CHAIN & DRIVES
COMPLETE POWER TRANSMISSION

POWER > SPEED > TORQUE

Sumitomo Drive Technologies
Always on the Move

Motion Control Drives

CYCLO® 6000 Series for Servo Motors

CW10

Sumitomo Heavy Industries, Ltd.

No. C2101E-2.0

No. C2101E-2

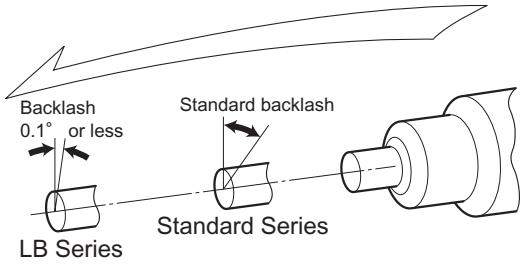
Features, Application

Our CYCLO® DRIVE LB Series and Standard Series for servo motors have excellent features in addition to **compactness, high-durability, long-lifetime, high-efficiency, maintenance-free**, and universal mounting (for grease lubrication models) also offered by our CYCLO® DRIVE for general industries.

<<LB Series>>

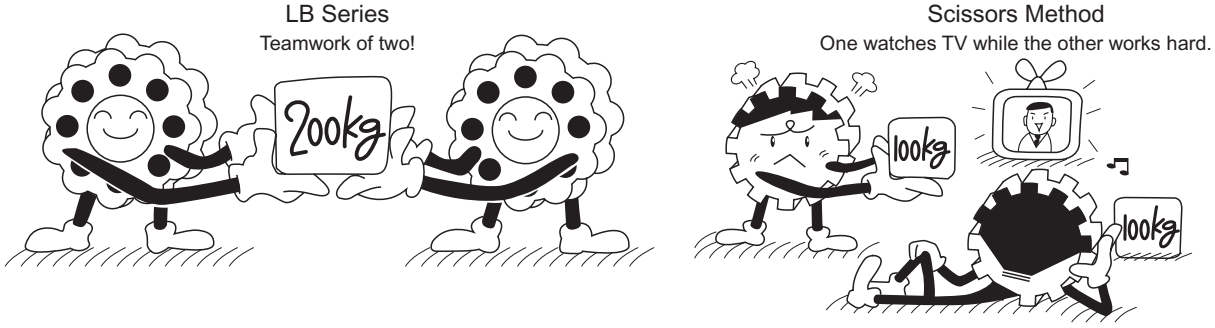
● Low Backlash Type (0.1˚ or less)

We adopted special tooth profile for LB Series to achieve low backlash naturally without preload.



● Double Power

Traditional reducers use scissors method to achieve low backlash, which enable use of only half of the gear for power transmission. Our gear utilizes all of the gears for power transmission, which doubles the power transmission capacity.



✂ What is the scissors method? This is a system of 2 gear tooth (1 pair) pinching the other gear's tooth.

Table 1

Usage of Series		Application	Control Method
Standard Series (Standard backlash)	LB Series (Backlash 0.1˚ or less)	Conveyor (intermittent, sorting, loading), transportation distribution system (AGV, automatic storage), printing machine, machine tool (ATC, index table, peripheral machine for robots (positioner, slider), packaging machine, textile machine, cutter	Position control
		Conveyor, transportation distribution system, printing machine, food processing machine	Speed control
		Film winder, intake machine, various testing machine	Torque control

Reducers for soft start, high-frequency startup, etc., are also available.

Contents

<<LB Series and Standard Series>>

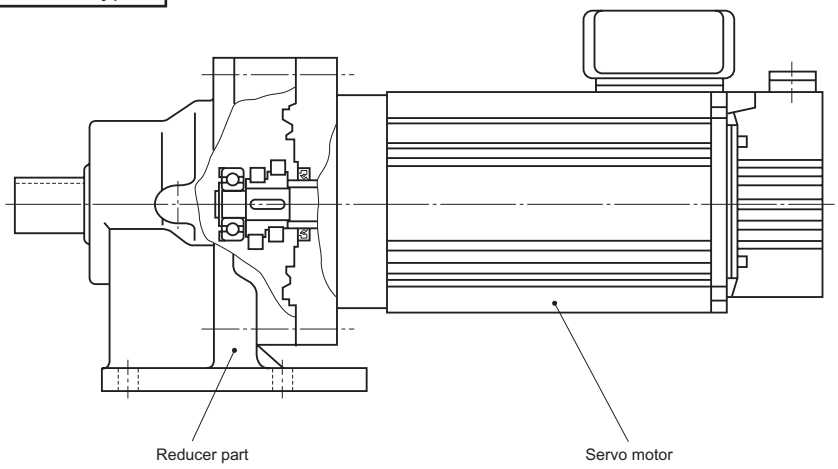
● Direct Connection with Servo Motor

Our stock of adapter plates enables immediate mounting of any type of servo motor.
Our direct connection series is directly connected to CYCLO® DRIVE without using adapter plate.

1. Direct Connection

Our servo motor is directly connected to our CYCLO® DRIVE making the overall length very short.

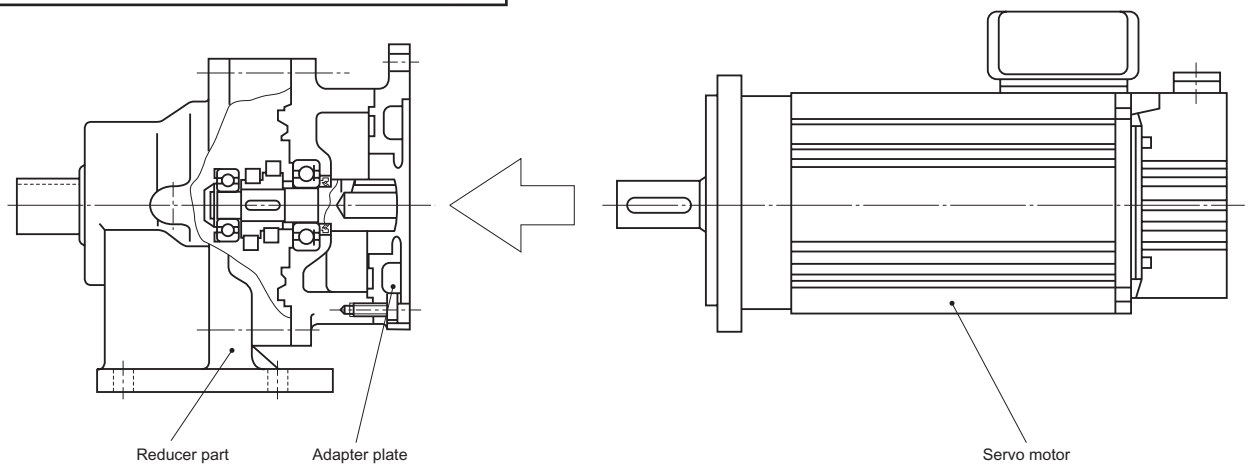
Fig. 1 Direct Connection Type: CNHM Type



2. Adapter Plate Connection

Any flange servo motor may be connected directly to our CYCLO® DRIVE by using an adapter plate.

Fig. 2 Plate Direct Connection Type: CNHX Type



Note: Key connection is the standard between servo motor shaft and reducer high speed (input) shaft.

● High Speed Input

Maximum 4000 r/min (10 minute cycle at 50% ED) high speed input is possible due to smooth rolling contact mechanism.

● Low Inertia

Small internal moment of inertia enables optimum servo control.

