U	37	240	3.000	3/1	3000	5500	5.0	4	13	10
1000	28	29	18	1.6	P421_0030 LM503U	59	240	3.000	3/1	3000	5500	11	4	13	13
1000	40	45	25	1.1	P421_0030 LM505U	93	240	3.000	3/1	3000	5500	17	4	13	18
P5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 300 Nm)															
54	235	239	1.7	0.85	P522_0560 LM402U	250	500	56.00	56/1	4000	7000	3.1	4	25	13
60	209	214	1.7	1.0	P522_0500 LM402U	300	600	50.00	50/1	4000	7000	3.1	4	27	13
75	168	171	2.0	1.2	P522_0400 LM402U	300	600	40.00	40/1	4000	7000	3.1	4	26	13
75	230	235	2.7	0.88	P522_0400 LM403U	300	600	40.00	40/1	4000	7000	4.4	4	26	15
86	147	150	2.0	1.4	P522_0350 LM402U	300	600	35.00	35/1	4000	7000	3.1	4	28	13
86	201	206	2.8	1.0	P522_0350 LM403U	300	600	35.00	35/1	4000	7000	4.4	4	28	15
94	134	137	2.2	1.5	P522_0320 LM402U	250	500	32.00	32/1	3300	6000	3.3	4	25	13
94	184	188	3.1	1.1	P522_0320 LM403U	250	500	32.00	32/1	3300	6000	4.6	4	25	15
107	117	120	2.3	1.8	P522_0280 LM402U	260	600	28.00	28/1	4000	7000	3.1	4	27	13
107	161	165	3.1	1.3	P522_0280 LM403U	300	600	28.00	28/1	4000	7000	4.4	4	27	15
120	105	107	2.4	2.0	P522_0250 LM402U	230	600	25.00	25/1	3700	6500	3.2	4	28	13
120	144	147	3.3	1.5	P522_0250 LM403U	300	600	25.00	25/1	3700	6500	4.5	4	28	15

