

Bore Sizes and Shaft Tolerances

English (inches)

Bore and shaft tolerances listed below will give the recommended fit for each size clutch. If a press fit is necessary, never exceed .001" (.025mm) interference fit. For all bore and shaft sizes not listed below use same tolerances and fits as next larger size.

Sleeve Bearing Clutches

Series	Nominal Bore	Bore Diameter	Shaft Diameter
FS	.250	.250/.252	.250/.249
	.375	.375/.377	.3745/.374
	.500	.500/.502	.4995/.499
	.625	.625/.626	.6245/.6240
	.750	.750/.751	.7495/.749
FSR	.375	.375/.376	.3745/.374
	.500	.500/.501	.4995/.499
	.625	.625/.626	.6245/.624
	.687	.687/.688	.6865/.6860
	.750	.750/.751	.7495/.749
	.875	.875/.876	.8745/.874
	1.000	1.000/1.001	.9995/.999
	1.125	1.125/1.126	1.1245/1.1235
	1.250	1.250/1.251	1.2495/1.2485
	1.375	1.375/1.376	1.3745/1.3735
	1.500	1.500/1.501	1.4995/1.4985
	1.625	1.625/1.626	1.6245/1.6235
	1.750	1.750/1.751	1.7495/1.7485
	1.875	1.875/1.876	1.8745/1.8735
	2.000	2.000/2.001	1.9995/1.9985
2.187	2.187/2.188	2.1865/2.1855	

* For LLH series, see page 78.

Ball Bearing Clutches (except LLH Series)

	Nominal Bore	Bore Diameter	Shaft Diameter		Nominal Bore	Bore Diameter	Shaft Diameter
	.500	.499/.500	.499/.498		7.000	7.000/6.998	6.997/6.998
	.625	.624/.625	.624/.623		7.500	7.504/7.506	7.503/7.502
	.750	.749/.750	.749/.748		7.750	7.754/7.756	7.753/7.752
	.875	.874/.875	.874/.873		8.000	8.004/8.006	8.003/8.002
	1.000	0.999/1.000	.999/.998		8.250	8.254/8.256	8.253/8.252
	1.125	1.124/1.125	1.124/1.123		8.500	8.504/8.506	8.503/8.502
	1.250	1.249/1.250	1.249/1.248		8.750	8.754/8.756	8.753/8.752
	1.312	1.311/1.312	1.311/1.310		9.000	9.004/9.006	9.003/9.002
	1.375	1.374/1.375	1.374/1.373		9.250	9.254/9.256	9.253/9.252
	1.500	1.499/1.500	1.499/1.498		9.500	9.504/9.506	9.503/9.502
	1.625	1.624/1.625	1.624/1.623		9.750	9.754/9.756	9.753/9.752
	1.750	1.749/1.750	1.749/1.748		10.000	10.004/10.006	10.003/10.002
	1.937	1.9365/1.9375	1.9365/1.9355		10.500	10.504/10.506	10.503/10.502
5	2.000	1.999/2.000	1.999/1.998		11.000	11.004/11.006	11.003/11.002
	2.125	2.124/2.125	2.124/2.123		11.500	11.504/11.506	11.503/11.502
	2.250	2.2485/2.2500	2.2485/2.2475		12.000	12.004/12.006	12.003/12.001
	2.375	2.375/2.376	2.375/2.374		12.250	12.254/12.256	12.253/12.251
1	2.437	2.4360/2.4375	2.4360/2.4350		12.500	12.504/12.506	12.503/12.501
	2.437	2.4365/2.4375	2.4365/2.4355		13.000	13.004/13.006	13.003/13.001
	2.500	2.4985/2.5000	2.4985/2.4975		13.250	13.254/13.256	13.253/13.251
	2.625	2.624/2.625	2.624/2.623		13.500	13.504/13.506	13.503/13.501
	2.750	2.7485/2.7500	2.7485/2.7475		13.750	13.754/13.756	13.753/13.751
	2.937	2.9360/2.9375	2.9360/2.9350		14.000	14.004/14.006	14.003/14.001
	3.000	2.9985/3.0000	2.9985/2.9975		14.250	14.254/14.256	14.253/14.251
	3.250	3.2485/3.2500	3.2485/3.2475		14.500	14.504/14.506	14.503/14.501
	3.437	3.4360/3.4375	3.4360/3.4350		14.750	14.754/14.756	14.753/14.751
	3.500	3.4985/3.5000	3.4985/3.4975		15.000	15.004/15.006	15.003/15.001
	3.750	3.7485/3.7500	3.7485/3.7475		15.250	15.254/15.256	15.253/15.251
	3.937	3.9360/3.9375	3.9360/3.9350		15.500	15.504/15.506	15.503/15.501
	3.937	3.9355/3.9370	3.9355/3.9345		15.750	15.754/15.756	15.753/15.751
	4.000	3.9985/4.0000	3.9985/3.9975		16.000	16.004/16.007	16.003/16.001
2,6	4.000	3.998/4.000	3.998/3.997		16.250	16.254/16.257	16.253/16.251
	4.250	4.248/4.250	4.248/4.247		16.500	16.504/16.507	16.503/16.501
2	4.250	4.2485/4.2500	4.2485/4.2470		16.750	16.754/16.757	16.753/16.751
	4.437	4.4355/4.4375	4.4355/4.4345		17.000	17.004/17.007	17.003/17.001
	4.437	4.4360/4.4375	4.4360/4.4350		17.250	17.254/17.257	17.253/17.251
2	4.500	4.498/4.500	4.498/4.497		17.500	17.504/17.507	17.503/17.501
	4.750	4.748/4.750	4.748/4.747		17.750	17.754/17.757	17.753/17.751
	4.937	4.9355/4.9375	4.9355/4.9345		18.000	18.004/18.007	18.003/18.001
2	4.937	4.9360/4.9375	4.9360/4.9345		18.250	18.254/18.257	18.253/18.251
	5.000	4.998/5.000	4.998/4.997		18.500	18.504/18.507	18.503/18.501
4	5.000	5.002/5.004	5.001/5.000		18.750	18.754/18.757	18.753/18.751
	5.250	5.248/5.250	5.248/5.247		19.000	19.004/19.007	19.003/19.001
	5.437	5.4355/5.4375	5.4355/5.4345		20.000	20.004/20.007	20.003/20.001
3	5.437	5.435/5.437	5.435/5.434				
	5.500	5.498/5.500	5.498/5.497				
	5.750	5.748/5.750	5.748/5.747				
	5.937	5.9355/5.9375	5.9355/5.9345				
3	5.937	5.9360/5.9375	5.9360/5.9350				
	6.000	5.998/6.000	5.998/5.997				
	6.250	6.248/6.250	6.248/6.247				
	6.437	6.4355/6.4375	6.4355/6.4345				
	6.437	6.436/6.438	6.436/6.435				
3	6.500	6.498/6.500	6.498/6.497				
	6.750	6.748/6.750	6.748/6.747				
	6.937	6.9355/6.9375	6.9355/6.9345				