Adapter Plate Connection

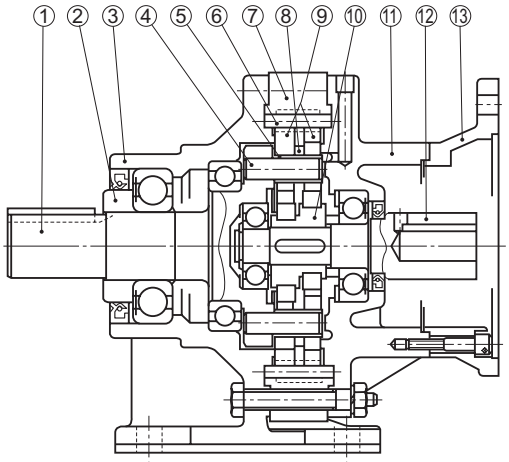


Fig.3

Table 2

No.	Part Name
1	Slow Speed Shaft
2	Collar
3	Horizontal Casing
4	Slow Speed Shaft Pin
5	Slow Speed Shaft Roller
6	Ring Gear Pin
7	Ring Gear Housing
8	Spacer Ring
9	Cycloid Disc
10	Eccentric Cam
11	High Speed Shaft End Shield
12	High Speed Shaft
13	Adapter Plate

● : Standard
▲ : Non-Standard

Table 3

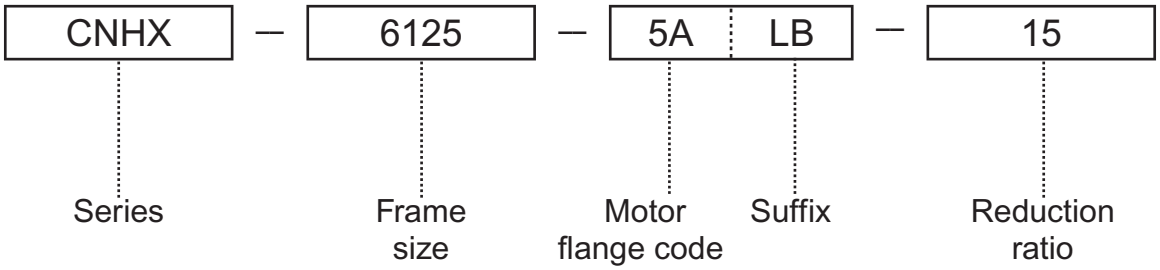
Frame Size			6065					6075							6085								6095							
Reduction Ratio			11	15	21	29	43	6	11	15	21	29	43	59	6	11	15	21	29	43	59	87	6	11	15	21	29	43	59	87
LB Series	Rated Output Torque	N·m	30.0					29.7	51.0	60.0					—	—	—	—	—	—	—	—	78.1	187	200					
		kgf·m	3.06					3.03	5.20	6.12					—	—	—	—	—	—	—	—	7.96	19.1	20.4					
	Category		●	●	●	●	▲	▲	●	●	●	●	▲	▲	—	—	—	—	—	—	—	—	▲	●	●	●	●	▲	▲	▲
	Backlash		0.1˚ or less (0.2˚ or less for reduction ratio 6).																											
	Max. Allowable Input Speed		4000 r/min (10 min cycle, 50% ED)																											

Frame Size			6105								6115								6125							
Reduction Ratio			6	11	15	21	29	43	59	87	6	11	15	21	29	43	59	87	6	11	15	21	29	43	59	87
LB Series	Rated Output Torque	N·m	157	305	300						—	—	—	—	—	—	—	—	304	526	592	630				
		kgf·m	16.0	31.1	30.6						—	—	—	—	—	—	—	—	31.0	53.6	60.3	64.2				
	Category		▲	●	●	●	●	▲	▲	▲	—	—	—	—	—	—	—	—	▲	●	●	●	●	▲	▲	▲
	Backlash		0.1˚ or less (0.2˚ or less for reduction ratio 6).																							
	Max. Allowable Input Speed		4000 r/min (10 min cycle, 50% ED)																							

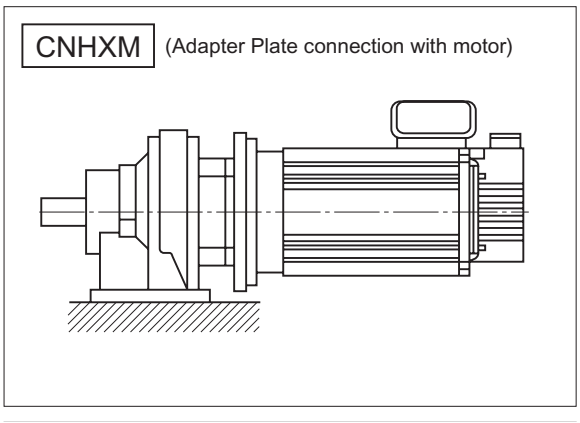
Frame Size		6060, 6065						6070, 6075							6080, 6085								6090, 6095							
Reduction Ratio		6	11	15	21	29	43	6	11	15	21	29	43	59	6	11	15	21	29	43	59	87	6	11	15	21	29	43	59	87
Standard Series	Category	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Backlash	Consult us for each case. Backlash varies depending on the frame size and reduction ratio.																												
	Max. Allowable Input Speed	4000 r/min (10 min cycle, 50% ED)																												

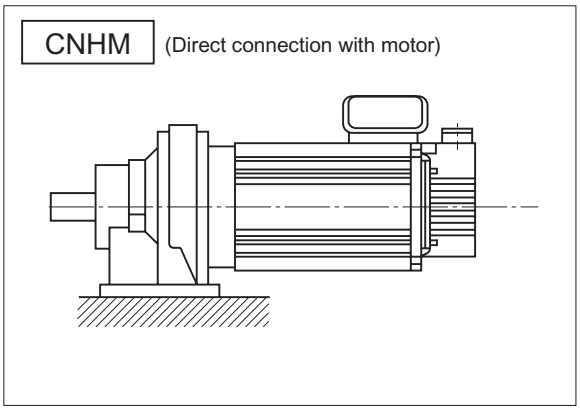
Frame Size		6100, 6105								6110, 6115								6120, 6125							
Reduction Ratio		6	11	15	21	29	43	59	87	6	11	15	21	29	43	59	87	6	11	15	21	29	43	59	87
Standard Series	Category	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Backlash	Consult us for each case. Backlash varies depending on the frame size and reduction ratio.																							
	Max. Allowable Input Speed	4000 r/min (10 min cycle, 50% ED)																							

Note: 1. Rated output torque indicates the mechanical rating of CYCLO® DRIVE. It indicates the allowable value of peak torque applied on the output shaft at the time of normal startup and stop.
2. FINE CYCLO® Series (Catalog No. F2001E) is available for lower backlash requirements.
3. Consult us for middle range reduction ratio of the Standard Series.
4. Consult us for backlash and delivery date of non-standard models.



Nomenclature Example (This is an example for frame size 6125 and below. Mounting direction is universal and the nomenclatures do not change by mounting direction in this case.)





Example of Suffix Usage

① Adapter Plate Connection (Foot Mount, Universal Mounting)

Without motor
- LB Series → CNHX-6125-5ALB-15
- Standard Series → CNHX-6125-5A-15

With motor
- LB Series → CNHXM-6125-5ALB-15
- Standard Series → CNHXM-6125-5A-15

② Direct Connection (Foot Mount, Universal Mounting)

Without motor
- LB Series → CNHM-6125-LB-15
- Standard Series → CNHM-6125-15

1. LB Series

Load time ratio should not exceed 50% (10 min cycle) in all capacity range.

