Sumitomo Drive Technologies

Motion Control Drives

E CYCLO®

High Precision Gearboxes
ECY Series

Sumitomo Heavy Industries, Ltd.

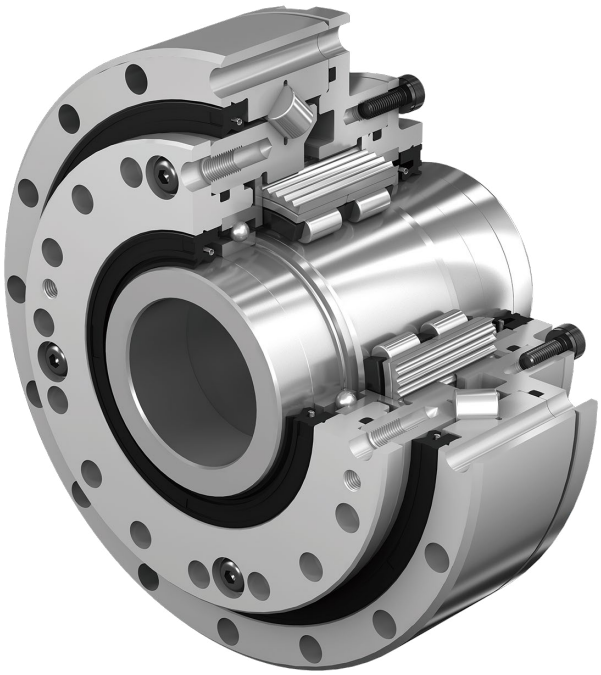
No.F1001E-2

Table of Contents

Strain Wave Gear System × CYCLO Drive Gear

E CYCLO® High Precision Gearboxes

ECY Series



CYCLO® Drives were created and developed by Sumitomo. This unique reducer structure by using teeth trochoid tooth profile* is being used in industrial robots and transfer devices all over the world.
The ECY Series, which was developed as a compact reducer for non-backlash applications, fuses the strain wave gear with the engagement theory of the CYCLO Drives, thus realizing high rigidity and a compact structure that were unavailable until now.

* Epitrochoid parallel curves

1. Construction

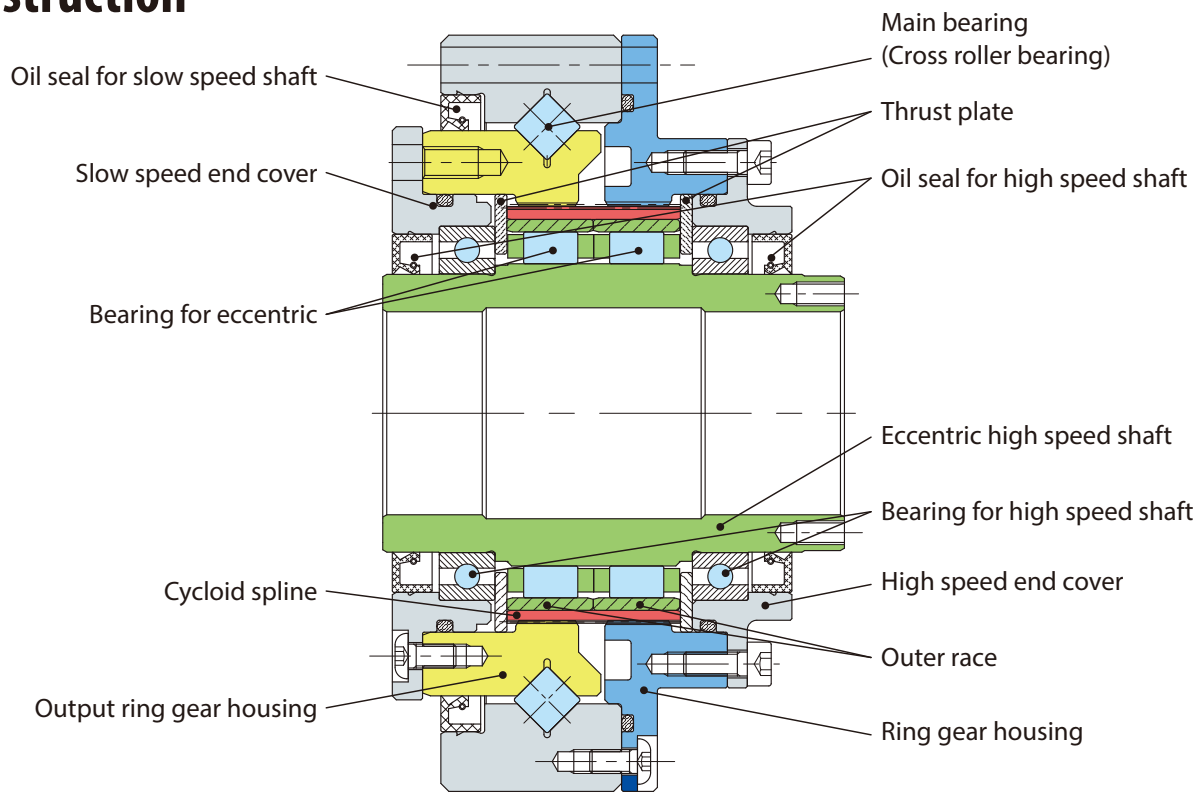
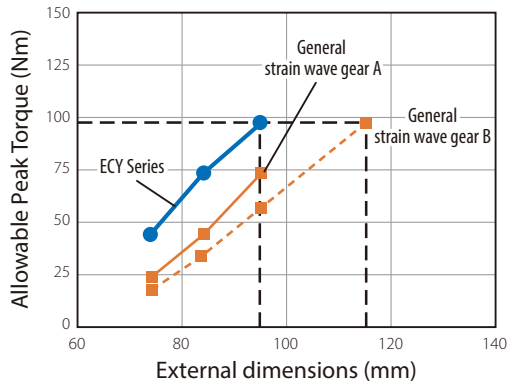