Note: On Models 750 thru 5000, Formsprag may elect to supply a stepped key in the event of keyseat distortion during heat treat of inner race.

- ¹ Model 750 only
- ² Model 900 only
- ³ Model 1027 only
- ⁴ Model 1051 only
- ⁵ FSO 600/2.00 tolerance 2.000/2.001
- ⁶ Model 800 only

Bore Sizes and Shaft Tolerances

Metric (millimeters)

Bore and shaft tolerances listed below will give the recommended fit for each size clutch. If a press fit is necessary, never exceed .001" (.025mm) interference fit.

For all bore and shaft sizes not listed below use same tolerances and fits as next larger size.

For Metric bores the recommended bore tolerances are H7.

Sleeve Bearing Clutches

Series	Nominal Bore	Bore Diameter	Shaft Diameter
FS	6.35	6.35/6.401	6.35/6.325
	9.525	9.525/9.576	9.512/9.500
	12.70	12.70/12.751	12.687/12.675
	15.875	15.875/15.900	15.862/15.850
	19.05	19.05/19.075	19.037/19.025
FSR	25.400	25.400/25.425	25.387/25.375
	28.575	28.575/28.600	28.562/28.537
	31.75	31.75/31.775	31.737/31.712
	34.925	34.925/34.950	34.912/34.887
	38.1	38.1/38.125	38.087/38.062
	41.275	41.275/41.300	41.262/41.237
	44.45	44.45/44.475	44.437/44.412
	47.625	47.625/47.650	47.612/47.587
	50.8	50.8/50.825	50.787/50.762
	55.550	55.550/55.575	55.537/55.512

* For LLH series, see page 79.

Nominal Bore	Bore Diameter	Shaft Diameter
12.700	12.675/12.700	12.675/12.649
15.875	15.850/15.875	15.850/15.824
19.050	19.025/19.050	19.025/18.999
22.225	22.200/22.225	22.200/22.174
25.400	25.375/25.400	25.375/25.349
28.575	28.550/28.575	28.550/28.524
31.750	31.725/31.750	31.725/31.699
33.325	33.299/33.325	33.299/33.274
34.925	34.900/34.925	34.900/34.874
38.100	38.075/38.100	38.075/38.049
41.275	41.250/41.275	41.250/41.224
44.450	44.425/44.45	44.425/44.399
49.200	49.187/49.213	49.187/49.162
50.800	50.775/50.800	50.775/50.749
53.975	53.950/53.975	53.950/53.924
57.150	57.112/57.150	57.112/57.087
61.900	61.874/61.913	61.874/61.849
61.900	61.887/61.913	61.887/61.862
63.500	63.462/63.500	63.462/63.437
66.675	66.650/66.675	66.650/66.624
69.850	69.812/69.850	69.812/69.787
74.600	74.574/74.613	74.574/74.549
76.200	76.162/76.200	76.162/76.137
82.550	82.512/82.550	82.512/82.487
87.300	87.274/87.313	87.274/87.249
88.900	88.862/88.900	88.862/88.837
95.250	95.212/95.250	95.212/95.187
100.000	99.974/100.013	99.974/99.949
100.000	99.962/100.000	99.962/99.936
101.600	101.562/101.600	101.562/101.537
101.600	101.549/101.600	101.549/101.524
107.950	107.899/107.950	107.899/107.874
107.950	107.912/107.950	107.912/107.874
112.700	112.662/112.713	112.662/112.636
112.700	112.674/112.713	112.674/112.649
114.300	114.249/114.300	114.249/114.224
120.650	120.599/120.650	120.599/120.574
125.400	125.362/125.413	125.362/125.336
125.400	125.374/125.413	125.374/125.336
127.000	126.949/127.000	126.949/126.924
127.000	127.051/127.102	127.025/127.000
133.350	133.299/133.350	133.299/133.274
138.100	138.062/138.113	138.062/138.036
138.100	138.049/138.100	138.049/138.024
139.700	139.649/139.700	139.649/139.624
146.050	145.999/146.050	145.999/145.974
150.800	150.762/150.813	150.762/150.736
150.800	150.774/150.813	150.774/150.749
152.400	152.349/152.400	152.349/152.324
158.750	158.699/158.750	158.699/158.674
163.500	163.462/163.513	163.462/163.436
163.500	163.474/163.525	163.474/163.449
165.100	165.049/165.100	165.049/165.024
171.450	171.399/171.450	171.399/171.374
176.200	176.162/176.213	176.162/176.136