Low Backlash
Input Speed 1000r/min

P_1 : Allowable input capacity [kW]
M_2 : Allowable output torque (Top row: [Nm], Bottom row: [kgfm])
M_{2A}: Rated output torque [Nm]
F_{R2} : Allowable radial load at slow speed shaft (Top row: [N], Bottom row: [kgf])

Table 4 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size																		
		6065				6075				6095				6105				6125			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
11	91	0.220	22.0 2.24	30.0 3.06	1180 120	0.377	37.7 3.84	51.0 5.20	1770 180	1.17	117 11.9	187 19.1	3340 340	2.32	232 23.6	305 31.1	5400 550	4.57	456 46.5	526 53.6	7270 741
15	67	0.220	30.0 3.06			0.377	51.4 5.24	60.0 6.12		1.07	146 14.9	200 20.4		2.11	287 29.3	300 30.6		3.83	521 53.1	592 60.3	8100 826
21	48	0.154	29.4 3.00			0.303	57.8 5.89			0.801	153 15.6			1.53	292 29.8			3.24	618 63.0	630 64.2	9000 917
29	34	0.112	29.5 3.01			0.211	55.5 5.66			0.671	177 18.0		3240 330	1.11	292 29.8			2.35	619 63.1		9810 1000

Allowable maximum input speed: 4000 r/min
Load time ratio: Should not exceed 50% (10 min cycle)

Low Backlash
Input Speed 1500r/min

Table 5 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size																		
		6065				6075				6095				6105				6125			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
11	136	0.286	19.0 1.94	30.0 3.06	1180 120	0.400	26.7 2.72	51.0 5.20	1660 169	1.40	93.3 9.51	187 19.1	3340 340	2.75	183 18.7	305 31.1	5070 517	5.18	345 35.2	526 53.6	6410 653
15	100	0.286	26.0 2.65			0.400	36.4 3.71		1750 178	1.35	123 12.5			2.75	250 25.5			5.18	471 48.0	592 60.3	7060 720
21	71	0.206	26.2 2.67			0.400	50.9 5.19	60.0 6.12	1770 180	1.05	133 13.6	200 20.4		2.02	257 26.2	300 30.6	5400 550	4.30	547 55.8	630 64.2	7860 801
29	52	0.149	26.2 2.67			0.260	45.7 4.66			0.68	120 12.2			1.38	242 24.7			3.00	527 53.7		8670 884

Allowable maximum input speed: 4000 r/min
Load time ratio: Should not exceed 50% (10 min cycle)

Low Backlash
Input Speed 2000r/min

P_1 : Allowable input capacity [kW]
M_2 : Allowable output torque (Top row: [Nm], Bottom row: [kgfm])
M_{2A}: Rated output torque [Nm]
F_{R2} : Allowable radial load at slow speed shaft (Top row: [N], Bottom row: [kgf])

Table 6 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size																			
		6065				6075				6095				6105				6125			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
11	182	0.350	17.5 1.78	30.0 3.06	1100 112	0.489	24.4 2.49	51.0 5.20	1510 154	1.71	85.5 8.72	187 19.1	3150 321	3.36	168 17.1	305 31.1	4600 469	6.34	317 32.3	526 53.6	5820 593
15	133	0.350	23.8 2.43			0.489	33.4 3.40		1590 162	1.65	113 11.5		3140 320	3.36	230 23.4		5030 513	6.34	432 44.0	592 60.3	6410 653
21	95	0.252	24.0 2.45		1180 120	0.489	46.7 4.76	60.0 6.12	1670 170	1.28	123 12.5	200 20.4	3180 324	2.47	235 24.0	300 30.6	5160 526	5.26	502 51.2	630 64.2	7130 727
29	69	0.182	23.9 2.44			0.318	41.9 4.27		1690 172	0.985	129 13.2		3330 339	1.69	223 22.7		5150 525	3.67	484 49.3		7870 802

Allowable maximum input speed: 4000 r/min
Load time ratio: Should not exceed 50% (10 min cycle)

Low Backlash
Input Speed 3000r/min

Table 7 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size																			
		6065				6075				6095				6105				6125			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
11	273	0.465	15.5 1.58	30.0 3.06	960 97.9	0.650	21.7 2.21	51.0 5.20	1320 135	2.27	75.7 7.72	187 19.1	2750 280	4.47	149 15.2	305 31.1	4020 410	8.42	281 28.6	526 53.6	5080 518
15	200	0.465	21.1 2.15			0.650	29.5 3.01		1390 142	2.19	100 10.2		2740 279	4.47	203 20.7		4390 448	8.42	383 39.0	592 60.3	5600 571
21	143	0.335	21.3 2.17		1180 120	0.650	41.3 4.21	60.0 6.12	1460 149	1.71	109 11.1	200 20.4	2780 283	3.28	209 21.3	300 30.6	4500 459	6.99	444 45.3	630 64.2	6230 635
29	103	0.242	21.3 2.17			0.422	37.1 3.78		1470 150	1.11	97.0 9.89		3000 306	2.24	197 20.1			4.87	428 43.6		6870 700

Allowable maximum input speed: 4000 r/min
Load time ratio: Should not exceed 50% (10 min cycle)

Note: 1. **Allowable output torque (M_2)**
Allowable output torque indicates allowable value of average load torque applied to the output shaft.
Allowable input capacity is the necessary input capacity when allowable output torque is at 100%.

2. **Rated output torque (M_{2A})**
Rated output torque indicates mechanical ratings of CYCLO® DRIVE. It indicates the allowable value of peak torque applied on the output shaft at the time of normal startup and stop.

3. **GD^2**
GD^2 varies depending on the shaft diameter of the servo motor. Refer to Table 19 and 20 for details.

2. Standard Series

Load time ratio of the Staudard series varies depending on the input speed and capacity range.

Standard

Input Speed 1000r/min

P_1 : Allowable input capacity [kW]
M_2 : Allowable output torque (Top row: [Nm], Bottom row: [kgfm])
M_{2A}: Rated output torque [Nm]
F_{R2} : Allowable radial load at slow speed shaft (Top row: [N], Bottom row: [kgf])

Table 8 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size																											
		6060				6065				6070				6075				6080				6085				6090			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
6	167	0.200	10.9 1.11	24.0 2.45	900 92	0.286	15.6 1.59	25.0 2.55	892 91	0.347	18.9 1.93	29.7 3.03	1540 157	0.407	22.1 2.26	29.7 3.03	1530 156	0.592	32.2 3.29	78.5 8.00	2150 219	0.778	42.3 4.32	78.5 8.00	2130 217	1.15	62.4 6.36	142 14.5	3160 322
11	91	0.200	20.0 2.04		1180 120	0.286	28.6 2.91	30.0 3.06	1170 119	0.347	34.6 3.53	45.0 4.59	1770 180	0.407	40.6 4.14	50.8 5.18	1770 180	0.592	59.1 6.03	80.0 8.15	2550 260	0.778	77.6 7.92	100 10.2	2510 256	1.15	114 11.6	150 15.3	3340 340
15	67	0.176	24.0 2.45			0.220	30.0 3.06		1180 120	0.331	45.0 4.59			0.407	55.4 5.65	60.0 6.12		0.588	80.0 8.15	77.2 7.87	2560 261	0.735	100 10.2	77.2 7.87	2560 261	1.10	150 15.3		
21	48	0.126	24.0 2.45			0.157	30.0 3.06	30.0 3.06		0.236	45.0 4.59			0.315	60.0 6.12			0.405	77.2 7.87	77.2 7.87		0.405	77.2 7.87	77.2 7.87		0.758	144 14.7	150 15.3	
29	34	0.091	24.0 2.45			0.114	30.0 3.06			0.171	45.0 4.59			0.228	60.0 6.12	60.0 6.12		0.304	80.0 8.16	80.0 8.15	2500 255	0.380	100 10.2	100 10.2	2300 234	0.570	150 15.3		3290 335
43	23	0.062	24.0 2.45			0.077	30.0 3.06			0.115	45.0 4.59			0.154	60.0 6.12		1660 169	0.205	80.0 8.16		2540 259	0.256	100 10.2		2340 239	0.384	150 15.3		3310 337
59	17	—	—	—	—	—	—	—	—	0.084	45.0 4.59			0.102	54.6 5.57		1630 166	0.149	79.8 8.13		2510 256	0.187	100 10.2		2310 235	0.273	146 14.9	146 14.9	3300 336
87	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.090	71.0 7.24		2520 257	0.121	95.6 9.74			0.190	150 15.3	150 15.3	3310 337