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 300 Nm)															
120	225	239	5.1	0.93	P522_0250 LM503U	300	600	25.00	25/1	3700	6500	11	4	28	18
150	84	86	2.7	2.5	P522_0200 LM402U	180	600	20.00	20/1	3300	6000	3.3	4	28	13
150	115	118	3.7	1.8	P522_0200 LM403U	240	600	20.00	20/1	3300	6000	4.6	4	28	15
150	180	191	5.8	1.2	P522_0200 LM503U	300	600	20.00	20/1	3300	6000	11	4	28	18
150	260	294	8.3	0.81	P522_0200 LM505U	300	600	20.00	20/1	3300	6000	17	4	28	22
188	67	68	3.0	3.1	P522_0160 LM402U	150	600	16.00	16/1	3300	6000	3.4	4	28	13
188	92	94	4.1	2.3	P522_0160 LM403U	200	600	16.00	16/1	3300	6000	4.7	4	28	15
188	144	153	6.4	1.5	P522_0160 LM503U	300	600	16.00	16/1	3300	6000	11	4	28	18
188	208	235	9.3	1.0	P522_0160 LM505U	300	600	16.00	16/1	3300	6000	17	4	28	22
250	50	51	6.0	2.4	P522_0120 LM402U	110	460	12.00	12/1	3000	6000	3.4	4	27	13
250	69	71	8.3	1.7	P522_0120 LM403U	150	460	12.00	12/1	3000	6000	4.7	4	27	15
250	108	115	13	1.1	P522_0120 LM503U	200	460	12.00	12/1	3000	6000	11	4	27	18
300	92	98	4.0	1.3	P521_0100 LM503U	200	500	10.00	10/1	3700	6500	11	3	25	15
300	133	150	5.8	0.92	P521_0100 LM505U	250	500	10.00	10/1	3700	6500	17	3	25	19
375	74	78	3.7	2.4	P521_0080 LM503U	160	500	8.000	8/1	3700	6500	11	3	26	15
375	106	120	5.3	1.6	P521_0080 LM505U	250	500	8.000	8/1	3700	6500	17	3	26	19
429	64	68	4.1	2.9	P521_0070 LM503U	140	600	7.000	7/1	3700	6500	11	3	28	15
429	93	105	6.0	2.0	P521_0070 LM505U	220	600	7.000	7/1	3700	6500	17	3	28	19
600	46	49	6.2	4.0	P521_0050 LM503U	99	430	5.000	5/1	3500	6000	11	3	31	15
600	66	75	8.9	2.8	P521_0050 LM505U	160	430	5.000	5/1	3500	6000	17	3	31	19
600	93	103	13	2.0	P521_0050 LM704U	200	600	5.000	5/1	3500	6000	37	3	31	25
600	125	145	17	1.5	P521_0050 LM706U	300	600	5.000	5/1	3500	6000	54	3	31	32
750	37	39	8.1	5.0	P521_0040 LM503U	79	350	4.000	4/1	3000	5000	11	3	32	15
750	53	60	12	3.5	P521_0040 LM505U	120	350	4.000	4/1	3000	5000	18	3	32	19
750	75	82	16	2.5	P521_0040 LM704U	160	600	4.000	4/1	3000	5000	38	3	32	25
750	100	116	22	1.8	P521_0040 LM706U	240	600	4.000	4/1	3000	5000	55	3	32	32
1000	28	29	20	3.8	P521_0030 LM503U	59	260	3.000	3/1	2500	4500	13	3	36	15
1000	40	45	29	2.6	P521_0030 LM505U	93	260	3.000	3/1	2500	4500	20	3	36	19
1000	56	62	41	1.9	P521_0030 LM704U	120	460	3.000	3/1	2500	4500	39	3	36	25
1000	75	87	54	1.4	P521_0030 LM706U	180	460	3.000	3/1	2500	4500	57	3	36	32
P7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 700 Nm)															
60	450	478	2.1	0.98	P722_0500 LM503U	700	1400	50.00	50/1	3700	6500	11	4	53	23
75	360	383	2.3	1.2	P722_0400 LM503U	700	1380	40.00	40/1	3700	6500	11	4	52	23
75	521	588	3.4	0.85	P722_0400 LM505U	700	1380	40.00	40/1	3700	6500	17	4	52	28
86	315	335	2.5	1.4	P722_0350 LM503U	680	1400	35.00	35/1	3700	6500	11	4	53	23
86	456	514	3.6	0.97	P722_0350 LM505U	700	1400	35.00	35/1	3700	6500	17	4	53	28
94	288	306	2.9	1.4	P722_0320 LM503U	500	1000	32.00	32/1	3000	5000	11	4	52	23
94	416	470	4.1	0.96	P722_0320 LM505U	500	1000	32.00	32/1	3000	5000	18	4	52	28
107	252	268	2.8	1.7	P722_0280 LM503U	540	1380	28.00	28/1	3700	6500	11	4	53	23
107	364	412	4.0	1.2	P722_0280 LM505U	700	1380	28.00	28/1	3700	6500	17	4	53	28
120	225	239	2.9	2.0	P722_0250 LM503U	480	1400	25.00	25/1	3500	6000	11	4	54	23
120	325	367	4.3	1.4	P722_0250 LM505U	700	1400	25.00	25/1	3500	6000	17	4	54	28
120	458	505	6.0	0.96	P722_0250 LM704U	700	1400	25.00	25/1	3500	6000	37	4	54	34
150	180	191	3.3	2.4	P722_0200 LM503U	390	1400	20.00	20/1	3000	5000	11	4	54	23
150	260	294	4.8	1.7	P722_0200 LM505U	610	1400	20.00	20/1	3000	5000	18	4	54	28
150	366	404	6.7	1.2	P722_0200 LM704U	700	1400	20.00	20/1	3000	5000	37	4	54	34
150	488	566	8.9	0.90	P722_0200 LM706U	700	1400	20.00	20/1	3000	5000	55	4	54	41
188	144	153	3.7	3.1	P722_0160 LM503U	310	1340	16.00	16/1	3000	5000	12	4	54	23
188	208	235	5.3	2.1	P722_0160 LM505U	490	1340	16.00	16/1	3000	5000	18	4	54	28
188	293	323	7.5	1.5	P722_0160 LM704U	630	1380	16.00	16/1	3000	5000	38	4	54	34
188	390	453	10	1.1	P722_0160 LM706U	700	1380	16.00	16/1	3000	5000	55	4	54	41
250	108	115	6.7	2.6	P722_0120 LM503U	230	1000	12.00	12/1	2500	5000	12	4	53	23
250	156	176	9.7	1.8	P722_0120 LM505U	370	1000	12.00	12/1	2500	5000	18	4	53	28
250	220	242	14	1.3	P722_0120 LM704U	470	1040	12.00	12/1	2500	5000	38	4	53	34
250	293	340	18	0.96	P722_0120 LM706U	500	1040	12.00	12/1	2500	5000	55	4	53	41
300	187	206	4.6	1.4	P721_0100 LM704U	400	1000	10.00	10/1	3300	6000	37	3	50	29
300	249	289	6.1	1.1	P721_0100 LM706U	500	1000	10.00	10/1	3300	6000	54	3	50	36
375	150	165	4.5	2.3	P721_0080 LM704U	320	1000	8.000	8/1	3300	6000	37	3	53	29
375	199	231	6.0	1.8	P721_0080 LM706U	480	1000	8.000	8/1	3300	6000	55	3	53	36
429	131	144	4.8	2.9	P721_0070 LM704U	280	1250	7.000	7/1	3300	6000	37	3	55	29
429	174	202	6.4	2.2	P721_0070 LM706U	420	1250	7.000	7/1	3300	6000	55	3	55	36
600	93	103	7.2	4.1	P721_0050 LM704U	200	900	5.000	5/1	3000	5500	38	3	58	29
600	125	145	9.6	3.1	P721_0050 LM706U	300	900	5.000	5/1	3000	5500	56	3	58	36
750	100	116	13	3.9	P721_0040 LM706U	240	720	4.000	4/1	2500	4500	57	3	60	36