Nominal Bore	Bore Diameter	Shaft Diameter
177.800	177.800/177.749	177.724/177.749
190.500	190.602/190.652	190.576/190.551
196.850	196.952/197.002	196.926/196.901
203.200	203.302/203.352	203.276/203.251
209.550	209.652/209.702	209.626/209.601
215.900	216.002/216.052	215.976/215.951
222.250	222.352/222.402	222.326/222.301
228.600	228.702/228.752	228.676/228.651
234.950	235.052/235.102	235.026/235.001
241.300	241.402/241.452	241.376/241.351
247.650	247.752/247.802	247.726/247.701
254.000	254.102/254.152	254.076/254.051
266.700	266.802/266.852	266.776/266.751
279.400	279.502/279.552	279.476/279.451
292.100	292.202/292.252	292.176/292.151
304.800	304.902/304.952	304.876/304.825
311.150	311.252/311.302	311.226/311.175
317.500	317.602/317.652	317.576/317.525
330.200	330.302/330.352	330.276/330.225
336.550	336.652/336.702	336.626/336.575
342.900	343.002/343.052	342.976/342.925
349.250	349.352/349.402	349.326/349.275
355.600	355.702/355.752	355.676/355.625
361.950	362.052/362.102	362.026/361.975
368.300	368.402/368.452	368.376/368.325
374.650	374.752/374.802	374.726/374.675
381.000	381.102/381.152	381.076/381.025
387.350	387.452/387.502	387.426/387.375
393.700	393.802/393.852	393.776/393.725
400.050	400.152/400.202	400.126/400.075
406.400	406.502/406.578	406.476/406.425
412.750	412.852/412.928	412.826/412.775
419.100	419.202/419.278	419.176/419.125
425.450	425.552/425.628	425.526/425.475
431.800	431.902/431.978	431.876/431.825
438.150	438.252/438.328	438.226/438.175
444.500	444.602/444.678	444.576/444.525
450.850	450.952/451.028	450.926/450.875
457.200	457.302/457.378	457.276/457.225
463.550	463.652/463.728	463.626/463.575
469.900	470.002/470.078	469.976/469.925
476.250	476.352/476.428	476.326/476.275
482.600	482.702/482.778	482.676/482.625
508.000	508.102/508.178	508.076/508.025

¹ Model 750 only

² Model 900 only

³ Model 1027 only

⁴ Model 1051 only

⁵ FSO 600/50.8 tolerance 50.800/50.825

⁶ Model 800 only

Note: On Models 750 thru 5000, Formsprag may elect to supply a stepped key in the event of keyseat distortion during heat treat of inner race.

Mounting Requirements

Press fit assemblies

Shaft and bore tolerances are specified on the pages for each type where press fitting is appropriate.

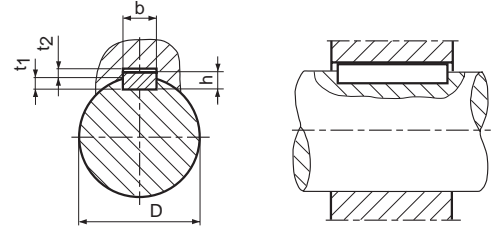
As with standard bearings, suitable tooling must be used for press fitting such that no axial load is transmitted through the inner part of the clutch during assembly.

Metric Key assemblies

For all overrunning clutch inner races connected to shaft by a key, our standard bore tolerance is H7, with keyway to JS10.

We recommend a shaft tolerance of h6 or j6. For maximum indexing accuracy, adjusted keys should be machined to give no clearance.

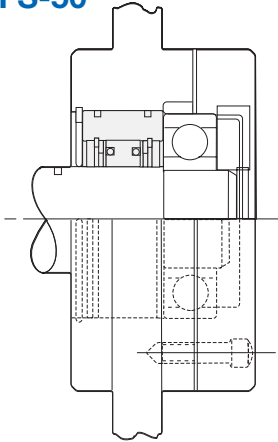
(Metric keyseat dimensions listed on page 123.)