Reduction Ratio	Output Speed r/min	Frame Size																											
		6095				6100				6105				6110				6115				6120				6125			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
6	167	1.52	82.5 8.41	170 17.3	3110 317	2.35	128 13.0	171 17.4	4590 468	3.07	167 17.0	171 17.4	4540 463	3.55	193 19.7	193 19.7	5140 524	3.55	193 19.7	193 19.7	5140 524	5.07	276 28.1	366 37.3	5770 588	6.50	354 36.1	366 37.3	5690 580
11	91	1.52	151 15.4			2.35	234 23.9			2.90	290 29.5	308 31.4		3.55	354 36.1		6470 660	3.92	391 39.9		6420 654	5.07	506 51.6	525 53.5	7220 736	5.26	525 53.5	622 63.4	7200 734
15	67	1.47	200 20.4		3340 340	1.84	250 25.5			2.20	300 30.6			2.65	360 36.7		7210 735	3.09	420 42.8		7130 727	3.86	525 53.5		8100 826	4.63	630 64.2		7990 814
21	48	1.05	200 20.4	200 20.4		1.31	250 25.5			1.57	300 30.6	300 30.6	5400 550	1.89	360 36.7		7610 776	2.20	420 42.8		7480 762	2.74	522 53.2	522 53.2	9090 927	3.31	630 64.2		8990 916
29	34	0.709	187 19.0		3220 328	0.950	250 25.5	250 25.5	5400 550	1.14	300 30.6			1.37	360 36.7	360 36.7	7200 734	1.60	420 42.8	420 42.8	6980 712	1.98	520 53.0	520 53.0		2.39	630 64.2	630 64.2		
43	23	0.478	187 19.0		3240 330	0.641	250 25.5			0.769	300 30.6			0.923	360 36.7		7590 774	1.08	420 42.8		7340 748	1.35	525 53.5		9810 1000	1.61	630 64.2		9810 1000
59	17	0.273	146 14.9	146 14.9	3300 336	0.467	250 25.5			0.539	288 29.4	296 30.2	5290 539	0.673	360 36.7		7610 776	0.785	420 42.8		7420 756	0.981	525 53.5	525 53.5		1.18	630 64.2		
87	11	0.198	156 15.9	195 19.9		0.317	250 25.5			0.378	299 30.4	300 30.6	4830 492	0.456	360 36.7		7600 775	0.532	420 42.8		7410 755	0.665	525 53.5		9780 997	0.773	610 62.2		9600 979

Allowable maximum input speed: 4000 r/min
Load time ratio: Continuous operation possible

Standard
Input Speed 1500r/min

P_1 : Allowable input capacity [kW]
M_2 : Allowable output torque (Top row: [Nm], Bottom row: [kgfm])
M_{2A}: Rated output torque [Nm]
F_{R2} : Allowable radial load at slow speed shaft (Top row: [N], Bottom row: [kgf])

Table 9 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size																													
		6060				6065				6070				6075				6080				6085				6090					
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}		
6	250	0.200	7.26 0.740		789 80	0.286	10.4 1.06	25.0 2.55	784 80	0.347	12.6 1.28	29.7 3.03	1360 139	0.407	14.8 1.51	29.7 3.03	1350 138	0.592	21.5 2.19	78.5 8.00	1890 193	0.778	28.2 2.88	78.5 8.00	1880 192	1.15	41.6 4.24	142 14.5	2780 283		
11	136	0.200	13.3 1.36			0.286	19.0 1.94			0.347	23.1 2.35		1680 171	0.407	27.1 2.76	50.8 5.18	1660 169	0.592	39.4 4.02	80.0 8.15	2250 229	0.778	51.7 5.27	100 10.2	2230 227	1.15	76.3 7.78				
15	100	0.200	18.1 1.85	24.0 2.45		0.286	26.0 2.65			0.347	31.4 3.20			0.407	36.9 3.77		1750 178	0.592	53.7 5.48		2490 254	0.778	70.6 7.20		2460 251	1.15	104 10.6				
21	71	0.189	24.0 2.45		1180 120	0.234	29.7 3.03	30.0 3.06	1180 120	0.320	40.7 4.15	45.0 4.59	1770 180	0.407	51.7 5.27	60.0 6.12	1770 180	0.478	60.7 6.19	77.2 7.87	2560 261	0.550	69.9 7.12	77.2 7.87	2540 259	0.758	96.2 9.81	150 15.3	3340 340		
29	52	0.110	19.3 1.97			0.166	29.1 2.97			0.226	39.6 4.04			0.286	50.2 5.12			0.340	59.6 6.08	80.0 8.15		0.467	81.9 8.35	100 10.2	2480 253	0.625	110 11.2				
43	35	0.090	23.4 2.39			0.113	29.4 3.00			0.170	44.1 4.50			0.226	58.8 5.99		1690 172	0.250	65.0 6.63			0.294	76.4 7.79		2560 261	0.435	113 11.5				
59	25	—	—	—	—	—	—	—	—	0.100	35.7 3.64			0.136	48.4 4.93		1720 175	0.185	65.9 6.72			0.234	83.4 8.50		2480 253	0.309	110 11.2	146 14.9			
87	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.090	47.4 4.83			0.121	63.7 6.49		2560 261	0.211	111 11.3	150 15.3			

Reduction Ratio	Output Speed r/min	Frame Size																													
		6095				6100				6105				6110				6115				6120				6125					
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}		
6	250	1.52	55.0 5.61	170 17.3	2760 281	2.35	85.2 8.69	171 17.4	4040 412	3.18	115 11.8	171 17.4	4000 408	3.55	129 13.1	193 19.7	4540 463	3.92	142 14.5	193 19.7	4520 461	5.07	184 18.8	366 37.3	5100 520	6.96	253 25.8	366 37.3	5030 513		
11	136	1.52	101 10.3			2.35	156 15.9		5100 520	3.18	212 21.6	308 31.4	5030 513	3.55	236 24.1		5730 584	3.92	261 26.6		5710 582	5.07	337 34.4	525 53.5	6420 654	5.92	394 40.2	622 63.4	6360 648		
15	100	1.52	137 14.0		3340 340	2.35	213 21.7			3.18	288 29.4	300 30.6		3.55	322 32.8		6290 641	3.90	354 36.1		6250 637	5.07	460 46.9		7070 721	5.92	537 54.8		7000 714		
21	71	1.52	192 19.6	200 20.4		1.93	245 25.0			2.34	297 30.3			2.72	346 35.2		6780 691	3.11	395 40.3		6720 685	3.96	503 51.3	522 53.2	7900 805	4.88	620 63.2		7790 794		
29	52	0.784	137 14.0		3320 338	1.21	212 21.6	250 25.5	5400 550	1.59	279 28.4		5400 550	1.90	333 34.0	360 36.7	7170 731	2.22	390 39.7	420 42.8	7120 726	2.96	519 53.0	520 53.0	8670 884	3.59	630 64.2	630 64.2	8570 874		
43	35	0.603	157 16.0		3300 336	0.780	203 20.7			1.08	281 28.6			1.30	338 34.5		7610 776	1.52	394 40.2		7550 770	1.91	497 50.7	525 53.5	9810 1000	2.38	619 63.1		9780 997		
59	25	0.342	122 12.4	146 14.9	3340 340	0.516	184 18.8			0.694	248 25.3	296 30.2		0.859	307 31.3			1.01	360 36.7		7610 776	1.30	464 47.3			1.62	578 59.0		9810 1000		
87	17	0.270	142 14.5	195 19.9	3330 339	0.433	228 23.2			0.516	272 27.7	300 30.6		0.661	348 35.5			0.758	399 40.7		7560 771	0.944	497 50.7			1.05	553 56.4		9720 991		

Allowable maximum input speed: 4000 r/min
Load time ratio: Continuous operation possible

Note: 1. **Allowable output torque (M_2)**
Allowable output torque indicates allowable value of average load torque applied to the output shaft.
Allowable input capacity is the necessary input capacity when allowable output torque is at 100%.

2. **Rated output torque (M_{2A})**
Rated output torque indicates mechanical ratings of CYCLO® DRIVE. It indicates the allowable value of peak torque applied on the output shaft at the time of normal startup and stop.

