

Special Load Guidelines Overhung Load

Reducer/Gearmotor Allowable Overhung Load

When a sprocket, sheave, or gear is mounted on the slow speed shaft of a reducer, an overhung load is applied on that shaft. It is necessary to check if the shaft of the Cyclo BBB Speed Reducer will allow the overhung load. Calculate the overhung load using this formula:

$$\text{Overhung Load} = \frac{126,000 \times \text{HP} \times \text{Cf} \times \text{Lf} \times \text{Sf}}{D \times N}$$

LEGEND

- HP:** Horsepower transmitted by shaft
- Cf:** Load connection factor (Fig. 5.1)
- Lf:** Load location factor (Fig. 5.3 Output Shaft; Fig. 5.7 Input Shaft)
- Sf:** Service factor (Determine from Fig. 5.2 and "How to Select," pages 2.4 and 3.4)
- D:** Pitch diameter of sprocket, etc.
- N:** Shaft speed (rpm)

Table 5.1 Load Connection Factor

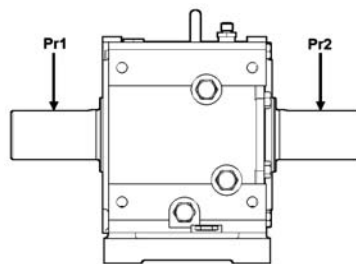
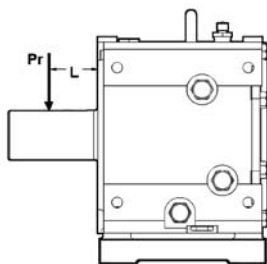
Type of Connection	Cf
General Purpose Chain	1.0
Machined Gear, Pinion or Synchronous Belt	1.25
V-Belt	1.5
Flat Belt	2.5

Table 5.2 Service Factor

Shock Factor	Sf
No Shock	1.0
Moderate Shock	1.5
Heavy Shock	2.0

Figure 5.1 Centerline of Load, Output

"L" indicates the distance from the hollow shaft end to the mid-point of the radial load.



For double extended output shafts, Pr1 + Pr2 must be less than the Allowable Overhung Load.

Table 5.3 Overhung Load Location Factor of Output Shaft, Lf (Keyed Hollow Bore, Tapered Grip Bushing)

Frame Size	L (inches)											
	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4	4 1/2	5	6
3A100, 3A105, 3A110, 3A115, 3A120, 3A125, 3A140, 3A145,	1.04	1.08	1.12	1.16	1.19	1.27	1.35	1.42	-	-	-	-
3B120, 3B125, 3B140, 3B145, 3B160, 3B165	1.03	1.06	1.09	1.13	1.15	1.22	1.28	1.34	1.40	1.46	-	-
3C140, 3C145, 3C160, 3C165, 3C170, 3C175	1.02	1.06	1.08	1.11	1.14	1.20	1.25	1.31	1.37	1.42	1.48	-
3D160, 3D165, 3D170, 3D175,	1.02	1.05	1.07	1.09	1.11	1.16	1.21	1.26	1.31	1.35	1.39	1.49
3E170, 3E175	1.02	1.04	1.06	1.09	1.10	1.15	1.19	1.24	1.27	1.31	1.35	1.44

Table 5.4 Allowable Overhung Load for Output Shaft (Keyed Hollow Bore, Tapered Grip Bushing) (Lf, Cf, Sf = 1) Unit: lbs.

Frame Size	Output Shaft Speed (RPM)									
	5	10	20	30	35	45	50	60	75	90
3A100, 3A105, 3A110, 3A115, 3A120, 3A125, 3A140, 3A145,	1124	1124	1124	1124	1124	1124	1124	1124	1124	1124
3B120, 3B125, 3B140, 3B145, 3B160, 3B165	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068
3C140, 3C145, 3C160, 3C165, 3C170, 3C175	3484	3484	3484	3484	3484	3484	3484	3484	3484	3215
3D160, 3D165, 3D170, 3D175,	4811	4811	4811	4811	4811	4811	4811	4811	4811	3799
3E170, 3E175	5170	5170	5170	5170	5170	5170	5170	5170	5170	5170

Special Load Guidelines Overhung Load continued

Table 5.5 Overhung Load Location Factor, Lf (Solid Output Shaft)