Figure 1-1 Construction

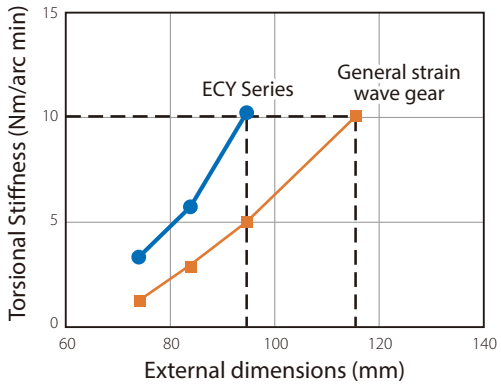
2. Features

Compact, and high torque



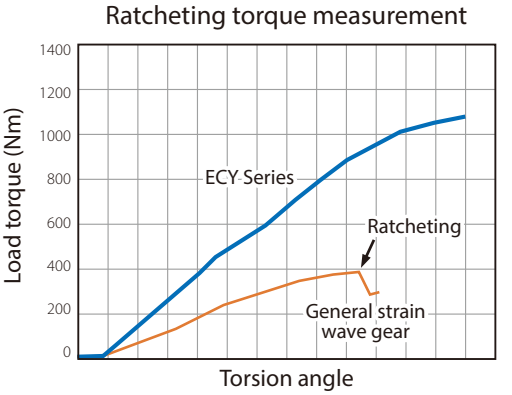
It has high torque compared to that of a general wave gear (equivalent size), contributing to make the device more compact.

High rigidity



The torsional stiffness is larger than that of a general strain wave gear (equivalent size).Thus it can increase the device's strength and reduce vibration, etc.

Ratcheting resistance (safety in the event of an overload)



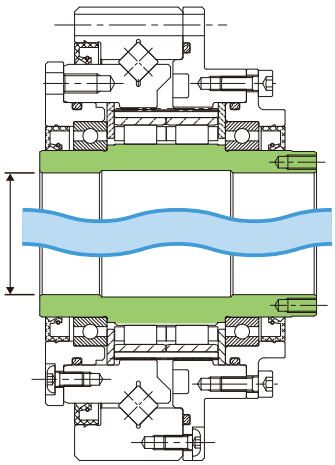
The structure suppressing ratcheting (situation where teeth do not engage smoothly) realizes high safety under overload.

Reasons for above-average strength

	Examples of general strain wave gear	ECY Series
External gear profile	Cup type/Hat type	Cylindrical type
Tooth contact in the tooth trace direction	Partly gear meshing (30-50%)	Fully gear meshing (≒100%)
Elliptical bearing structure	Ball bearing	Roller bearing

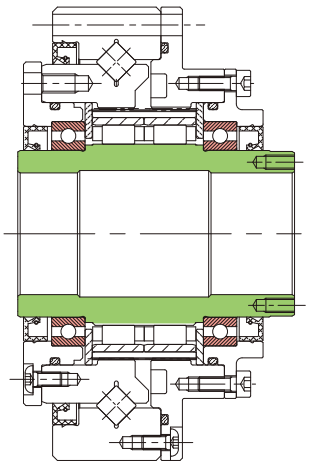
The structure differs from a general strain wave gear, realizing high strength.

Large diameter hollow of high speed shaft



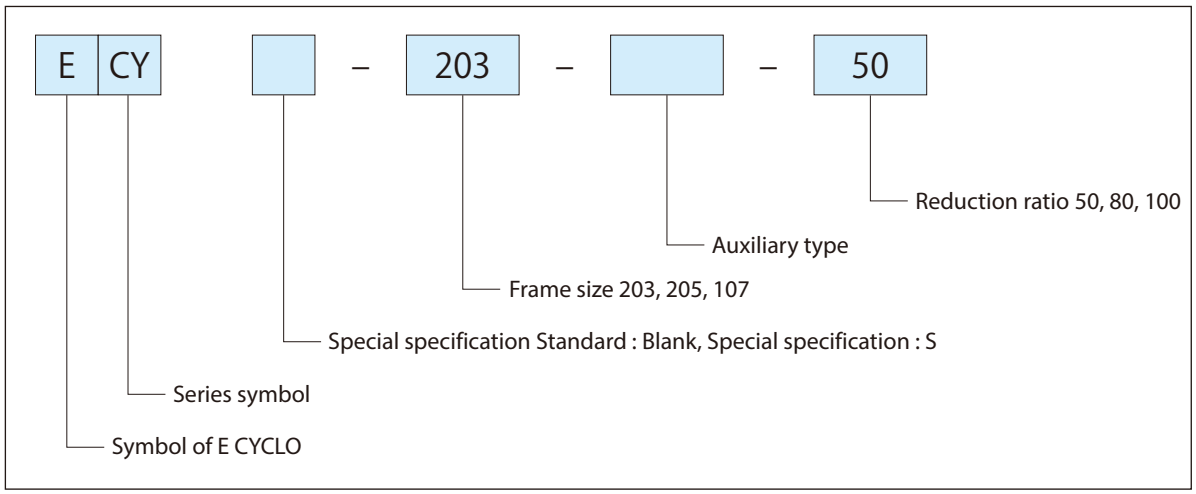
The diameter of the hollow shaft of the high speed shaft has been increased, permitting effective utilization of the space between the wall of the hollow shaft and your cables, shafts, and so on.