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm^2]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
P7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 700 Nm)															
1000	56	62	21	4.4	P721_0030 LM704U	120	540	3.000	3/1	2200	3700	45	3	65	29
1000	75	87	28	3.3	P721_0030 LM706U	180	540	3.000	3/1	2200	3700	62	3	65	36
P8 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 1600 Nm)															
60	915	1010	2.0	1.1	P822_0500 LM704U	1600	3200	50.00	50/1	3300	6000	37	4	168	49
60	1219	1416	2.7	0.82	P822_0500 LM706U	1600	3200	50.00	50/1	3300	6000	54	4	168	56
75	732	808	2.8	1.1	P822_0400 LM704U	1560	3180	40.00	40/1	3300	6000	37	4	163	49
75	975	1132	3.8	0.82	P822_0400 LM706U	1600	3180	40.00	40/1	3300	6000	54	4	163	56
86	641	707	2.4	1.6	P822_0350 LM704U	1370	3200	35.00	35/1	3300	6000	38	4	170	49
86	854	991	3.2	1.2	P822_0350 LM706U	1600	3200	35.00	35/1	3300	6000	55	4	170	56
94	586	646	3.2	1.4	P822_0320 LM704U	1200	2400	32.00	32/1	2500	4500	40	4	159	49
94	780	906	4.2	1.0	P822_0320 LM706U	1200	2400	32.00	32/1	2500	4500	57	4	159	56
107	513	566	3.4	1.6	P822_0280 LM704U	1100	3180	28.00	28/1	3300	6000	38	4	166	49
107	683	793	4.5	1.2	P822_0280 LM706U	1600	3180	28.00	28/1	3300	6000	55	4	166	56
120	458	505	2.9	2.2	P822_0250 LM704U	980	3200	25.00	25/1	3000	5500	39	4	171	49
120	610	708	3.8	1.6	P822_0250 LM706U	1460	3200	25.00	25/1	3000	5500	56	4	171	56
150	366	404	3.2	2.7	P822_0200 LM704U	780	3200	20.00	20/1	2500	4500	40	4	172	49
150	488	566	4.3	2.1	P822_0200 LM706U	1170	3200	20.00	20/1	2500	4500	57	4	172	56
188	293	323	4.5	2.7	P822_0160 LM704U	630	2790	16.00	16/1	2500	4500	41	4	169	49
188	390	453	5.9	2.1	P822_0160 LM706U	930	2790	16.00	16/1	2500	4500	58	4	169	56
250	220	242	5.2	3.6	P822_0120 LM704U	470	2090	12.00	12/1	2200	4500	42	4	156	49
250	293	340	6.9	2.7	P822_0120 LM706U	700	2090	12.00	12/1	2200	4500	59	4	156	56

6.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download CAD models of our standard drives at http://cad.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can be found at http://cad.stoeber.de.