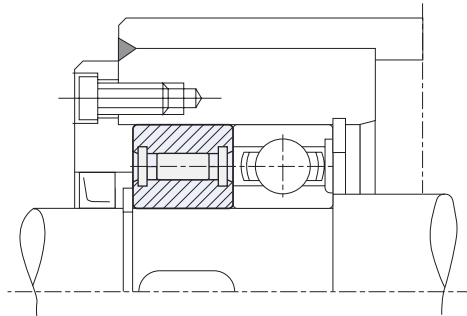
Mounting Examples

Non-supported models

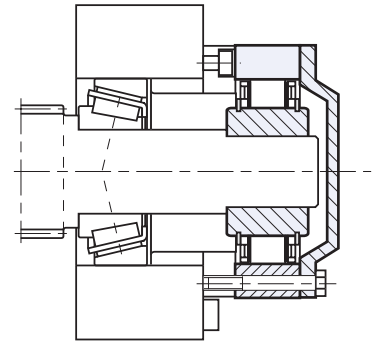
FS-50



AS

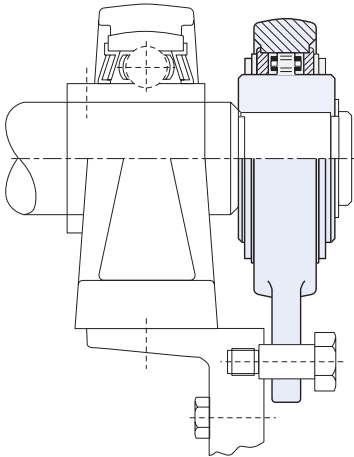


RSCI

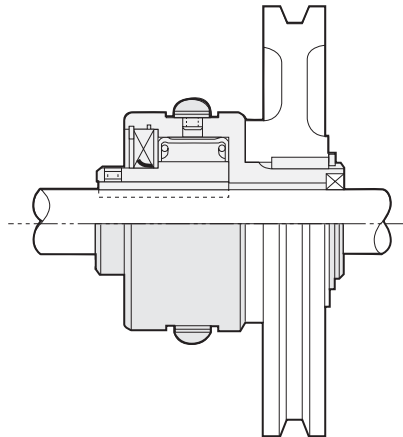


Bearing supported models

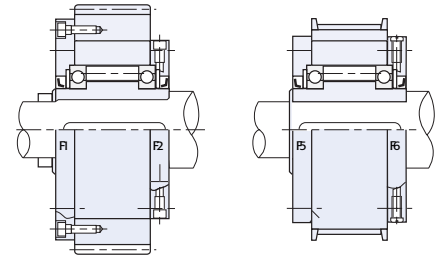
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FSR

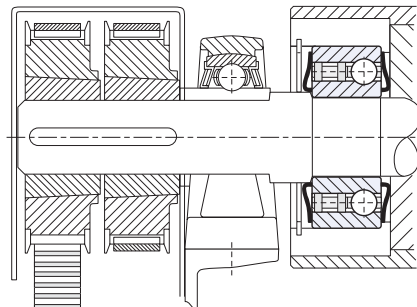


GFR

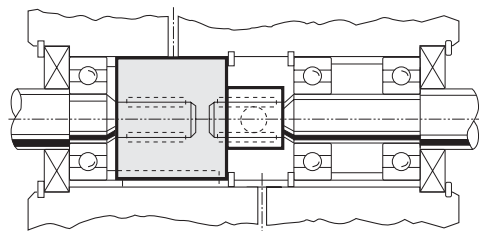


Combined bearing/clutch models

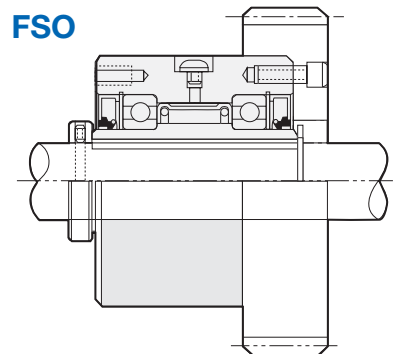
CSK



RL



FSO



Mounting Requirements

Metric Keyseat Dimensions

Bore size (mm)	DIN 6885.1 (mm)				DIN 6885.3 (mm)			
	b (width)	h (key height)	t1 (keyseat-shaft)	t2 (keyseat-housing)	b (width)	h (key height)	t1 (keyseat-shaft)	t2 (keyseat-housing)
6 – 8.0	2 ± 0,020	2	1,2 + 0,1	1 + 0,3				
8.1 – 10.0	3 ± 0,020	3	1,8 + 0,1	1,4 + 0,3				
10.1 – 12.0	4 ± 0,024	4	2,5 + 0,1	1,8 + 0,3				
12.1 – 17.0	5 ± 0,024	5	3 + 0,1	2,3 + 0,3	5 ± 0,024	3	1,9 + 0,1	1,2 + 0,3
17.1 – 22.0	6 ± 0,024	6	3,5 + 0,1	2,8 + 0,3	6 ± 0,024	4	2,5 + 0,1	1,6 + 0,3
22.1 – 30.0	8 ± 0,029	7	4 + 0,2	3,3 + 0,4	8 ± 0,029	5	3,1 + 0,1	2 + 0,3
30.1 – 38.0	10 ± 0,029	8	5 + 0,2	3,3 + 0,4	10 ± 0,029	6	3,7 + 0,2	2,4 + 0,3
38.1 – 44.0	12 ± 0,035	8	5 + 0,2	3,3 + 0,4	12 ± 0,035	6	3,9 + 0,2	2,2 + 0,3
44.1 – 50.0	14 ± 0,035	9	5,5 + 0,2	3,8 + 0,4	14 ± 0,035	6	4 + 0,2	2,1 + 0,3
50.1 – 58.0	16 ± 0,035	10	6 + 0,2	4,3 + 0,4	16 ± 0,035	7	4,7 + 0,2	2,4 + 0,3
58.1 – 65.0	18 ± 0,035	11	7 + 0,2	4,4 + 0,4	18 ± 0,035	7	4,8 + 0,2	2,3 + 0,3
65.1 – 75.0	20 ± 0,042	12	7,5 + 0,2	4,9 + 0,4	20 ± 0,042	8	5,4 + 0,2	2,7 + 0,3
75.1 – 85.0	22 ± 0,042	14	9 + 0,2	5,4 + 0,4	22 ± 0,042	9	6 + 0,2	3,1 + 0,4
85.1 – 95.0	25 ± 0,042	14	9 + 0,2	5,4 + 0,4	25 ± 0,042	9	6,2 + 0,2	2,9 + 0,4
95.1 – 110.0	28 ± 0,042	16	10 + 0,2	6,4 + 0,4	28 ± 0,042	10	6,9 + 0,2	3,2 + 0,4
110.1 – 130.0	32 ± 0,050	18	11 + 0,3	7,4 + 0,4	32 ± 0,050	11	7,6 + 0,2	3,5 + 0,4
130.1 – 150.0	36 ± 0,050	20	12 + 0,3	8,4 + 0,4	36 ± 0,050	12	8,3 + 0,2	3,8 + 0,4