Reduction of assembly work performed by a user



Because the high speed shaft is supported by the reducer and the grease is packed in a sealed structure, it is easy to mount the shaft on the device or on the motor.

3. Nomenclature



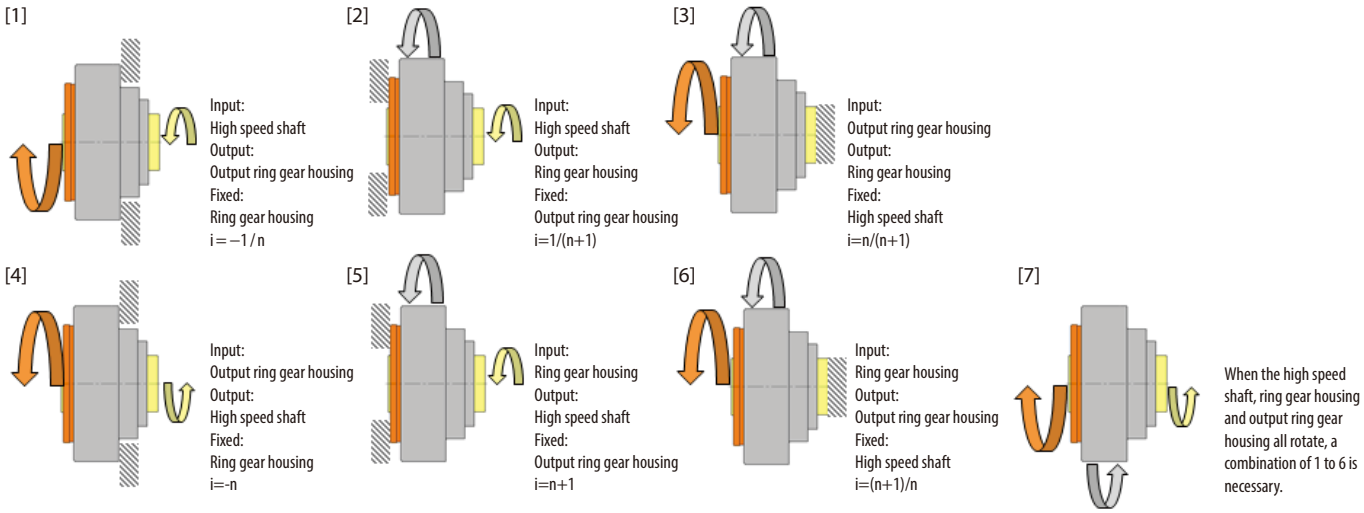
4. Line up

Table 4-1 ● : Production possible range

Frame size	Reduction ratio		
	50	80	100
203	●	●	●
205	●	●	●
107	●	●	●

5. Speed Ratio and Rotation Direction

The rotation direction and speed ratio are as illustrated in the figure below depending on the fixed, input, and output locations.



● i : Speed ratio (= [Output speed]/[Input speed]) *"-" indicates opposite direction.
+ and - of the speed ratio i indicate that the input and output are in the same and opposite directions, respectively.

● n : Reduction ratio.

Figure 5-1

6. Standard Specifications

Table 6-1

Lubrication	Grease lubrication Grease is filled before shipment from the factory. For details, see 1 3-4 "Lubrication".
Ambient conditions	Ambient temperature–10 to +40℃ (Start failure may occur depending on the speed and torque of the motor in use, so consult us if the reducer will be used at about –10 to 0°C.)
Ambient humidity	85% or less. No condensation.
Altitude	1000m or lower
Atmosphere	- Free from corrosive gas, volatile gas or steam. - Dust-free and well-ventilated area.
Mounting location	- Indoor (Free from dust, water, other liquids) - Mounting in conditions other than the above requires adherence to special specifications. Please consult with us. - Mount in a location that enables easy operation, such as inspection and maintenance. - Mount on a sufficiently rigid member.
Mounting direction	Mounting direction is free.
Painting	Paintless * Although the packing material used has good anti-rust performance, carry out rustproofing of each part separately after unpacking the product and in case of long-term storage.

7. Operating Principle

As a principle rule, the ECY Series consists of 4 parts.

- The bearing for eccentric deforms the cycloid spline into an elliptical shape.
- The major axis of the cycloid spline that was deformed into an elliptical shape engages the fixed ring gear housing and the output ring gear housing.
- When the fixed ring gear housing is fixed and the bearing used for the eccentric body is turned 1 rotation in the clockwise direction, the cycloid spline will rotate in the counterclockwise direction by an amount corresponding exactly to the difference in the number of teeth, while the elastic deformation is changing.
- This amount of rotation is taken off at the output ring gear housing.