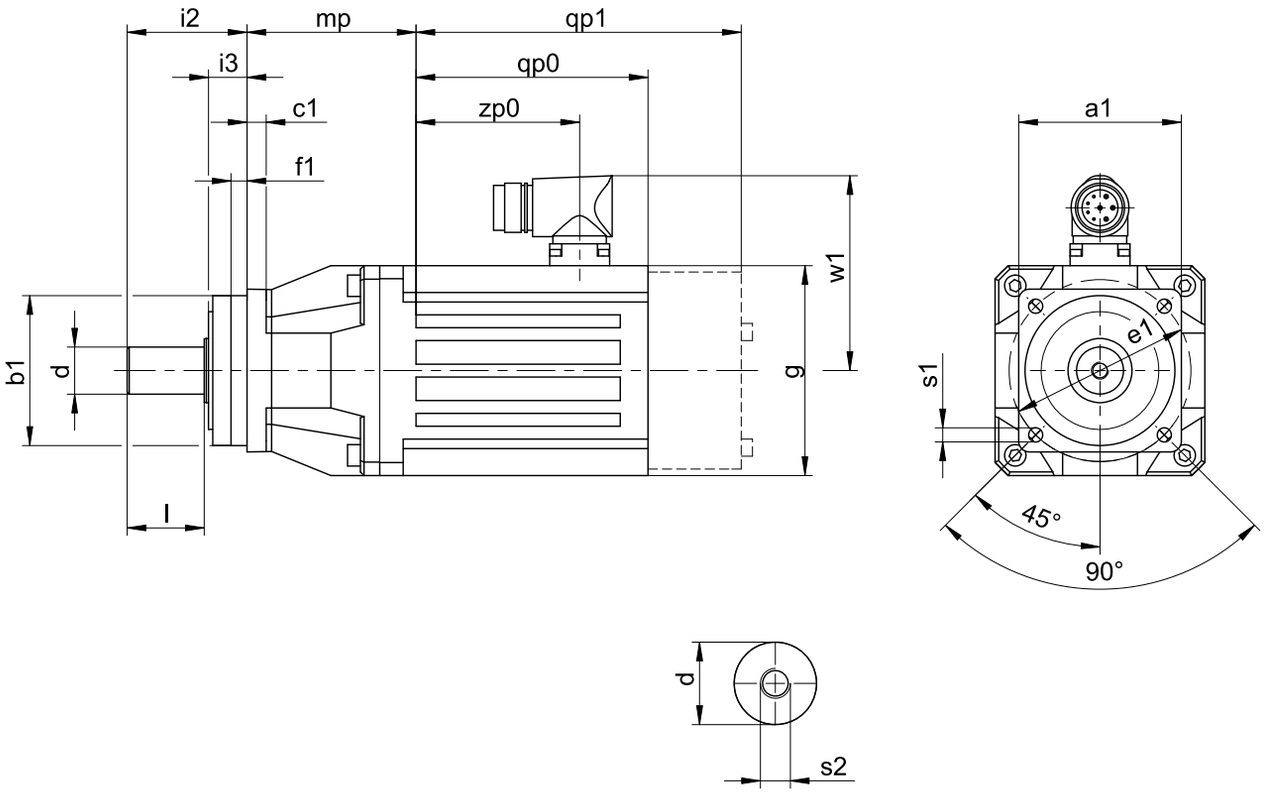
Tolerances

Solid shaft	Tolerance
Shaft ∅ fit ≤ 50 mm	DIN 748-1, ISO k6
Shaft ∅ fit > 50 mm	DIN 748-1, ISO m6
Feather keys	DIN 6885-1, high form A
Balance quality	Q 2.5 (balanced with half feather key)

Centering holes in solid shafts in accordance with DIN 332-2, DR shape

Thread size	M4	M5	M6	M8	M10	M12	M16	M20	M24
Thread depth [mm]	10	12.5	16	19	22	28	36	42	50

6.3.1 G shaft design (solid shaft without feather key)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	□a1	Ø$b1_{h6}$	c1	Ød_{k6}	Ø$e1_{h6}$	f1	i2	i3	l	Ø$s1_{H13}$	s2
P321	72	60_{h6}	7	16_{k6}	75	7.5	48	18	28	5.5	M5
P421	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	6.6	M8
P422	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	6.6	M8
P521	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	9.0	M12
P522	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	9.0	M12
P721	145	130_{h6}	15	40_{k6}	165	3.5	112	27	82	11.0	M16
P722	145	130_{h6}	15	40_{k6}	165	3.5	112	27	82	11.0	M16
P822	190	160_{h6}	15	55_{k6}	215	10.0	112	27	82	13.5	M20

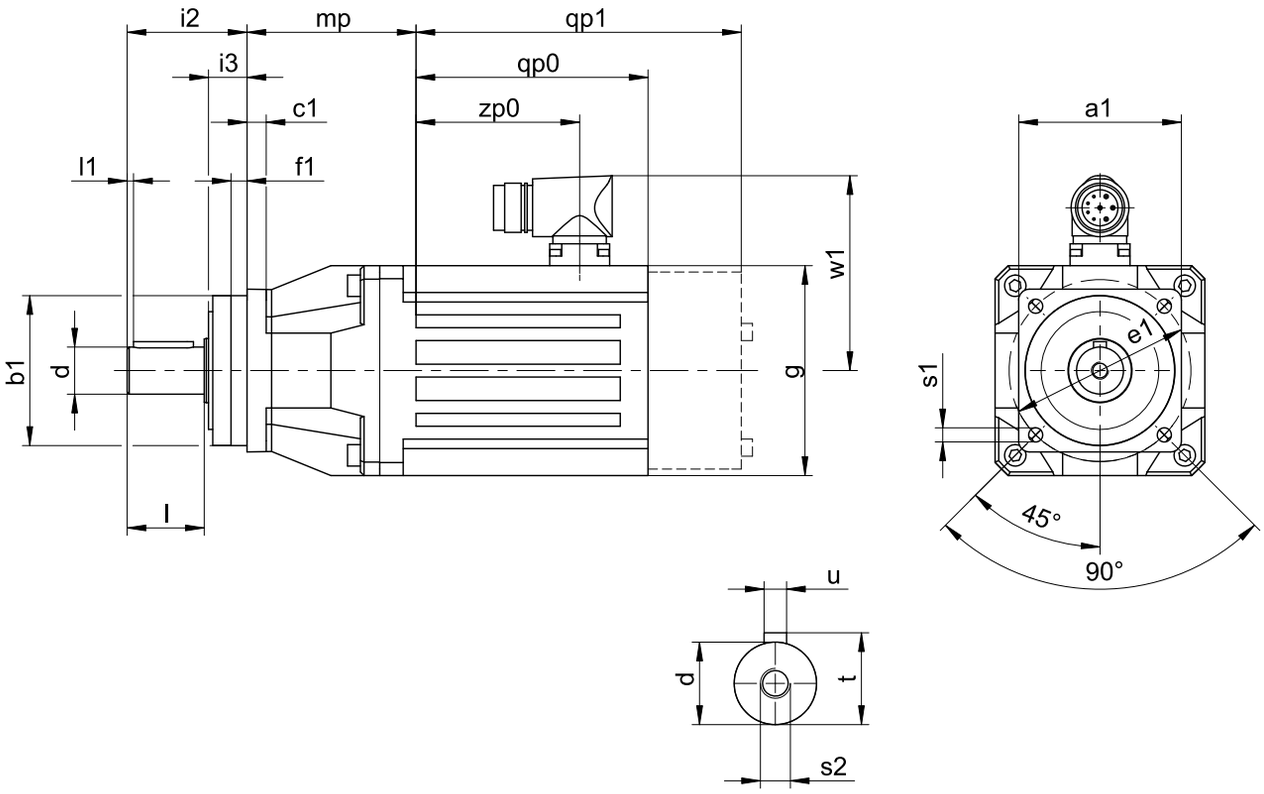
Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152.0	91.0	76.5
LM402U	98	147.5	191.0	91.0	115.5
LM403U	98	178.5	222.0	91.0	146.5
LM503U	115	186.5	234.5	100.0	156.0
LM505U	115	256.5	304.5	100.0	226.0
LM704U	145	236.5	295.5	115.0	204.0
LM706U	145	306.5	365.5	115.0	274.0