Note: For key assemblies on outer race (models GFRN, ALP, RIZN) the outer member bore should be to H7 tolerance.

ISO tolerance limits for shafts

Tolerance zone	Deviation	Nominal Shaft Dimension in mm					Tolerance Dimension in mm											
		1 incl. 3	over 3 incl. 6	over 6 incl. 10	over 10 incl. 18	over 18 incl. 30	over 30 incl. 40	over 40 incl. 50	over 50 incl. 65	over 65 incl. 80	over 80 incl. 100	over 100 incl. 120	over 120 incl. 140	over 140 incl. 160	over 160 incl. 180	over 180 incl. 200	over 200 incl. 225	over 225 incl. 250
h5	upper lower	0 -.004	0 -.005	0 -.006	0 -.008	0 -.009	0 -.011	0 -.013	0 -.015	0 -.018	0 -.020							0 -.020
h6	upper lower	0 -.006	0 -.008	0 -.009	0 -.011	0 -.012	0 -.016	0 -.019	0 -.022	0 -.025	0 -.029							0 -.029
h7	upper lower	0 -.007	0 -.012	0 -.015	0 -.018	0 -.021	0 -.025	0 -.030	0 -.035	0 -.040	0 -.045							0 -.045
j6	upper lower	+ .004 -.002	+ .006 -.002	+ .007 -.002	+ .008 -.003	+ .009 -.004	+ .011 -.005	+ .012 -.007	+ .013 -.009	+ .014 -.011	+ .016 -.013							
k6	upper lower	-.006 0	+ .009 +.001	+ .010 +.001	+ .012 +.001	+ .015 +.002	+ .018 +.002	+ .021 +.002	+ .025 +.003	+ .028 +.003	+ .033 +.004							+ .033 +.004
n6	upper lower	+ .010 +.004	+ .016 +.008	+ .019 +.010	+ .023 +.012	+ .028 +.015	+ .033 +.017	+ .039 +.020	+ .045 +.023	+ .052 +.027	+ .060 +.031							+ .060 +.031
p5	upper lower	+ .010 +.006	+ .017 +.012	+ .021 +.015	+ .026 +.018	+ .031 +.022	+ .037 +.026	+ .045 +.032	+ .052 +.037	+ .061 +.043	+ .070 +.050							+ .070 +.050
p6	upper lower	+ .012 +.008	+ .020 +.012	+ .024 +.015	+ .029 +.018	+ .035 +.022	+ .042 +.026	+ .051 +.032	+ .059 +.037	+ .068 +.043	+ .079 +.050							+ .079 +.050
p7	upper lower	+ .018 +.008	+ .024 +.012	+ .030 +.015	+ .036 +.018	+ .043 +.022	+ .051 +.026	+ .062 +.032	+ .072 +.037	+ .083 +.043	+ .096 +.050							+ .096 +.050
r6	upper lower	+ .016 +.010	+ .023 +.015	+ .028 +.019	+ .034 +.023	+ .041 +.028	+ .050 +.034	+ .060 +.041	+ .062 +.043	+ .073 +.051	+ .076 +.054	+ .088 +.063	+ .090 +.065	+ .093 +.068	+ .106 +.077	+ .109 +.080	+ .113 +.084	