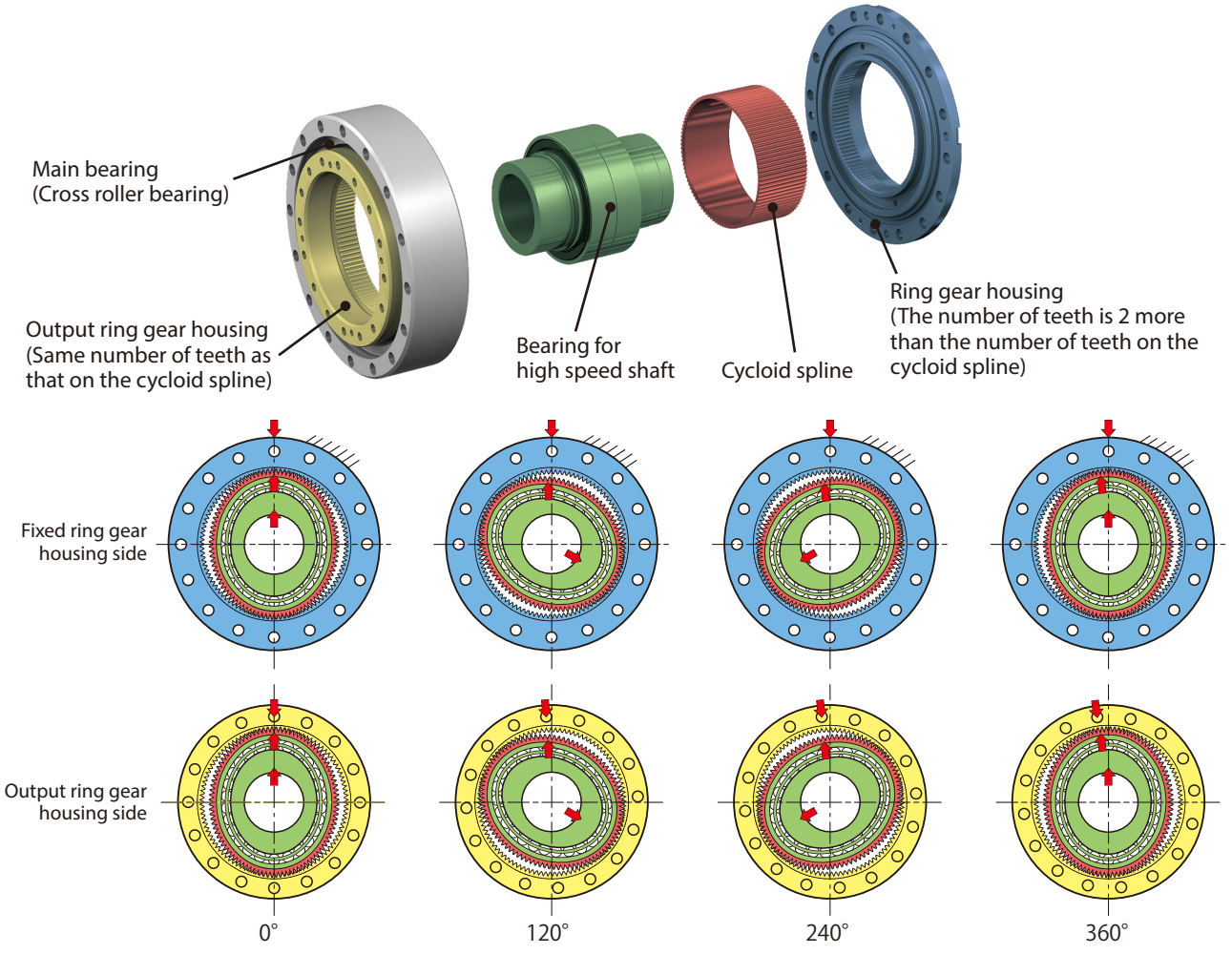


Figure 7-1

8. Rating

Table 8-1 Rating table

Frame size	Reduction ratio	Rated output torque (Upper row/N-m) (Lower row/kgf-m)	Allowable peak torque at acceleration and deceleration (Upper row/N-m) (Lower row/kgf-m)	Maximum value of average load torque (Upper row/N-m) (Lower row/kgf-m)	Allowable maximum momentary torque (Upper row/N-m) (Lower row/kgf-m)	Allowable maximum input speed (r/min)	Allowable average input speed (r/min)	Equivalent on input shaft Moment of inertia/ GD^2		Mass (kg)
								($X10^{-4}kg \cdot m^2$)	($X10^{-4}kgf \cdot m^2$)	
203	50	21 2.1	44 4.5	34 3.5	91 9.3	8500	2500	0.13	0.52	0.9
	80	29 3.0	56 5.7	35 3.6	113 11.5					
	100	31 3.2	70 7.1	51 5.2	143 14.6					
205	50	33 3.4	73 7.4	44 4.5	127 12.9	7300	2500	0.30	1.20	1.2
	80	44 4.5	96 9.8	61 6.2	165 16.8					
	100	52 5.3	107 10.9	64 6.5	191 19.5					
107	50	39 4.0	98 10.0	55 5.6	186 19.0	6500	2000	0.62	2.48	1.6
	80	63 6.4	137 14.0	87 8.9	255 26.0					
	100	67 6.8	157 16.0	108 11.0	284 29.0					

1. Rated torque
   The rated torque indicates the allowable output torque at the output flange at an input speed of 2000 r/min.
2. Allowable peak torque during acceleration and deceleration
   This is the peak torque allowed during normal acceleration and deceleration.
3. Allowable maximum momentary torque
   This is the allowable value of the impact torque that is applied instantaneously to the output shaft by an emergency shutdown or an external shock etc.
   Indicates the value when 10^4 deflection cycles are applied to the cycloid spline throughout the entire life of the product.

$$N = \frac{10^4}{2 \cdot \frac{n}{60} \cdot t}$$

N : Allowable speed under an impact torque (r/min)
n : Input speed when an impact torque is applied (r/min)
T : Time during which an impact torque is applied (s)

4. Allowable maximum input speed and allowable average input speed
   Although use is possible within the range of the maximum allowable input speed, the operation cycle is limited by the allowable average input speed.
   When a high duty ratio is used, there will be a risk of the E CYCLO overheating, causing it to break. To prevent this, when using the E CYCLO, ensure that its surface temperature is no higher than 40°C above the ambient temperature, or is no higher than an absolute value of 60°C, whichever is lower, as a general rule.
5. Moment of inertia, GD^2
   This indicates the value of the moment of inertia and GD^2 on input shaft (high speed shaft) of each model.
   When converting these values to inertia ($kgf \cdot m \cdot s^2$), divide by g (9.8 m / sec^2) for moment of inertia, and by 4g (4 x 9.8 m/s^2) for GD^2.