3. **GD^2**
GD^2 varies depending on the shaft diameter of the servo motor. Refer to Table 19 and 20 for details.

Standard
Input Speed 2000r/min

P_1 : Allowable input capacity [kW]
M_2 : Allowable output torque (Top row: [Nm], Bottom row: [kgfm])
M_{2A}: Rated output torque [Nm]
F_{R2} : Allowable radial load at slow speed shaft (Top row: [N], Bottom row: [kgf])

Table 10 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size																													
		6060				6065				6070				6075				6080				6085				6090					
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}		
6	333	0.200	5.44 0.555	24.0 2.45	719 73	0.286	7.79 0.794	25.0 2.55	715 73	0.347	9.43 0.961	29.7 3.03	1240 126	0.407	11.1 1.13	29.7 3.03	1240 126	0.592	16.1 1.64	78.5 8.00	1720 175	0.778	21.2 2.16	78.5 8.00	1710 174	1.15	31.2 3.18	142 14.5	2540 259		
11	182	0.200	9.98 1.02		1120 114	0.286	14.3 1.46	30.0 3.06	1110 113	0.347	17.3 1.77	45.0 4.59	1530 156	0.407	20.3 2.07	50.8 5.18	1520 155	0.592	29.6 3.01	80.0 8.15	2050 209	0.778	38.8 3.96	100 10.2	2040 208	1.15	57.2 5.83	150 15.3	3210 327		
15	133	0.200	13.6 1.39		1180 120	0.286	19.5 1.98		1180 120	0.347	23.6 2.41		1620 165	0.407	27.7 2.82	60.0 6.12	1610 164	0.592	40.3 4.11		2280 232	0.778	52.9 5.39		2250 229	1.15	78.0 7.95					
21	95	0.200	19.1 1.94			0.234	22.3 2.27			0.320	30.5 3.11		1730 176	0.407	38.8 3.95		1700 173	0.478	45.6 4.64	77.2 7.87	2340 239	0.550	52.4 5.34	77.2 7.87	2330 238	0.758	72.2 7.36					
29	69	0.110	14.5 1.48			0.166	21.8 2.23			0.226	29.7 3.03		1720 175	0.286	37.6 3.84			0.340	44.7 4.56		2470 252	0.467	61.5 6.27		2450 250	0.625	82.3 8.39		3340 340		
43	47	0.090	17.6 1.79			0.113	22.0 2.24			0.170	33.1 3.37		1740 177	0.226	44.1 4.50		1710 174	0.250	48.8 4.97	80.0 8.15	2560 261	0.294	57.3 5.84	100 10.2	2560 261	0.435	84.9 8.65					
59	34	—	—	—	—	—	—	—	—	0.100	26.8 2.73		1770 180	0.136	36.3 3.70		1770 180	0.185	49.4 5.04			0.234	62.5 6.37			0.309	82.7 8.43	146 14.9			
87	23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.090	35.5 3.62			0.121	47.8 4.87			0.211	83.3 8.49	150 15.3			

Reduction Ratio	Output Speed r/min	Frame Size																													
		6095				6100				6105				6110				6115				6120				6125					
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}		
6	333	1.52	41.2 4.20	170 17.3	2520 257	2.35	63.9 6.51	171 17.4	3690 376	3.18	86.5 8.82	171 17.4	3660 373	3.55	96.6 9.85	193 19.7	4140 422	3.92	107 10.9	193 19.7	4130 421	4.85	132 13.5	366 37.3	4670 476	4.85	132 13.5	366 37.3	4670 476		
11	182	1.52	75.6 7.71		3170 323	2.35	117 12.0		4660 475	3.18	159 16.2	308 31.4	4610 470	3.55	177 18.1		5250 535	3.92	196 19.9		5230 533	5.07	253 25.8	525 53.5	5880 599	5.92	295 30.1	622 63.4	5840 595		
15	133	1.52	103 10.5		3160 322	2.35	160 16.3		5110 521	3.18	216 22.1	300 30.6	5040 514	3.55	242 24.6		5770 588	3.90	265 27.0		5740 585	5.07	345 35.2		6500 663	5.92	403 41.1		6440 656		
21	95	1.52	144 14.7	200 20.4	3140 320	1.93	183 18.7			2.34	223 22.7		5170 527	2.72	259 26.4		6220 634	3.11	296 30.2		6180 630	3.96	377 38.5	522 53.2	7250 739	4.88	465 47.4		7170 731		
29	69	0.784	103 10.5			1.21	159 16.2	250 25.5	5210 531	1.59	209 21.3			1.90	250 25.5	360 36.7	6570 670	2.22	292 29.8	420 42.8	6530 666	2.99	394 40.1	520 53.0	7950 810	3.77	496 50.6	630 64.2	7860 801		
43	47	0.603	118 12.0		3340 340	0.780	152 15.5			1.08	211 21.5			1.30	254 25.9			1.52	296 30.2		7610 776	1.91	373 38.0		9050 923	2.38	464 47.3		8970 914		
59	34	0.384	103 10.5	146 14.9		0.516	138 14.1		5200 530	0.708	190 19.3	296 30.2	5160 526	0.859	230 23.4		7610 776	1.01	270 27.6			1.30	348 35.5	525 53.5	9460 964	1.62	434 44.2		9390 957		
87	23	0.301	119 12.1	195 19.9		0.433	171 17.4		5400 550	0.565	223 22.7	300 30.6	5400 550	0.661	261 26.6			0.758	299 30.5			0.944	372 37.9		9580 977	1.13	446 45.5		9530 971		

Allowable maximum input speed: 4000 r/min
Load time ratio: Continuous operation possible

Standard
Input Speed 3000r/min

P_1 : Allowable input capacity [kW]
M_2 : Allowable output torque (Top row: [Nm], Bottom row: [kgfm])
M_{2A}: Rated output torque [Nm]
F_{R2} : Allowable radial load at slow speed shaft (Top row: [N], Bottom row: [kgf])

Table 11 Rating Table

Reduction Ratio	Output Speed r/min	Frame Size 6060				6065				6070				6075				6080				6085				6090			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
6	500	0.200	3.63 0.370	24.0 2.45	630 64	0.259	4.70 0.479	25.0 2.55	628 64	0.259	4.70 0.479	29.7 3.03	1100 112	0.259	4.70 0.479	29.7 3.03	1100 112	0.565	10.2 1.04	78.5 8.00	1510 154	0.565	10.2 1.04	78.5 8.00	1510 154	0.874	15.9 1.62	142 14.5	2240 228
11	273	0.200	6.65 0.678		980 100	0.286	9.52 0.970		974 99	0.347	11.5 1.18	45.0 4.59	1350 138	0.407	13.5 1.38	50.8 5.18	1350 138	0.592	19.7 2.01	80.0 8.15	1810 185	0.778	25.9 2.64	100 10.2	1790 182	1.15	38.1 3.88	150 15.3	2820 287
15	200	0.200	9.07 0.925		1180 120	0.286	13.0 1.32	30.0 3.06	1180 120	0.347	15.7 1.61		1440 147	0.407	18.5 1.88	60.0 6.12	1430 146	0.592	26.9 2.74		2000 204	0.778	35.3 3.60		1990 203	1.15	52.0 5.30		2830 288
21	143	0.200	12.7 1.30			0.234	14.8 1.51			0.320	20.3 2.07		1530 156	0.407	25.8 2.63		1510 154	0.478	30.4 3.10	77.2 7.87	2050 209	0.550	34.9 3.56	77.2 7.87	2050 209	0.758	48.1 4.90		2880 294
29	103	0.110	9.65 0.984			0.166	14.5 1.48			0.226	19.8 2.02		1520 155	0.286	25.1 2.56			0.340	29.8 3.04		2170 221	0.467	41.0 4.18		2160 220	0.625	54.8 5.59		3070 313
43	70	0.090	11.7 1.19			0.113	14.7 1.50			0.170	22.0 2.24		1530 156	0.226	29.4 3.00		1520 155	0.250	32.5 3.32	80.0 8.15	2520 257	0.294	38.2 3.89	100 10.2	2510 256	0.435	56.6 5.77		
59	51	—	—	—	—	—	—	—	—	0.100	17.8 1.81		1590 162	0.136	24.2 2.47		1580 161	0.185	32.9 3.35		2560 261	0.234	41.7 4.25		2560 261	0.309	55.1 5.62	146 14.9	3340 340
87	35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.090	23.7 2.42			0.121	31.9 3.25			0.211	55.5 5.66	150 15.3	