ISO tolerance limits for holes/bores

Tolerance zone	Deviation	Nominal Hole/Bore Dimension in mm					Tolerance Dimension in mm											
		over 3 incl. 6	over 6 incl. 10	over 10 incl. 18	over 18 incl. 30	over 30 incl. 40	over 40 incl. 50	over 50 incl. 65	over 65 incl. 80	over 80 incl. 100	over 100 incl. 120	over 120 incl. 140	over 140 incl. 160	over 160 incl. 180	over 180 incl. 200	over 200 incl. 225	over 225 incl. 250	over 250 incl. 280
H6	upper lower	+ .008 0	+ .009 0	+ .011 0	+ .013 0	+ .016 0	+ .019 0	+ .022 0	+ .025 0	+ .029 0	+ .032 0							+ .032 0
H7	upper lower	+ .012 .00	+ .015 0	+ .018 0	+ .021 0	+ .025 0	+ .030 0	+ .035 0	+ .040 0	+ .046 0	+ .052 0							+ .052 0
H11	upper lower	+ .075 .00	+ .090 0	+ .110 0	+ .130 0	+ .160 0	+ .190 0	+ .220 0	+ .250 0	+ .290 0	+ .320 0							+ .320 0
K6	upper lower	+ .002 -.006	+ .002 -.007	+ .002 -.009	+ .002 -.011	+ .003 -.013	+ .004 -.015	+ .004 -.018	+ .004 -.021	+ .005 -.024	+ .005 -.027							+ .005 -.027
N6	upper lower	-.005 -.013	-.007 -.016	-.009 -.020	-.011 -.024	-.012 -.028	-.014 -.033	-.016 -.038	-.020 -.045	-.022 -.051	-.025 -.057							-.025 -.057
P6	upper lower	-.009 -.017	-.012 -.021	-.015 -.026	-.016 -.031	-.021 -.037	-.026 -.045	-.030 -.052	-.036 -.061	-.041 -.070	-.047 -.079							-.047 -.079
R6	upper lower	-.012 -.020	-.015 -.025	-.020 -.031	-.024 -.037	-.029 -.045	-.035 -.054	-.037 -.056	-.044 -.066	-.047 -.069	-.056 -.081	-.058 -.083	-.061 -.086	-.068 -.097	-.071 -.100	-.075 -.104	-.085 -.117	-.089 -.121
R7	upper lower	-.011 -.023	-.013 -.026	-.016 -.034	-.020 -.041	-.025 -.050	-.030 -.060	-.032 -.062	-.038 -.073	-.041 -.076	-.048 -.088	-.050 -.090	-.053 -.093	-.060 -.106	-.063 -.109	-.067 -.113	-.074 -.126	-.078 -.130

Formsprag ball bearing clutches are able to carry both radial and thrust loads. Often it is necessary to check the radial loading of the bearings for an application where the clutch is subjected to radial loads imposed by drive chains, gears, sprockets or V- belts. The radial loads imposed by high tension, multi-V belts are particularly high.

The load that can be applied to a ball bearing clutch is dependent upon the bearings used in the clutch and the recommended bearing load rating as specified by the bearing manufacturer. Table 1 gives the Maximum Permissible Load (lbs.) for radial and thrust conditions for Formsprag ball bearing clutches sizes 300 through 1027. These loads are based upon a calculated L-10 bearing life of 10,000 hours (50,000 hrs. avg. bearing life). Higher loads are possible at lower speeds.

Condition #1 (A) is the Maximum Permissible Load (lbs.) for radial loads centered between the bearings.

Condition #2 (B) is the Maximum Permissible Load (lbs.) radially applied above the end face of the clutch.

Condition #3 (C) is the Maximum Permissible Load (lbs.) radially applied which can be offset or overhung from the end of the clutch.

Example: Determine the Maximum permissible load (C) that can be radially applied to a stub shaft adapter 10 inches from the end of a FSO-700 clutch.

Using the formula:

$$\text{Load (C)} = \frac{(A) (L)}{2 (d + D + L)}$$

$$\text{Load (C)} = \frac{2520 \times 3.060}{2 (10 + .925 + 3.060)}$$

$$\text{Load (C)} = 276 \text{ lbs.}$$

L-10 bearing lives for loads and speeds other than those listed in Table 1 for each clutch may be calculated by using the following formula:

$$(L-10)_0 = \left(\frac{A}{X_0}\right)^3 \times \left(\frac{N}{N_0}\right) \times 10,000$$

where: (L-10) is the new L-10 life in hrs.

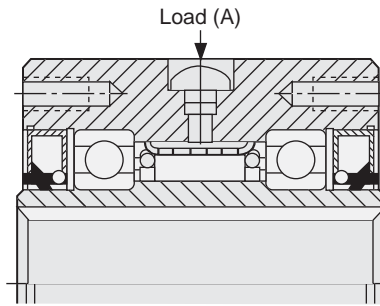
X_0 is new load in lbs.

A is load from Table 1 in lbs.
 (note: B and C can be used in place of A for Conditions #2 and #3 as required)

N is overrunning (O/R) speed from Table 1.

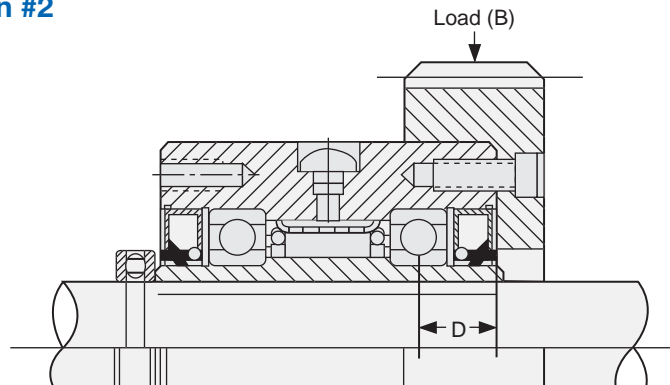
N_0 is new O/R speed.

Condition #1



Condition #1 has force or Load (A) in center of clutch between the two ball bearings. (See Table 1.)