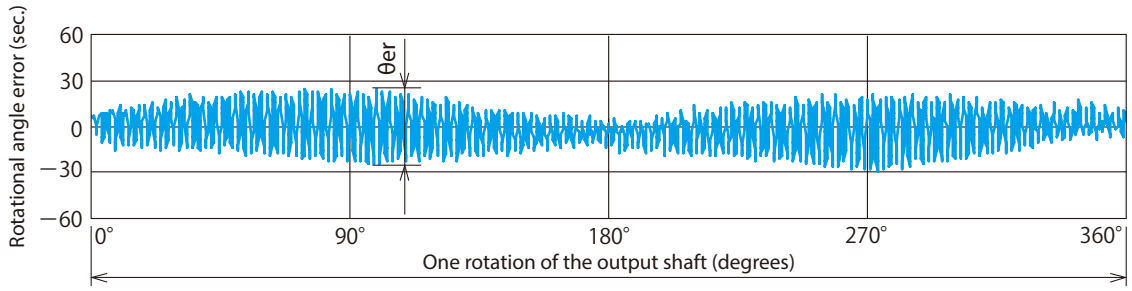
9. Engineering Data

9-1. Angular transmission error

Angular transmission error: This is the difference between the theoretical output rotational angle and the actual output rotational angle when an arbitrary rotational angle is applied to the input under a no-load condition.

$$\theta er(\text{Angular transmission error}) = \frac{\theta in\ (\text{Arbitrary input rotational angle})}{i\ (\text{Reduction ratio})} - \theta out\ (\text{Actual output rotational output})$$

Figure 9-1 Angular transmission error value



(Measurement conditions)

Model	ECY-107-80
Load condition	No load

Table 9-1 Angular transmission error (arc sec)

Reduction ratio	Frame size		
	203	205	107
50	±45	±45	±45
80	±45	±45	±45
100	±45	±45	±45

Note : The values indicate the specification value. Arc sec indicates the angle "second."

9-2. No Load Friction Torque on Output Shaft

No load friction torque: This indicates the torque required to start rotation from the output side of reducer without load.

Table 9-2 No load friction torque on output shaft (N・m)

Reduction ratio	Frame size		
	203	205	107
50	20	21	22
80	31	34	40
100	33	45	51

Note : 1. Indicates the representative value after run-in.
2. Lubrication: Our standard grease

9-3. Stiffness and Hysteresis

Hysteresis curve: This is the relationship between the load and the output side torsion angle when the high speed shaft is fixed, the rated torque applied to the output side, and the load subsequently removed.
Lost motion: Torsion angle under the load of the rating torque × ±3%
Hysteresis loss: The difference between the torsion angles at zero torque along the hysteresis curve
Stiffness: Inclination of the straight line joining 2 points on the hysteresis curve, in the region between arbitrary torque values

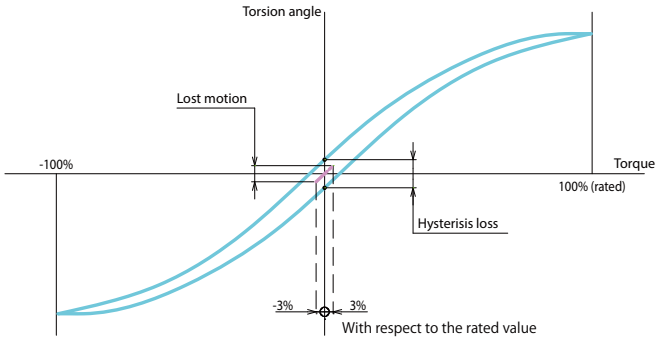


Figure 9-2 Hysteresis curve

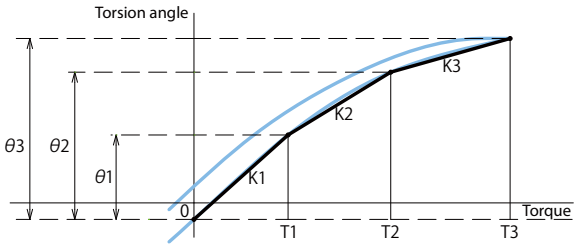


Figure 9-3 Classification of stiffness

Table 9-3 Lost motion (arc min)

Reduction ratio	Frame size		
	203	205	107
50	1.0	1.0	1.0
80	1.0	1.0	1.0
100	1.0	1.0	1.0

Note : The values indicate the specification value. Arc min indicates the angle "minute."

Table 9-4 Hysteresis loss (arc min)

Reduction ratio	Frame size		
	203	205	107
50	2.0	2.0	2.0
80	2.0	2.0	1.5
100	2.0	2.0	1.5

Note : The values indicate the specification value. Arc min indicates the angle "minute."