Reduction Ratio	Output Speed r/min	Frame Size 6095				6100				6105				6110				6115				6120				6125			
		P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}	P_1	M_2	M_{2A}	F_{R2}
6	500	0.961	17.4 1.78	170 17.3	2240 228	2.35	42.6 4.34	171 17.4	3240 330	3.18	57.7 5.88	171 17.4	3220 328	3.55	64.4 6.57	193 19.7	3640 371	3.92	71.1 7.25	193 19.7	3630 370								
11	273	1.52	50.4 5.14			2.35	78.1 7.96		4100 418	3.18	106 10.8	308 31.4	4070 415	3.55	118 12.0		4630 472	3.92	130 13.3		4620 471	5.07	169 17.2	525 53.5	5190 529	5.92	197 20.1	622 63.4	5160 526
15	200	1.52	68.7 7.00		2800 285	2.35	106 10.8		4500 459	3.18	144 14.7		4460 455	3.55	161 16.4		5100 520	3.90	177 18.0		5080 518	5.07	230 23.5		5740 585	5.92	269 27.4		5700 581
21	143	1.52	96.2 9.81	200 20.4		1.93	122 12.4		4590 468	2.34	148 15.1	300 30.6	4570 466	2.72	173 17.6		5490 560	3.11	198 20.1		5470 558	3.96	252 25.6	522 53.2	6400 652	4.88	310 31.6		6350 647
29	103	0.784	68.7 7.00		3050 311	1.21	106 10.8	250 25.5	4580 467	1.59	139 14.2		4550 464	1.90	167 17.0	360 36.7	5790 590	2.22	195 19.9	420 42.8	5760 587	2.99	262 26.7	520 53.0	7010 715	3.77	330 33.6	630 64.2	6950 708
43	70	0.603	78.4 7.99			0.780	101 10.3			1.08	141 14.3			1.30	169 17.2		6970 710	1.52	197 20.1		6940 707	1.91	249 25.3	525 53.5	7970 812	2.38	310 31.6		7920 807
59	51	0.384	68.6 6.99	146 14.9	3340 340	0.516	92.1 9.39		4560 465	0.708	126 12.9	296 30.2	4540 463	0.859	153 15.6		7610 776	1.01	180 18.4		7610 776	1.30	232 23.7		8320 848	1.62	289 29.5		8280 844
87	35	0.301	79.2 8.08	195 19.9		0.433	114 11.6		4980 508	0.565	149 15.2	300 30.6	4960 506	0.661	174 17.7			0.758	199 20.3			0.944	248 25.3		8420 858	1.13	297 30.3		8390 855

Allowable maximum input speed: 4000 r/min
Load time ratio: Should not exceed 50% (10 min cycle)

*Always use within 80% of the allowable input capacity and rated output torque indicated in the above table when using for continuous operation.

Note: 1. **Allowable output torque (M_2)**
Allowable output torque indicates allowable value of average load torque applied to the output shaft.
Allowable input capacity is the necessary input capacity when allowable output torque is at 100%.

2. **Rated output torque (M_{2A})**
Rated output torque indicates mechanical ratings of CYCLO® DRIVE. It indicates the allowable value of peak torque applied on the output shaft at the time of normal startup and stop.

3. **GD^2**
GD^2 varies depending on the shaft diameter of the servo motor. Refer to Table 19 and 20 for details.

1. Flowchart and Formula for Selection

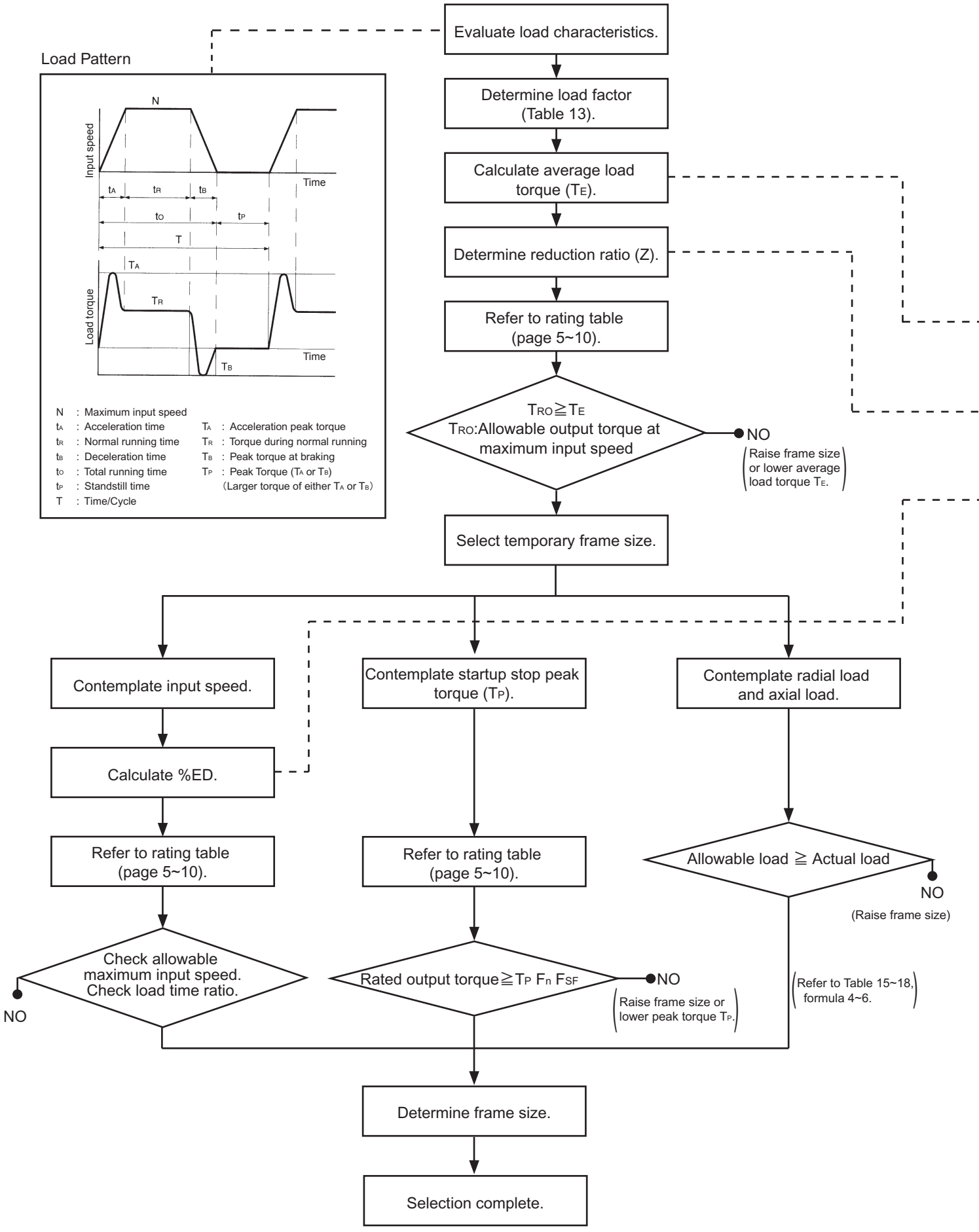


Table 12 Fn Startup frequency factor

Startup frequency	Factor
1~2 times/min	1.0
3~5 times/min	1.1
6~9 times/min	1.2

*Consult us when the startup frequency is other than the above.