Frame Size	L (inches)											
	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4	4 1/2	5	6
3A100, 3A105, 3A110, 3A115, 3A120, 3A125, 3A140, 3A145,	0.87	0.91	0.90	1.00	1.14	1.42	1.70	1.98	–	–	–	–
3B120, 3B125, 3B140, 3B145, 3B160, 3B165	0.83	0.87	0.90	0.94	0.97	1.11	1.33	1.55	1.77	1.99	–	–
3C140, 3C145, 3C160, 3C165, 3C170, 3C175	0.81	0.84	0.86	0.89	0.91	0.97	1.09	1.27	1.45	1.64	1.82	–
3D160, 3D165, 3D170, 3D175,	0.79	0.82	0.84	0.87	0.89	0.94	0.98	1.12	1.27	1.43	1.59	1.91
3E170, 3E175	0.78	0.81	0.83	0.85	0.87	0.91	0.95	1.00	1.14	1.28	1.42	1.70

Table 5.6 Allowable Overhung Load for Output Shaft: (Solid Output Shaft) (Lf, Cf, Fs = 1)

Unit: lbs.

Frame Size	Output Shaft Speed (RPM)										
	5	10	20	30	35	45	50	60	75	90	
3A100, 3A105, 3A110, 3A115, 3A120, 3A125, 3A140, 3A145,	989	989	989	989	989	989	989	989	989	989	989
3B120, 3B125, 3B140, 3B145, 3B160, 3B165	1641	1641	1641	1641	1641	1641	1641	1641	1641	1641	1641
3C140, 3C145, 3C160, 3C165, 3C170, 3C175	2855	2855	2855	2855	2855	2855	2855	2855	2855	2855	2405
3D160, 3D165, 3D170, 3D175,	3934	3934	3934	3934	3934	3934	3934	3934	3934	3754	2788
3E170, 3E175	4114	4114	4114	4114	4114	4114	4114	4114	4114	4114	4114

Table 5.7 Input Shaft Load Location Factor

Single Reduction Frame Size	L (inch)											
	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/2	3	3 1/2	4
3A100, 3A105, 3A110, 3A115	0.93	1.09	1.52	2.03	–	–	–	–	–	–	–	–
3A120, 3A125 3B120, 3B125	–	0.87	1.10	1.43	1.77	2.12	–	–	–	–	–	–
3A140, 3A145 3B140, 3B145 3C140, 3C145	–	0.84	0.98	1.25	1.53	1.83	2.11	–	–	–	–	–
3B160, 3B165 3C160, 3C165 3D160, 3D165	–	0.94	0.97	1.06	1.22	1.36	1.51	1.66	–	–	–	–
3C170, 3C175 3D170, 3D175 3E170, 3E175	–	–	0.95	0.99	1.09	1.23	1.38	1.51	1.79	2.08	–	–

Figure 5.2

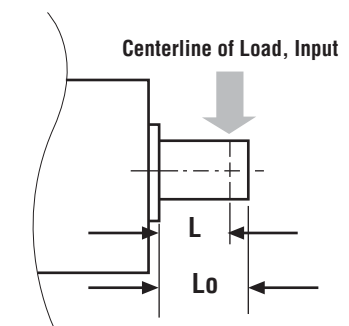


Table 5.8 Input Shaft Overhung Load Capacity (Lf, Cf, Sf = 1)

Unit: lbs.

Single Reduction Frame Size	Ratio	Input Speed RPM							
		1750	1450	1165	980	870	720	580	
3A100, 3A105	11~39, 60~417 46, 53	99	99	110	121	132	132	132	
		99	77	99	110	110	121	132	
3A110, 3A115	21, 28, 74~305 39~60	99	77	99	110	110	121	132	
		44	44	44	44	55	55	66	
3A120, 3A125 3B120, 3B125	21~60 74~305	133	155	166	175	198	198	198	
		121	99	110	121	133	198	198	
3A140, 3A145 3B140, 3B145 3C140, 3C145	21, 28 39~74 88 102~305	308	308	308	342	364	387	418	
		277	220	243	265	277	297	330	
3B160, 3B165 3C160, 3C165 3D160, 3D165	28~88, 179, 207 102~151, 249, 305	243	254	265	288	297	308	330	
		121	133	133	155	155	155	243	
3C170, 3C175, 3D170, 3D175, 3E170, 3E175	39~305	398	398	441	463	486	486	486	
		243	265	288	308	308	353	398	
3C170, 3C175, 3D170, 3D175, 3E170, 3E175	39~305	463	463	508	508	528	551	596	
		463	463	508	508	528	551	596	