Table 9-5 Stiffness

Reduction ratio	Symbol	Unit	Frame size		
			203	205	107
T1		N・m	3.9	7.0	14
T2		N・m	12	25	48
50	T3	N・m	34	56	98
	K1	N・m/arc min	3.3	5.3	10.1
		X10⁴N・m/rad	1.1	1.8	3.5
	K2	N・m/arc min	3.5	5.5	10.3
		X10⁴N・m/rad	1.2	1.9	3.5
	K3	N・m/arc min	4.4	7.1	12.0
		X10⁴N・m/rad	1.5	2.4	4.1
	θ1	arc min	1.2	1.3	1.4
	θ2	arc min	3.5	4.6	4.7
	θ3	arc min	8.5	9.0	8.9
80	T3	N・m	43	74	137
	K1	N・m/arc min	3.9	6.6	11.6
		X10⁴N・m/rad	1.3	2.3	4.0
	K2	N・m/arc min	4.0	7.4	12.5
		X10⁴N・m/rad	1.4	2.5	4.3
	K3	N・m/arc min	5.0	8.5	14.4
		X10⁴N・m/rad	1.7	2.9	5.0
	θ1	arc min	1.0	1.1	1.2
	θ2	arc min	3.0	3.5	3.9
	θ3	arc min	9.2	9.3	10.1
100	T3	N・m	54	82	157
	K1	N・m/arc min	3.8	7.7	10.7
		X10⁴N・m/rad	1.3	2.6	3.7
	K2	N・m/arc min	4.3	8.2	11.0
		X10⁴N・m/rad	1.5	2.8	3.8
	K3	N・m/arc min	5.4	9.5	15.9
		X10⁴N・m/rad	1.9	3.3	5.5
	θ1	arc min	1.0	0.9	1.3
	θ2	arc min	2.9	3.1	4.4
	θ3	arc min	10.7	9.1	11.3

Note : arc min indicates the angle "minute."
The values indicate the representative value.

9-4. No Load Running Torque

No load running torque: This means the torque on the input side required to rotate the reducer without a load.

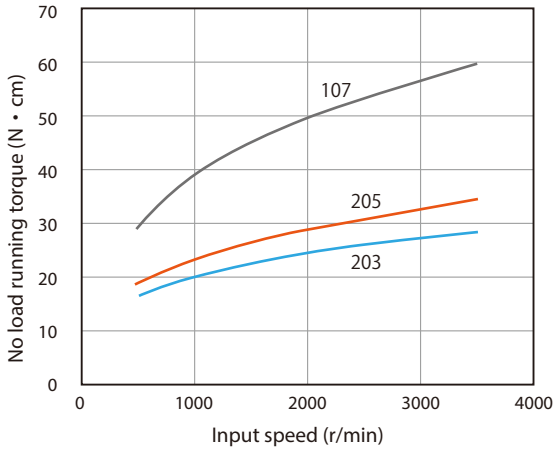


Figure 9-4

Note :1. The value indicates the representative value after run-in.
2. Lubrication: Our standard grease
3. Temperature of the E CYCLO's surface: Approx, 40°C

9-5. Efficiency

Efficiency: This is the ratio of the actual input torque to the theoretical input torque when the rated torque is applied to the output side.
The efficiency varies according to the input speed, load torque, grease temperature, reduction ratio, etc.
The figure shows the values of efficiency with respect to the input speed at the rated torque when the temperature on the casing is approximately 40°C.
When using the E CYCLO under a load torque other than the rated torque, correct the efficiency using the efficiency correction curve shown in the Figure 9-8.