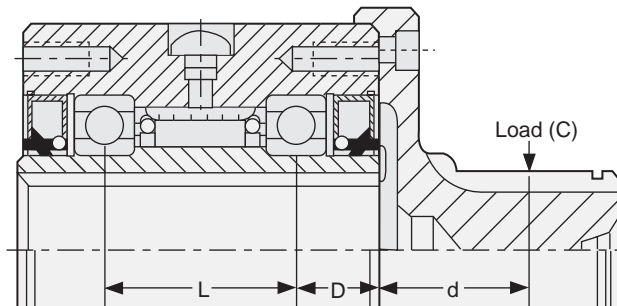
Condition #2



Condition #2 has force or Load (B) exerted on clutch bearings at end of clutch. Distance "D" is the distance from the centerline of the ball bearing nearest the load to end of clutch.

(See Table 1)

Condition #3



Condition #3 has force or load applied "d" distance from face of the clutch. (To be determined by individual application.) To calculate the Maximum Permissible Load (C) a distance "d" from the clutch face, use the following equation:

$$\text{Load (C)} = \frac{(A)(L)}{2 (d + D + L)}$$

(Refer to Table 1 for values of A, D and L)

Table 1

Clutch No.	Maximum Permissible Load			L in.	Thrust Cap. @ Max. O/R Speed lb.*	Max O/R Speed RPM
	Cond. #1 (A) lb.	Cond. #2 (B) lb.	D in.			
FSO-300	452	165	.516	1.381	226	3,600
FSO-400	450	151	.675	1.376	225	3,600
FSO-500	755	275	.745	1.990	378	3,000
FSO-600	1,248	437	.836	1.950	624	2,400
FSO-700	2,520	968	.925	3.060	1,260	2,000
FSO-750	2,040	755	1.247	3.550	1,020	1,800
FSO-800	2,555	944	1.251	3.542	1,277	1,500
FSO-900	3,030	1,134	1.257	3.740	1,515	1,350
FSO-1027	500	51	1.446	3.355	0	1,100
HPO-720	2,196	837	.925	2.96	1,098	3,000
HPO-750	1,795	663	1.247	3.53	897	2,600
HPO-800	2,273	840	1.251	3.55	1,136	2,100
HPO-900	2,712	1,014	1.257	3.73	1,356	1,850
HPO-1027	639	230	1.446	3.72	319	1,500

* Always contact Formsprag Engineering for approval when applying axial loads to the clutch.

Example: Determine the maximum permissible load that can be radially applied between the bearings of a FSO-750 with an overrunning speed of 600 RPM that will result in a L-10 bearing life of 10,000 hours.

Since the load is applied between the bearings the value (A) for Condition #1 is used for this calculation. Also, because the bearing life is 10,000 hours, the new L-10 remains at 10,000 hrs.

Using the bearing life formula:

$$(L-10)_0 = \left(\frac{A}{X_0}\right)^3 \times \left(\frac{N}{N_0}\right) \times 10,000$$

Substituting values into the equation:

$$10,000 = \left(\frac{2,040}{X_0}\right)^3 \times \left(\frac{1,800}{600}\right) \times 10,000$$

$$X_0^3 = 2,040^3 \times \frac{1,800}{600} \times \frac{10,000}{10,000}$$

$$X_0 = \sqrt[3]{2,040^3 \times 3 \times 1}$$

$$X_0 = 2,942 \text{ lbs}$$

Answer: The new maximum permissible radial load that can be applied is 2,942 lbs.

The clutch thrust capacity at Max. O/R speed given in Table 1 is the **Maximum permissible load** applied in an axial direction to the end of the clutch. The clutch thrust capacity listed in Table 1 is without any radial load applied to the clutch. For applications that have both thrust and radial loads consult Formsprag engineering.

Sleeve bearing clutches, models FS-02 through FSR-16, are equipped with oil-impregnated bronze bearings (Figure 1). The bearings are designed to provide proper support for radial loads imposed on the clutch hubs, however, they are not designed to accept axial loads.

Table 2 gives the radial load capacity for each sleeve bearing model. The bearing capacity shown is rated at the maximum overrunning (O/R) speed of the inner race for each clutch model.

Higher radial loads are possible at lower speeds. In such cases please consult Formsprag engineering.

Table 2

Clutch No.	Bore (Ref.)	Radial Load Capacity (lb.)	Max O/R Speed Inner Race RPM
FS-02	.250	12	3,450
FS-04	.375	15	2,800
FS-04	.500	15	2,800
FS-05	.625	30	1,800
FSR-3	.375	40	1,950
FSR-3	.500	40	1,950
FSR-5	.500	45	1,950
FSR-5	.625	45	1,950
FSR-6	.750	70	1,950
FSR-8	.875	110	1,650
FSR-8	1.000	110	1,650
FSR-10	1.125	130	1,250
FSR-10	1.250	130	1,250
FSR-12	1.375	190	1,150
FSR-12	1.500	190	1,150
FSR-14	1.625	250	950
FSR-14	1.750	250	950
FSR-16	1.875	260	950
FSR-16	2.000	260	950