Special Load Guidelines Inertia

Table 5.9 Moment of Inertia on Motor Shaft of Gearmotor¹ Units: lbs·inch²

Frame Size	Reduction Ratio								
	11	18	21	28	39	46	53	60	74
3A100, 3A105	1.53	0.636	0.461	0.301	0.175	0.162	0.141	0.101	0.104
3A110, 3A115	–	–	0.697	0.485	0.345	0.302	0.276	0.258	0.224
3A120, 3A125	3.59	1.48	1.23	0.960	0.584	0.619	0.581	0.434	0.489
3A140, 3A145	7.59	3.16	3.37	2.27	1.60	1.29	1.16	1.03	0.875
3B120, 3B125	4.99	2.00	1.59	1.16	0.690	0.697	0.636	0.479	0.520
3B140, 3B145	9.06	3.69	3.73	2.47	1.71	1.36	1.22	1.07	0.906
3B160, 3B165	23.0	9.67	8.78	6.08	4.00	3.62	3.28	2.80	2.58
3C140, 3C145	13.2	5.20	4.79	3.06	2.02	1.59	1.38	1.20	0.991
3C160, 3C165	27.2	11.2	9.84	6.70	4.31	3.86	3.45	2.93	2.67
3C170, 3C175	50.2	21.8	23.6	17.4	13.4	12.2	10.8	10.3	9.57
3D160, 3D165	38.6	15.3	12.7	8.3	5.16	4.44	3.90	3.28	2.90
3D170, 3D175	61.5	25.8	26.5	19.0	14.2	12.8	11.2	10.7	9.81
3E170, 3E175	76.9	31.3	30.3	21.2	15.4	13.6	11.8	11.1	10.1

Note: [1] Table 5.9 does not include the inertia of the integral motors. Total unit inertia is obtained by adding the reducer inertia to the motor inertia.

Frame Size	Reduction Ratio							
	88	102	123	151	179	207	249	305
3A100, 3A105	0.092	0.064	0.058	0.053	0.070	0.047	0.067	0.045
3A110, 3A115	0.214	0.206	0.196	0.191	0.185	0.183	0.181	0.179
3A120, 3A125	0.451	0.318	0.301	0.285	0.393	0.271	0.383	0.260
3A140, 3A145	0.813	0.745	0.718	0.673	0.656	0.653	0.639	0.632
3B120, 3B125	0.472	0.333	0.311	0.292	0.400	0.275	0.386	0.262
3B140, 3B145	0.834	0.759	0.728	0.680	0.660	0.660	0.639	0.636
3B160, 3B165	2.43	2.17	2.09	2.00	1.97	1.98	1.89	1.87
3C140, 3C145	0.892	0.803	0.759	0.701	0.677	0.670	0.649	0.639
3C160, 3C165	2.49	2.21	2.12	2.02	1.99	1.99	1.90	1.87
3C170, 3C175	9.19	8.75	8.58	8.37	8.27	8.17	8.13	8.10
3D160, 3D165	2.66	2.33	2.20	2.07	2.02	2.02	1.92	1.88
3D170, 3D175	9.37	8.89	8.65	8.44	8.31	8.20	8.17	8.10
3E170, 3E175	9.60	9.06	8.78	8.51	8.37	8.24	8.20	8.13

Table 5.10 Moment of Inertia on Motor Shaft of 3-Phase Integral Motor Units: lbs·inch²

1/8 HP x 4 Pole		1/4 HP x 4 Pole		1/3 HP x 4 pole		1/2 HP x 4 pole		3/4 HP x 4 pole		1 HP x 4 pole	
Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake
1.11	1.20	1.71	1.88	1.71	1.88	2.22	2.31	3.45	3.79	4.10	4.44
1/5 HP x 4 Pole		2 HP x 4 Pole		3 HP x 4 pole		5 HP x 4 pole		7.5 HP x 4 pole		10 HP x 4 pole	
Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake
6.32	7.11	7.28	8.03	11.4	12.7	29.0	32.7	39.0	42.7	91.6	104
15 HP x 4 Pole		20 HP x 4 Pole		25 HP x 4 pole		30 HP x 4 pole		40 HP x 4 pole		50 HP x 4 pole	
Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake
128	140	307	455	769	793	769	793	855	878	1053	1097

Table 5.11 Moment of Inertia on Motor Shaft of 3 Phase, Inverter Duty, Integral Motor Units: lbs·inch²

1/8 HP x 4 Pole		1/4 HP x 4 Pole		1/2 HP x 4 pole		1 HP x 4 pole		2 HP x 4 pole		3 HP x 4 pole	
Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake
1.71	1.88	2.22	2.31	4.10	4.44	7.28	8.03	11.4	12.7	29.0	32.7
5 HP x 4 Pole		7.5 HP x 4 Pole		10 HP x 4 pole		15 HP x 4 pole		20 HP x 4 pole		25 HP x 4 pole	
Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake	Standard	w/ Brake
39.0	42.7	91.6	104	128	140	307	455	769	-	769	793
30 HP x 4 Pole		40 HP x 4 Pole									
Standard	w/ Brake	Standard	w/ Brake								
855	878	1053	1097								