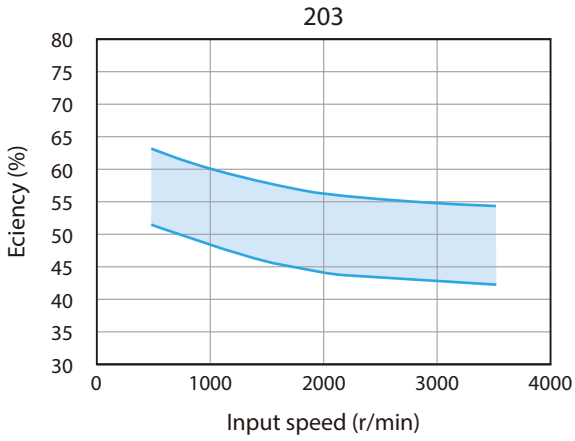


Figure 9-5

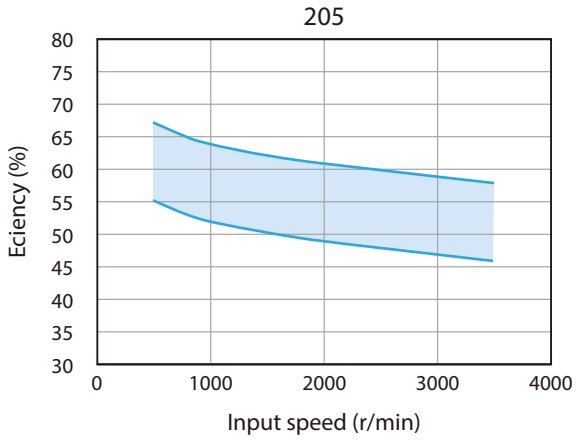


Figure 9-6

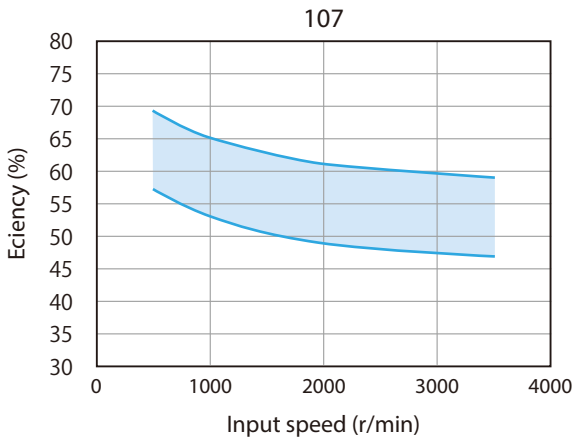


Figure 9-7

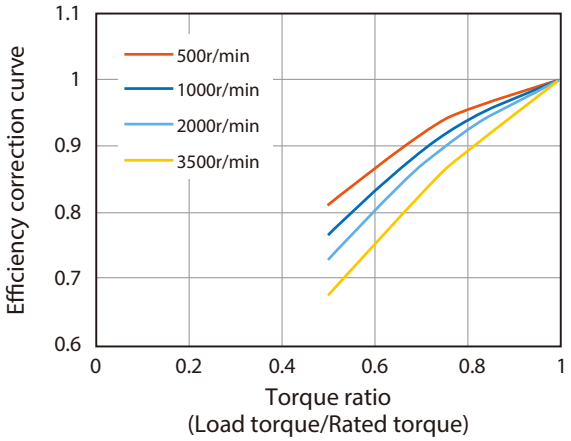


Figure 9-8

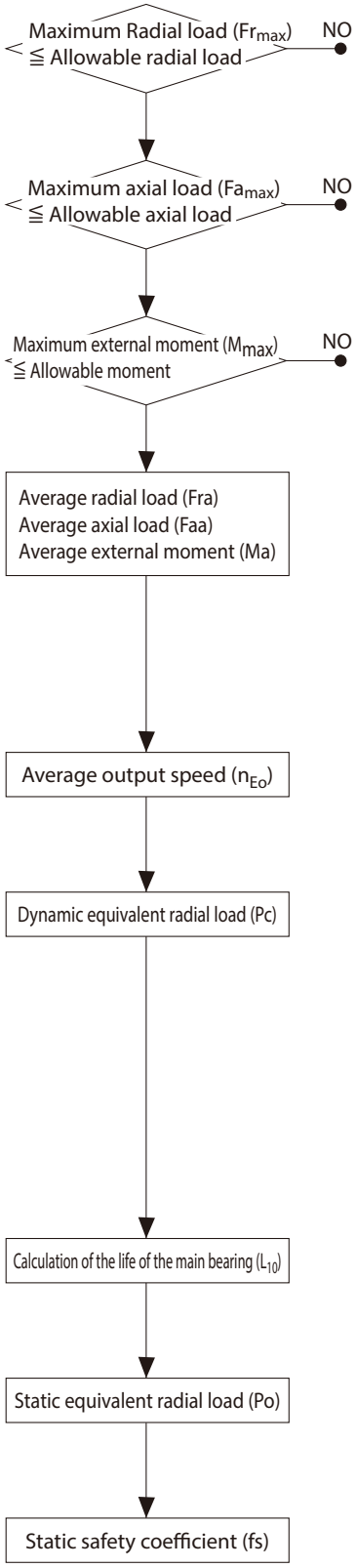
Note : 1. The efficiency value is indicated as the representative value after run-in, and is displayed to some range.
2. Lubrication: Our standard grease
3. Temperature on the casing : Approx, 40°C

Corrected efficiency value = Efficiency value × Efficiency correction factor
Note : 1. If the load torque is less than the rated torque, the efficiency value will be smaller.
2. If the torque ratio is 1.0 or more, the efficiency correction factor will be 1.0.

10. Main Bearing

Table10-1 Main bearing specifications

Frame size	Pitch circle diameter of roller	Offset	Basic dynamic rated load	Basic static rated load	Allowable moment	Allowable radial load	Allowable axial load	Moment stiffness (representative value)	
	dp	R	C	C0	N•m	N	N	x10⁴N•m/rad	N•m/arc min
	m	m	N	N					
203	0.0547	0.01875	9000	18300	105	1300	1590	10.1	29.4
205	0.0630	0.01940	12900	19700	159	1700	1590	14.5	42.2
107	0.0720	0.01985	18100	30400	219	2050	3000	20.3	59.1



Fr_{max} = Maximum radial load

Fa_{max} = Maximum axial load

$$M_{max} = Fr_{max} \cdot (Lr + R) + Fa_{max} \cdot La$$

* If the radial load and the axial load act in combination with each other, ensure that the total load is within the load value indicated in Fig. 10-2.

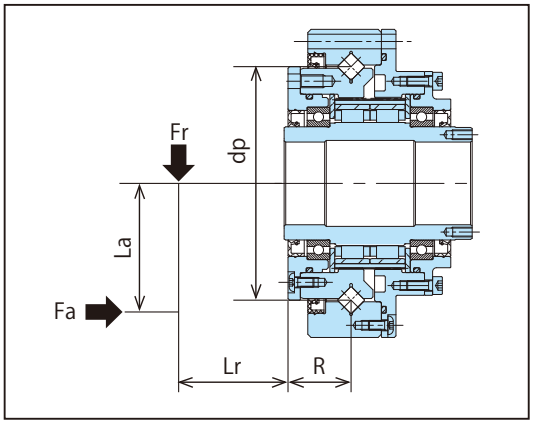


Figure 10-1

$$Fra = \left(\frac{n_A \cdot t_A \cdot Fr_A^{10/3} + n_B \cdot t_B \cdot Fr_B^{10/3} + \ldots n_n \cdot t_n \cdot Fr_n^{10/3}}{n_A \cdot t_A + n_B \cdot t_B + \ldots n_n \cdot t_n} \right)^{0.3}$$