Table 13 F_{SF} Load factor

Operation time \ Load condition	U (Uniform shock)	M (Light shock)	H (Heavy shock)
~10 hours/day	1.0	1.0	1.4
24 hours/day	1.2	1.35	1.6

Table 14 Load Characteristics Table for Machinery

Transportation & Distribution Machines	
Conveyor (uniform load) Apron, Assembly,Belt, Bucket, Chain, Oven, Screw	U
Conveyor (heavy load, intermittent) Apron, Assembly, Belt, Bucket	M
Sorting apparatus	M
AGV	M
Peripheral equipment for robots	
Slider	M
Positioner	M
Consult us for applications for * and the ones not indicated above.	
Metal processing machine	
Tapping machine	H
Punch press (gear operation)	H
Planer	H
Bending machine	M
ATC	M
General machine tools	*
Printing machine	*
Textile, Spinning and Weaving	
Batcher, Calendar, Card, Drying can, Dryer, Dyeing machine, Mangle, Napper, Pad, Slasher, Soaper, Winder, Spinning machine, Stenter, Fabric washing machine, Fabric finishing machine, Fabric washing machine, Pad, Stenter, Dryer, Calendar, etc.	M

● Average load torque $TE = \left(\frac{\frac{1}{2} \cdot T_A^{10/3} \cdot t_A + T_R^{10/3} \cdot t_R + \frac{1}{2} \cdot T_B^{10/3} \cdot t_B}{\frac{1}{2} \cdot t_A + t_R + \frac{1}{2} \cdot t_B} \right)^{0.3}$ ····· (Formula 1)

● Reduction ratio $Z = \left(\frac{\text{Output speed}}{\text{Maximum input speed}} \right)$ ····· (Formula 2)

● % ED $\%ED = \frac{to}{T} \times 100$ ····· (Formula 3)

Maximum operation cycle is 10 minutes when calculating % ED. Assign T=10 (min) when calculating for cycle over this time.

2. Selection Example

<Applications> Low backlash specification for transportation vehicle drive

<Specification>

T_A: Acceleration peak torque	8.0kgf·m	n: Maximum output speed	69r/min
T_R: Torque during normal running	0.7kgf·m	t_A: Acceleration time	0.5sec
T_B: Peak torque at braking	4.9kgf·m	t_R: Normal running time	6.5sec
		t_B: Deceleration time	1.0sec
		t_O: Total running time	8.0sec
		t_P: Standstill time	8.0sec
		T: Time/Cycle	16.0sec

Radial load 200kgf is applied to the midpoint of slow speed shaft.
Rated seed of servomotor is 2000r/min
10 hours/day operation

<Calculations>

● Determine load factor — Fn = 1.1 F_{SF} = 1.0 (Table 12~14)

● Calculate average load torque — $T_E = \left(\frac{\frac{1}{2} \times 8.0^{10/3} \times 0.5 + 0.7^{10/3} \times 6.5 + \frac{1}{2} \times 4.9^{10/3} \times 1}{\frac{1}{2} \times 0.5 + 6.5 + \frac{1}{2} \times 1.0} \right)^{0.3} = 3.2(\text{kgf·m})$ (Formula 1)

● Determine reduction ratio — $Z = \left(\frac{69}{2000} \right) = \frac{1}{29}$ (Formula 2)

● Calculate allowable output torque at maximum input speed — T_{RO} = 13.2(kgf·m) > 3.2(kgf·m) → Select temporary frame size 6095#-29 (P.5~P.10)

● Calculate %ED — $\%ED = \frac{8}{16} \times 100 = 50\%$ (Formula 3)

● Check maximum input speed — 2000(r/min) at 50%ED < 4000 (r/min) at 50% ED (P.5~P.10)

● Check peak torque at startup stop — 8.0(kgf·m) × 1.1 × 1.0= 8.8(kgf·m) < 20.4(kgf·m) (P.5~P.10)

● Allowable radial load of slow speed shaft with factor in consideration. — Pro = 339(kgf), Lf = 1.0, Cf = 1.25, Fs = 1.2

$\frac{Pro}{Lf \times Cf \times Fs} = \frac{339}{1.0 \times 1.25 \times 1.2} = 226(\text{kgf}) > 200(\text{kgf})$ (Table 15~18, Formula 4)

Frame size 6095#-29 from the contemplation above.

Allowable Radial and Axial Load

Do not exceed the allowable value for radial and axial load when attaching gear or pulley to the CYCLO® DRIVE

Radial and Axial Load of the Slow Speed Shaft

Check the radial and axial load for slow speed shaft following the formulas 4~6.

Radial load Pr $Pr = \frac{T_\ell}{R} \leqq \frac{Pro}{Lf \cdot Cf \cdot Fs}$ [kgf] ····· (Formula 4) Axial load Pa $Pa \leqq \frac{Pao}{Cf \cdot Fs}$ [kgf] ····· (Formula 5) When radial and axial load coexists $\left(\frac{Pr \cdot Lf}{Pro} + \frac{Pa}{Pao}\right) \cdot Cf \cdot Fs \leqq 1$ ····· (Formula 6)	Pr : Actual radial load [N, kgf] T_ℓ : Actual transmitted torque [N·m, kgf·m] on slow speed shaft of the reducer R : Pitch circle radius [m] of sprocket, gear, pulley, etc. Pro : Allowable radial load [N, kgf] (Refer to the Rating Table) Pa : Actual axial load [N, kgf] Pao: Allowable axial load [N, kgf] (Table 18) Lf : Load location factor (Table 17) Cf : Coupling factor (Table 15) Fs : Shock factor (Table 16)

Table 15 Coupling Factor Cf

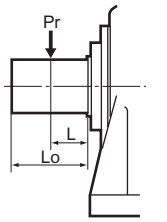
Coupling Method	Cf
Chain	1
Gears	1.25
V-Belt	1.5

Table 16 Shock Factor Fs

Degree of Shock	Fs
Practically no shock	1
Light shock	1~1.2
Severe shock	1.4~1.6

Table 17 Load Location Factor Lf on Slow Speed Shaft

Frame Size \ Lmm	~5	10	15	20	25	30	35	40	45	50
6060, 6065	0.83	0.94	1.19	1.56	—	—	—	—	—	—
6070, 6075	0.82	0.91	1.00	1.29	1.59	1.88	—	—	—	—
6080, 6085	0.81	0.87	0.94	1.03	1.28	1.54	1.80	—	—	—
6090, 6095	0.86	0.92	0.97	1.13	1.38	1.64	1.90	—	—	—
6100, 6105	0.86	0.92	0.97	1.13	1.38	1.64	1.90	—	—	—
6110, 6115	0.78	0.84	0.90	0.96	1.02	1.08	1.19	1.36	1.53	—
6120, 6125	—	0.82	0.87	0.92	0.97	1.08	1.25	1.42	1.59	1.76



Lf=1 when L=Lo/2.

Table 18 Allowable Axial Load Pao on Slow Speed Shaft [N] / [kgf] (Cf, Lf, Fs = 1)

Output Speed r/min / Frame Size	~10	15	20	25	30	35	40	50	60	80	100	125	150	200	250	300
6060, 6065	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	294.3 30	— —	— —
6070, 6075	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80	784.8 80
6080, 6085	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100
6090, 6095	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100	981 100
6100, 6105	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150
6110, 6115	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150	1470 150
6120, 6125	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2940 300	2770 282	2500 255	2390 244

Calculate detailed intermediate value using interpolation method as below.
[Example of Interpolation Method Calculation]
Radial load location factor
Radial load location factor of slow speed shaft for frame size 6075 with L= 18mm is:

$$1.00 + \frac{1.29-1.00}{20-15} \times (18\text{-}15) = 1.17$$

Allowable axial load
Allowable axial load of slow speed shaft for frame size 6125 with output speed 180 r/min is:

$$282 + \frac{300-282}{200-150} \times (200\text{-}180) = 289 \text{ [kgf]}$$

GD^2 (on High Speed Shaft)

GD^2 of CYCLO® DRIVE for servo motor differ according to the frame size, reduction ratio, and the shaft diameter of the servo motor used.
GD^2 of CYCLO® DRIVE for servo motor is calculated by adding the GD_1^2 and GD_2^2.