Dimensions of geared motors

Type	LM4 mp	LM5 mp	LM7 mp
P321	70.0	–	–
P421	79.0	81.5	–
P422	127.5	–	–
P521	–	81.0	87.0
P522	136.5	139.0	–
P721	–	–	98.0
P722	–	158.0	164.0
P822	–	–	206.5

6.3.2 P shaft design (solid shaft with feather key)



qp0 Applies to motors without brake.

qp1 Applies to motors with brake.

Dimensions of gear units

Type	□a1	Ød1	c1	Ød	Øe1	f1	i2	i3	l	l1	Øs1	s2	t	u
P321	72	60_{h6}	7	16_{k6}	75	7.5	48	18	28	2	5.5	M5	18.0	A5×5×22
P421	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	3	6.6	M8	24.5	A6×6×28
P422	76	70_{h6}	9	22_{k6}	85	7.5	56	18	36	3	6.6	M8	24.5	A6×6×28
P521	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	3	9.0	M12	35.0	A10×8×50
P522	101	90_{h6}	10	32_{k6}	120	15.0	88	28	58	3	9.0	M12	35.0	A10×8×50
P721	145	130_{h6}	15	40_{k6}	165	3.5	112	27	82	4	11.0	M16	43.0	A12×8×70
P722	145	130_{h6}	15	40_{k6}	165	3.5	112	27	82	4	11.0	M16	43.0	A12×8×70
P822	190	160_{h6}	15	55_{k6}	215	10.0	112	27	82	6	13.5	M20	59.0	A16×10×70

Dimensions of motors

Type	□g	qp0	qp1	w1	zp0
LM401U	98	108.5	152.0	91.0	76.5
LM402U	98	147.5	191.0	91.0	115.5
LM403U	98	178.5	222.0	91.0	146.5
LM503U	115	186.5	234.5	100.0	156.0
LM505U	115	256.5	304.5	100.0	226.0
LM704U	145	236.5	295.5	115.0	204.0
LM706U	145	306.5	365.5	115.0	274.0

Dimensions of geared motors

Type	LM4	LM5	LM7
	mp	mp	mp
P321	70.0	–	–
P421	79.0	81.5	–
P422	127.5	–	–
P521	–	81.0	87.0
P522	136.5	139.0	–
P721	–	–	98.0
P722	–	158.0	164.0
P822	–	–	206.5

6.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

P	4	2	1	S	G	R	0040	LM403U

Explanation

Code	Designation	Design
P	Type	Planetary gear unit
4	Size	4 (example)
2	Generation	Generation 2
1	Stages	Single-stage
2		Two-stage
S	Housing	Standard
G	Shaft	Solid shaft without feather key
P		Solid shaft with feather key
R	Bearing	Standard bearing
D		Axially reinforced bearing
Z		Radially reinforced bearing
0040	Transmission ratio (i x 10)	i = 4 (example)
LM403U	Motor	LM Lean motor

In order to complete the type designation, also specify:

- A detailed type designation of the motor, see the chapter [▷ 2]
- Radial shaft seal rings at the output made of FKM or NBR, see the chapter [▷ 6.6.3]
- The position of the plug connector, see the chapter [▷ 6.5.3]
- For reverse operation of the output shaft at ± 20° to ± 90° and horizontal installation, note the chapter [▷ 6.6.4]

6.5 Product description

6.5.1 Installation conditions

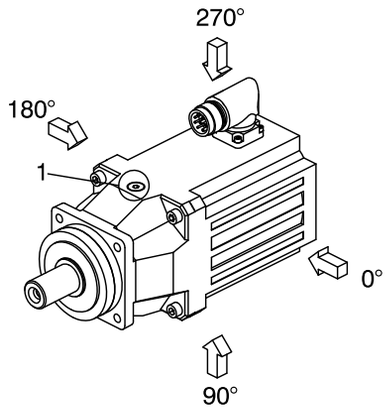
The specified torques and forces only apply when attaching gear units at the machine side using screws of quality 10.9. In addition, the gear housing must be adjusted at the pilot (H7).

6.5.2 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate.