Cyclo BBB

Appendix

Special Load Guidelines **Inertia** continued

Table 5.12 *Moment of Inertia on High Speed Shaft of Reducer*Units: lbs·inch²

Frame Size	Reduction Ratio								
	11	18	21	28	39	46	53	60	74
3A100, 3A105	1.54	0.649	0.482	0.281	0.196	0.140	0.120	0.125	0.083
3A110, 3A115	—	—	0.718	0.506	0.366	0.323	0.296	0.279	0.244
3A120, 3A125	3.62	1.54	1.35	0.841	0.704	0.499	0.461	0.554	0.369
3A140, 3A145	7.76	3.33	3.73	2.55	1.86	1.51	1.37	1.26	1.09
3B120, 3B125	5.06	2.06	1.71	1.04	0.810	0.578	0.520	0.598	0.400
3B140, 3B145	9.23	3.86	4.07	2.76	1.97	1.59	1.43	1.30	1.12
3B160, 3B165	31.3	18.0	12.9	10.1	8.03	7.66	7.31	6.84	6.63
3C140, 3C145	13.4	5.37	5.13	3.35	2.28	1.81	1.60	1.43	1.20
3C160, 3C165	35.5	19.6	13.9	10.7	8.34	7.90	7.49	6.97	6.70
3C170, 3C175	57.4	29.2	28.0	21.8	17.7	16.5	15.1	14.7	13.8
3D160, 3D165	46.8	27.1	16.7	12.3	9.16	8.48	7.93	7.31	6.94
3D170, 3D175	69.0	33.3	30.8	23.4	18.6	17.2	15.6	15.0	14.1
3E170, 3E175	84.4	39.0	34.5	25.6	19.8	18.0	16.2	15.5	14.4

Frame Size	Reduction Ratio							
	88	102	123	151	179	207	249	305
3A100, 3A105	0.071	0.085	0.079	0.074	0.049	0.068	0.046	0.066
3A110, 3A115	0.234	0.227	0.217	0.211	0.205	0.204	0.201	0.200
3A120, 3A125	0.332	0.438	0.420	0.407	0.275	0.390	0.265	0.379
3A140, 3A145	1.04	0.964	0.937	0.882	0.875	0.872	0.855	0.851
3B120, 3B125	0.352	0.451	0.431	0.414	0.280	0.393	0.267	0.383
3B140, 3B145	1.06	0.978	0.947	0.889	0.878	0.878	0.858	0.851
3B160, 3B165	6.46	6.19	6.12	6.02	6.02	6.02	5.91	5.91
3C140, 3C145	1.11	1.03	0.978	0.909	0.892	0.889	0.865	0.855
3C160, 3C165	6.53	6.25	6.15	6.05	6.02	6.02	5.95	5.91
3C170, 3C175	13.6	13.1	12.9	12.7	12.6	12.5	12.5	12.4
3D160, 3D165	6.70	6.36	6.22	6.02	6.05	6.05	5.95	5.91
3D170, 3D175	13.7	13.2	13.0	12.7	12.6	12.5	12.5	12.4
3E170, 3E175	13.9	13.4	13.1	12.8	12.7	12.5	12.5	12.4

Special Load Guidelines Misc.

Excessive Overloads

Cyclo BBB Speed Reducers provide 300% momentary intermittent shock load capacity and are warranted for 2 years from date of shipment. Refer to our standard terms and conditions for our complete warranty.

Selection for Applications Involving Shock Loading

For applications involving frequent start-stop, braking or reversing, or quick starting of load having large inertia, consult factory for model selection or recommended modifications.

Allowable Radial and Thrust Loads

The loads imposed on the slow speed shaft vary with the method of connecting the shaft to the driven machine. Frequently, in addition to torsional forces, radial

and thrust loads are applied to the slow speed shaft at the same time. For example, coupling connections normally involve torsional forces only. However, when power is transmitted through spur gears, belts, pulleys or chains, both torsional and radial forces may be applied to the slow speed shaft. When driving through helical or bevel gears, all three conditions (torsional, radial and thrust load) may be referred to the reducer shaft.

The slow speed shaft and bearings must have sufficient strength to withstand these loads, and it is, therefore, necessary to determine the allowable limits for each condition.

Load Centering

The radial load capacities are calculated with the load concentrated at the midpoint of the slow speed shaft extension. Radial load capacities decrease if the center of the load is moved farther from the reducer and the values obtained from the charts must be adjusted accordingly.