$GD^2 = GD_1^2 + GD_2^2$ [kgf·m^2] ·····(Formula 7)

GD^2 : GD^2 of CYCLO® DRIVE for servo motor [kgfm^2]
GD_1^2 : GD^2 determined by frame size and reduction ratio [kgfm^2]
GD_2^2 : GD^2 determined by shaft diameter of servo motor [kgfm^2]

Table 19 GD_1^2 : GD^2 Determined by Frame Size and Reduction Ratio (× 10^{-4}kgf·m^2)

Frame Size \ Reduction Ratio	6	11	15	21	29	43	59	87
6060 6065		0.449	0.407	0.379	0.361	0.351		
6070 6075	0.682	0.454	0.409	0.379	0.362	0.351	0.346	
6080 6085	1.61	1.12	1.02	0.688	0.650	0.380	0.370	0.363
6090 6095	3.87	2.41	1.99	1.19	1.35	1.04	0.779	0.768
6100 6105	3.13	1.41	0.844	0.593	0.709	0.630	0.586	0.568
6110 6115	5.99	3.38	2.88	2.44	2.31	2.19	2.12	2.09
6120 6125	12.6	6.45	3.87	2.98	3.84	3.51	3.36	3.25

Note: Divide by 4g (4 x 9.8m/s^2) to convert GD^2 to moment of inertia.

Table 20 GD_2^2 : GD^2 Determined by Shaft Diameter of Servo Motor (× 10^{-4}kgf·m^2)

Frame Size \ Shaft Diameter	ϕ11	ϕ14	ϕ16	ϕ19	ϕ22	ϕ24	ϕ28	ϕ32	ϕ35
6060 6065	0.484	0.423							
6070 6075	0.487	0.426	0.471						
6080 6085	0.560	0.489	0.542	3.450	3.640				
6090 6095	0.594	0.534	0.579	3.98	4.20	4.20			
6100 6105	0.604	0.543	0.589	3.99	4.21	4.21	9.23		11.6
6110 6115	0.876	0.808	0.860	4.46	4.72	4.69	9.65		
6120 6125	1.98	1.88	1.97	4.90	5.12	5.04	10.2	12.5	12.6

Note: Divide by 4g (4 x 9.8m/s^2) to convert GD^2 to moment of inertia.

<Calculation Example>

When CYCLO® DRIVE for servo motor has frame size 6065#, reduction ratio 1/11, and servo motor shaft diameter ϕ11:

GD_1^2 = 0.449 (Table 19)
GD_2^2 = 0.484 (Table 20)
$GD^2 = GD_1^2 + GD_2^2 = 0.449 + 0.484$
= 0.933(×10^{-4}kgf·m^2) (Table 7)

1. Lubrication Method

Both LB and Standard Series are shipped filled with grease, ready to use.

Table 21 Common Grease for Horizontal and Vertical Types

Reduction Ratio / Frame Size	6	11	15	21	29	43	59	87
6060 6065								
6070 6075	Grease lubrication (maintenance-free type) (MF)							
6080 6085								
6090 6095								
6100 6105								
6110 6115								
6120 6125								

2. Lubricant

(1) Filled with long-lifetime grease, both LB and Standard Series require infrequent lubricant replacement. However, replacement every 20,000 hours or every 4 to 5 years will provide even longer lifetime.
(2) Do not use grease other than the ones indicated in Table 22.
(3) Consult us when operating constantly at temperature range exceeding 0~40℃ .

Table 22

Ambient Temperature (℃)	Maintenance-Free Type	
	LB Series	Standard Series
0~40	Shell Oil Shell Alvania Grease RA	

Assembling with Servo Motor

(1) Apply grease to the servo motor shaft in advance for smooth fitting to the high speed hollow shaft.
(2) Align the motor shaft key with the hollow shaft key way.
(3) Always check whether the spigot of the servo motor is exactly matching the spigot of adapter plate when tightening servo motor and adapter plate with bolt. Tightening bolt with uneven fitting may damage the internals.

1. Assembly with Keyless Type Motor

(1) Wipe servo motor shaft and inside of high speed shaft of CYCLO® DRIVE to remove all traces of oil and dust. (Rustproof oil is applied to the inside of high seed shaft at the time of shipment.)

(2) Place the reducer on an appropriate platform with the slow speed shaft on the bottom side.

(3) Match the cut of the high speed shaft and the clamp ring.

(4) Remove the cap on the adapter plate. Insert a hexagon wrench into the hexagon socket head bolt through the assembly opening. Without removing the hexagon wrench, insert the shaft of servo motor into the high speed shaft.

(5) Make sure that the spigot of the servo motor and adapter plate is fitting each other properly. Tighten motor attachment bolt to connect servo motor and adapter plate. Do not tighten bolt when spigots do not fit properly. Assembly will be uneven, which may damage the internal bearing.

(6) Tighten hexagon socket head bolt of the clamp ring with torque indicated in Table 23.

(7) Operate at slow speed for some time. Tighten again with torque indicated in Table 23.

(8) Attach the cap of the adapter plate which was removed in the earlier step.

Table 23 Tightening Torque for Hexagon Socket Head Bolt on the Clamp Ring

Bolt Size	M4	M5	M6	M8	M10	M12
Tightening Torque (Nm)	4.3	5.5	9.6	23	46	79

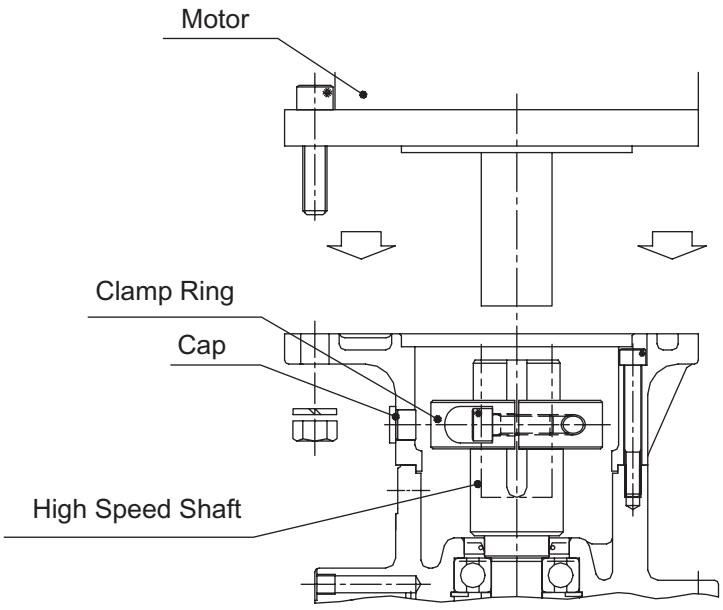


Fig. 4. Assembly Diagram

2. Assembly with Key Type Motor

(1) Apply fretting prevention to the servo motor shaft and CYCLO® DRIVE high speed shaft hole before assembly.

(2) Take sufficient care for shaft center alignment when assembling servo motor and CYCLO® DRIVE.

(3) Always make sure that the spigot of servo motor fits the spigot of adapter plate properly. Then tighten motor attachment bolt to connect servo motor and adapter plate. Do not tighten bolt when spigots do not fit properly. Assembly will be uneven, which may damage the internal bearing.

Introduction to Our Servo Control Related Products

CYCLO® DRIVE
FA and FT

CYCLO® DRIVE for precision control in demanding applications.

Our FA and FT Series of CYCLO® DRIVE is the precision control reducer for high-precision positioning.These series are the crystallization of newest technologies with triple cycloid discs (FA Series) and new tooth profiles (FT Series), etc. They are optimal for driving and controlling machinery related to industrial robots, machine tools, factory automation.

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