Lubricant filling quantities for gear units, document ID 441871, can be found online at http://www.stoeber.de

6.5.3 Position of the plug connector



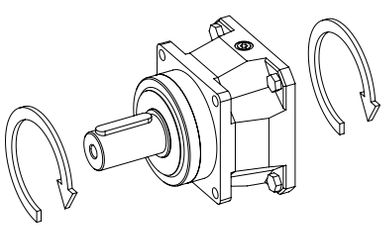
In the standard version, the plug connector is attached in the 270° position (relative to the oil drain plug (1) of the planetary gear unit). Indicate variations for your geared motor in the purchase order.

6.5.4 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 90 °C
Paint	Black RAL 9005
(ATEX) Directive 2014/34/EU	Not suitable
Protection class: [1]	
Gear unit	IP65
Motor	IP56, optionally IP66

6.5.5 Direction of rotation

The input and output rotate in the same direction.



6.6 Project configuration

Project your drives using our SERVOsoft designing software. You can receive SERVOsoft for free from your adviser at one of our sales centers. Observe the limit conditions in this chapter to ensure a safe design for your drives.

An explanation of the formula symbols can be found in Chapter Symbols in formulas.

6.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

$$n_{1m^*} \leq \frac{n_{1maxDB}}{fB_T}$$

$$n_{1max^*} \leq \frac{n_{1maxZB}}{fB_T}$$

$$M_{2eff^*} \leq M_{2th}$$

[1] Observe the protection class of all the components.

$$M_{2acc*} \leq M_{2acc}$$

$$M_{2NOT*} \leq M_{2NOT}$$

$$M_{2eq*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

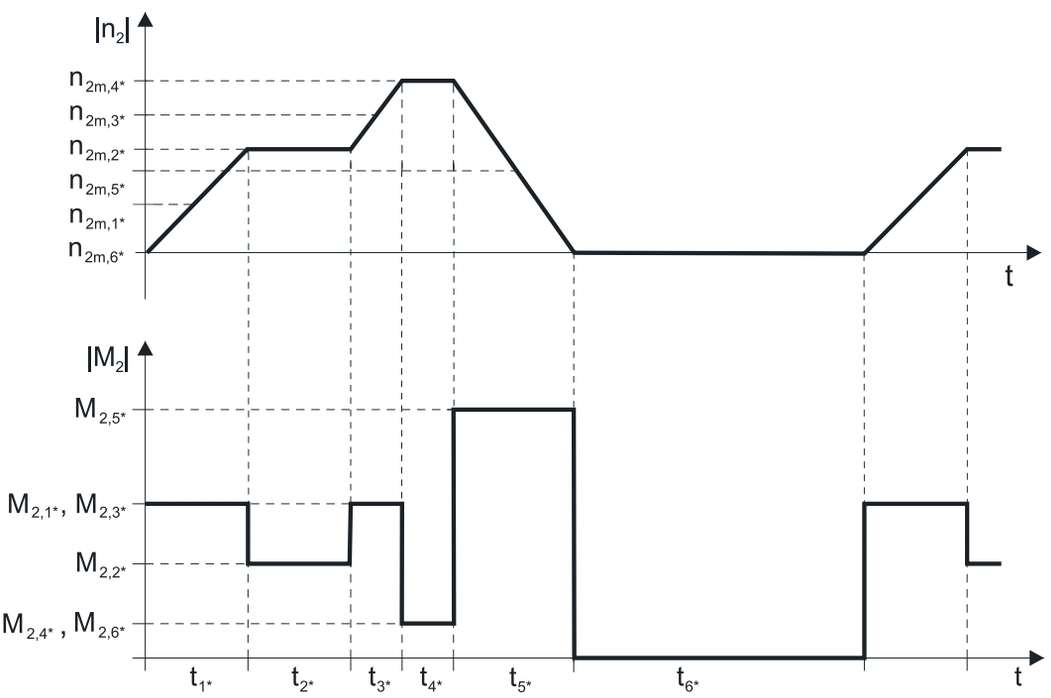
The values for n_{1maxDB}, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S can be found in the selection tables.

The values for fB_T, fB_{op} and fB_t can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

Example of cyclic operation

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m*} = n_{2m*} \cdot i$$

$$n_{2m*} = \frac{\left|n_{2m,1*}\right| \cdot t_{1*} + \ldots + \left|n_{2m,n*}\right| \cdot t_{n*}}{t_{1*} + \ldots + t_{n*}}$$

If $t_{1*} + \ldots + t_{5*} \geq 20$ min, calculate n_{2m*} without the rest phase t_{6*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff*} = \sqrt{\frac{t_{1*} \cdot M_{2,1*}{}^2 + \ldots + t_{n*} \cdot M_{2,n*}{}^2}{t_{1*} + \ldots + t_{n*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq*} = \sqrt[3]{\frac{\left|n_{2m,1*}\right| \cdot t_{1*} \cdot \left|M_{2,1*}{}^3\right| + \ldots + \left|n_{2m,n*}\right| \cdot t_{n*} \cdot \left|M_{2,n*}{}^3\right|}{\left|n_{2m,1*}\right| \cdot t_{1*} + \ldots + \left|n_{2m,n*}\right| \cdot t_{n*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED_{20} > 50% and the actual average input speed n_{1m*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m*} accordingly or select another geared motor size.)