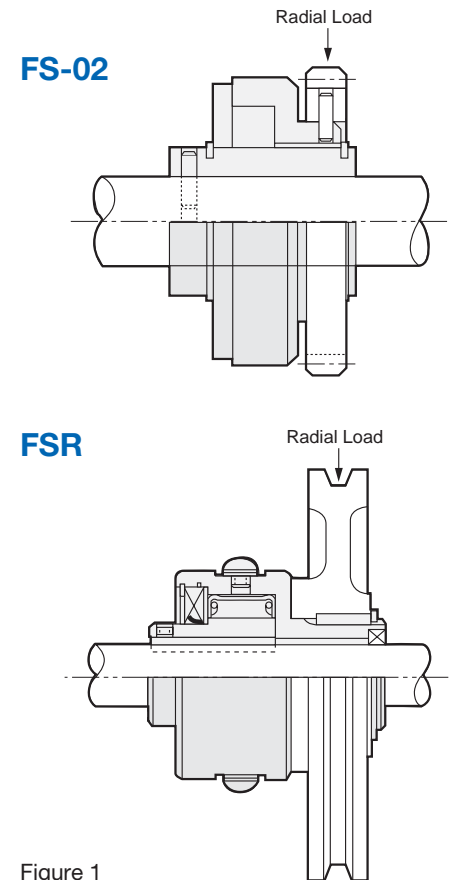


Figure 1

Proper lubrication and lubricant maintenance are the most important single maintenance factors for long, effective, trouble-free clutch operation.

All self-contained units are shipped from the factory prelubricated and ready to install. See data pages for details.

Oil lubrication is preferable in most applications. Grease lubrication may be used if: (1) conditions do not permit the type of main-

tenance required for oil lubricated clutches, (2) if the clutch is mounted on a vertical shaft, (3) if the clutch is a sprag design.

Grease lubricated clutches should not be operated at temperatures below +20°F (-7°C). If operation at temperatures below +20°F (-7°C) are required, consult Formsprag. In the following tables we have compiled a list of lubricants proven to be of value in the lubrication of overrunning clutches.

Recommended Lubricants

Overrunning and Backstopping Applications			
Temperature Range			
+20°F to +150°F (-7°C to +65°C) Maximum permissible ambient temperature	-10°F to +20°F (-23°C to -7°C) Ambient temperature	-40°F to +150°F (-40°C to +65°C) Maximum permissible ambient temperature	+20°F to +150°F (-7°C to +65°C) If below +20°F (-7°C) Consult Formsprag
Oil Lubricants			Grease Lubricants
Chevron GST Oil 68 Mobil DTE Heavy Medium Any Automatic Transmission Fluid (ATF) Texaco Regal Oil R&O 68 Shell Turbo Oil 68 Amoco Industrial Oil 68 Exxon Teresstic Oil 68 Sunoco Sunvis 931 Mobil SHC-626 Mobil SHC-629	Mobil Gargoyle Arctic C Heavy Texaco Regal Oil R&O 46 Any Automatic Transmission Fluid (ATF) Amoco Oil Industrial 46 Sunoco Sunvis 921	Mobil Jet Oil 2 Shell Turbine Oil 555 Exxon Turbo Oil 2380 Exxon Turbo Oil 2389 Standard Esso Turbo Oil 2389 Military Oils MIL-L-7808 or MIL-L-23699 Shell Aeroshell Turbine Oil 500	Fiske Bros. Lubriplate Low- Temp Fiske Bros. Aero Lubriplate Shell Aeroshell No. 7 Shell Aeroshell No. 16 Beacon 325 Mobil DTE Light
Indexing Applications			
At 150 strokes per minutes or less	At 150 strokes per minutes or less	-10°F or below (-23°C)	Not Applicable Consult Formsprag
Oil Lubricants			
Mobil DTE Light Oil Any Automatic Transmission Fluid (ATF) Texaco Regal Oil R&O 32 Shell Turbo Oil 32 Amoco Industrial Oil 32 Exxon Teresstic Oil 32	Sunoco Sunvis 916 Exxon Zerice 46 Any Automatic Transmission Fluid (ATF)	Consult Formsprag	

CAUTION: Do not use lubricants containing slippery additives or those having extreme pressure characteristics such as any EP type lubricants. Model RSCI clutch is the only design that can use lubricants containing extreme pressure (EP) additives. For additional lubrication and maintenance information, see the Installation and Maintenance instructions enclosed with each product shipped, or see Brochure P-1053, Lubrication & Maintenance of Sprag Clutches.

Bolt assemblies

In clutch designs torque is often transmitted through bolts. Experience has shown that it is a practical and reliable way since clutches transmit torque in only one direction.

For the metric clutch designs the Bolt Strength Standards (8.8, 10.9 and 12.9) and torque tightening values (Nm) are listed in the adjacent table.

Metric Bolt Strength and Tightening Standards

Thread	8.8		10.9	
	Model	(Nm)	Model	(Nm)
M5	RSCI	(6)	GFR, AL, and RIZ	(8)
M6	RSCI	(10)	GFR, AL, and RIZ	(14)
M8	RSCI	(25)	GFR, AL, and RIZ	(34)
M10	RSCI	(48)	GFR, AL, and RIZ	(68)
M12	RSCI	(84)	GFR, AL, and RIZ	(118)
M16	RSCI	(206)	GFR, AL, and RIZ	(290)
M20	RSCI	(402)	GFR, AL, and RIZ	(550)
M24	RSCI	(696)	GFR, AL, and RIZ	(950)
M30	RSCI	(1420)	GFR, AL, and RIZ	(1900)