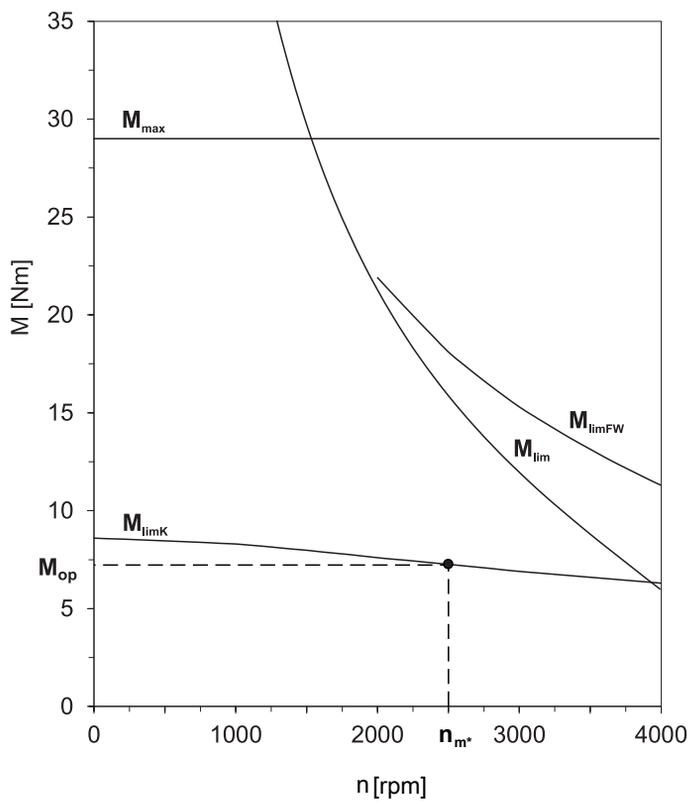
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}95 - \frac{a_{th}}{1000} \cdot fB_T \cdot \left(\frac{n_{1m*}}{1000} \right)^3$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [▷ 2.3]. Note the size and nominal speed n_N of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.00
Reversing load cyclic operation	1.00

Run time	fB_t
Daily run time ≤ 8 h	1.00
Daily run time ≤ 16 h	1.15
Daily run time ≤ 24 h	1.20

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with convection cooling	≤ 20 °C	1.0
	≤ 30 °C	1.1
	≤ 40 °C	1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.
- The values specified in the selection tables for M_{2acc} refer to the gear units with a solid shaft design without feather key (G). We recommend this shaft design in general for cyclic operation.

6.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds $n_{2m*} \leq 100$ rpm ($F^{2axN} = F_{2ax100}$; $F_{2radN} = F_{2rad100}$; $M_{2kN} = M_{2k100}$)
- Only if radial forces on the gear unit are stabilized by its pilots (housing, flange shaft)

Permitted shaft loads for standard bearing R

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
P2	17.0	500	1200	1300	34	36
P3	21.0	1000	2500	2500	88	88
P4	22.0	1500	4000	4500	160	180
P5	23.0	2300	6500	7000	338	364
P7	26.0	2900	8000	9000	536	603
P8	28.0	4700	13000	18000	897	1242
P9	40.0	6000	18000	27000	1665	2498

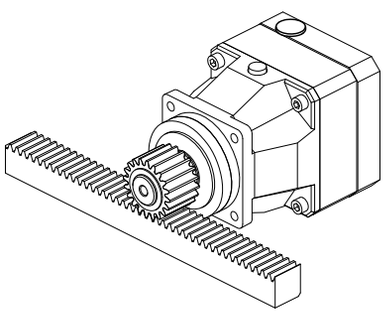


Fig. 1: Recommendation for bearing assignment R

Permitted shaft loads for axially reinforced bearing D

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
P3	24.0	1400	2750	2750	105	105
P4	25.0	2250	4500	5000	194	215
P5	29.0	3500	7000	8000	406	464
P7	31.0	4500	9000	10000	648	720
P8	35.0	7500	15000	18000	1140	1368
P9	51.0	10000	20000	30000	2070	3105

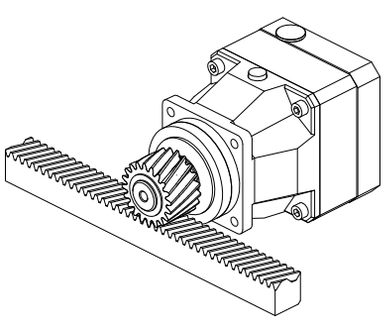


Fig. 2: Recommendation for bearing assignment D

Permitted shaft loads for radially reinforced bearing Z

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
P3	21.0	600	3000	3000	105	105
P4	22.0	1000	5000	5000	200	200
P5	23.0	1600	8000	8000	416	416
P7	26.0	2000	10000	10000	670	670
P8	28.0	3600	18000	18000	1242	1242
P9	40.0	5000	27000	35000	2500	3238

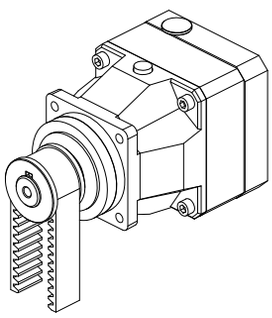


Fig. 3: Recommendation for bearing assignment Z

For other output speeds, download diagrams at http://products.stoeber.de.

The following applies to output speeds n_{2m*} > 100 rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m*}}{100\ rpm}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m*}}{100\ rpm}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m*}}{100\ rpm}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

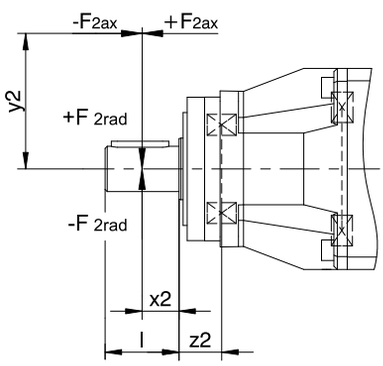


Fig. 4: Force application points

The specified values for $F_{2rad100}$ and $F_{2rad,acc}$ refer to an application of force at the center of the output shaft: $x_2 = l/2$.

Shaft dimensions can be found in the "Dimensional drawings" chapter.

The following applies to other force application points:

$$M_{2k,acc*} = \frac{2 \cdot F_{2ax*} \cdot y_2 + F_{2rad,acc*} \cdot (x_2 + z_2)}{1000} \leq M_{2k,acc}$$

$$F_{2rad,acc*} \leq F_{2rad,acc}$$

$$F_{2ax*} \leq F_{2axN}$$

The values for $F_{2rad,acc}$ and $M_{2k,acc}$ can be found in the table "Permitted shaft loads" in this chapter.

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax100}, $F_{2rad100}$ and M_{2k100} by a factor of two.

Also note the calculation for equivalent values:

$$M_{2k,eq^*} = \sqrt[3]{\frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} \cdot \left|M_{2k,acc,1^*}{}^3\right| + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*} \cdot \left|M_{2k,acc,n^*}{}^3\right|}{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}} \leq M_{2kN}$$

$$F_{2rad,eq^*} = \sqrt[3]{\frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} \cdot \left|F_{2rad,acc,1^*}{}^3\right| + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*} \cdot \left|F_{2rad,acc,n^*}{}^3\right|}{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}} \leq F_{2radN}$$

The following apply to the bearing service life L_{10h} ($ED_{20} \leq 40\%$):

$L_{10h} > 10000$ h with $1 < M_{2kN}/M_{2k^*} < 1.25$

$L_{10h} > 20000$ h with $1.25 < M_{2kN}/M_{2k^*} < 1.5$

$L_{10h} > 30000$ h with $1.5 < M_{2kN}/M_{2k^*}$

For different duty cycles:

$$L_{10h} > L_{10h(ED_{20}=40\%)} \cdot \frac{40\%}{ED_{20}}$$

6.6.3 Recommendation for radial shaft seal rings

For a duty cycle > 60%, we recommend radial shaft seal rings made of FKM.

Properties:

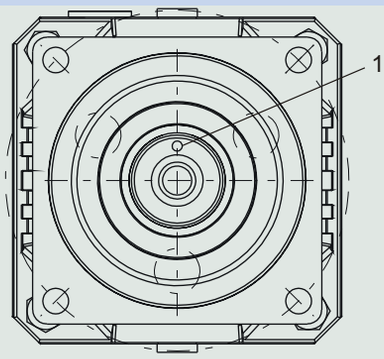
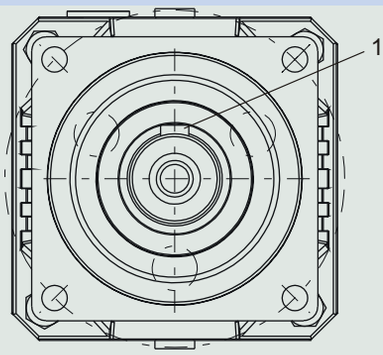
- Excellent temperature resistance
- High chemical stability
- Very good resistance to aging
- Excellent resistance to mineral oils and greases
- For use in the food, beverage and pharmaceutical industries

Leak-proofness

Our gear units are equipped with high-quality radial shaft seal rings and checked for leak-proofness. However, a leak cannot be fully ruled out over the length of use of a gear unit. If you use a gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

6.6.4 Reverse operation

To ensure lubrication of circulating geared parts during cyclic reverse operation from ± 20° to ± 90°, pay careful attention to the position of the output shaft if the gear unit is installed horizontally as shown in the images below. The images show the center position of reverse operation. Cyclic reverse operation ≤ ± 20° on request.

Solid shaft without feather key	Solid shaft with feather key
	
1) Position of the mark: top	1) Position of the feather key: top

Notes

- If you use the solid shaft without a feather key (G) with a mark, note the position of the mark during assembly.
- As an alternative, you can use the solid shaft with a feather key (P) and clamp. In that case, the feather key functions for position orientation.

6.7 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/download

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for P/PA/PE/PH/PHA/PHQ/PHQA/PHV/PHVA planetary gear units and planetary geared motors	443029_en
Lubricant filling quantities for gear units	441871