$$Faa = \left(\frac{n_A \cdot t_A \cdot Fa_A^{10/3} + n_B \cdot t_B \cdot Fa_B^{10/3} + \ldots n_n \cdot t_n \cdot Fa_n^{10/3}}{n_A \cdot t_A + n_B \cdot t_B + \ldots n_n \cdot t_n} \right)^{0.3}$$

$$Ma = Fra \cdot (Lr + R) + Faa \cdot La$$

$$n_{Eo} = \frac{n_A \cdot t_A + n_B \cdot t_B \ldots n_n \cdot t_n}{t_A + t_B + \ldots t_n}$$

Dynamic radial factor Xc and dynamic axial factor Yc

$$\frac{Faa}{Fra + 2Ma/dp} \leqq 1.5 \quad Xc = 1.0,\ Yc = 0.45$$

$$\frac{Faa}{Fra + 2Ma/dp} > 1.5 \quad Xc = 0.67,\ Yc = 0.67$$

$$Pc = Xc \cdot \left(Fra + \frac{2Ma}{dp} \right) + Yc \cdot Faa$$

$$L_{10} = \frac{10^6}{60 \times n_{Eo}} \cdot \left(\frac{C}{fw \cdot Pc} \right)^{10/3}$$

$$Po = Fr_{max} + \frac{2M_{max}}{dp} + 0.44\, Fa_{max}$$

$$fs = \frac{Co}{Po}$$

Table 10-2 Load factor fw

Uniform load (No shock)	1-1.2
Moderate shock	1.2-1.5
Heavy shock	1.5-3

Table 10-3 Static safety factor fs

When high speed accuracy is necessary	≧ 3
When there is vibration and/or shock	≧ 2
When the operating conditions are normal	≧ 1.5

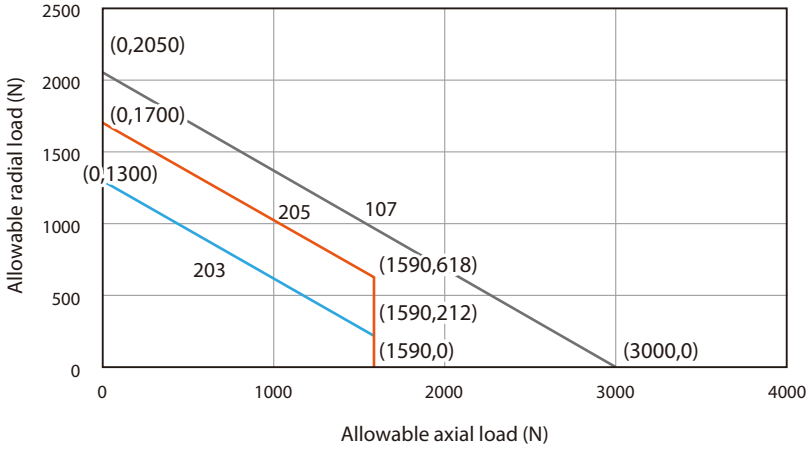

2500
2000
1500
1000
500
0
Allowable radial load (N)
(0,2050)
(0,1700)
(0,1300)
107
205
203
(1590,618)
(1590,212)
(1590,0)
(3000,0)
0
1000
2000
3000
4000
Allowable axial load (N)

Figure 10-2

11. High Speed Shaft Radial Load and Axial Load

When mounting a gear or pulley on a high speed shaft, use the reducer within a range where the radial load and axial load do not exceed the allowable values. Check the radial load and axial load of the high speed shaft according to the following formulas ([1] to [3]).

[1] Radial load P_r

$$P_r = \frac{Tl}{R} \leqq \frac{P_{ro}}{L_f \cdot C_f \cdot F_{s1}} \quad (N) \qquad (式1)$$

[2] Axial load P_a

$$P_a \leqq \frac{P_{ao}}{C_f \cdot F_{s1}} \quad (N) \qquad (式2)$$

[3] When a radial load and axial load coexist

$$\left(\frac{P_r \cdot L_f}{P_{ro}} + \frac{P_a}{P_{ao}} \right) \cdot C_f \cdot F_{s1} \leqq 1 \qquad (式3)$$

P_r : Actual radial load (N)

Tl : Actual transmission torque on high speed shaft of reducer (N • m)

R : Pitch circle radius of sprocket, gear, pulley, etc. (m)

P_{ro} : Allowable radial load (N) (Table 11-1)

P_a : Actual axial load (N)

P_{ao} : Allowable axial load (N) (Table 11-2)

L_f : Load position factor (Table 11-3)

C_f : Coupling factor (Table 11-4)

F_{s1} : Shock factor (Table 11-5)

Table 11-1 Allowable radial load P_{ro}(N)

Frame size	Input speed r/min								
	4000	3000	2500	2000	1750	1500	1000	750	600
203	198	218	232	250	261	275	315	347	373
205	218	240	255	275	288	303	346	381	411
107	238	262	278	300	314	330	378	416	448

Table 11-2 Allowable axial load P_{ao}(N)

Frame size	Input speed r/min								
	4000	3000	2500	2000	1750	1500	1000	750	600
203	169	191	207	228	242	259	308	349	385
205	186	210	228	250	266	284	339	384	424
107	212	240	260	283	303	324	387	439	483

Note : 1. The allowable radial load and the allowable axial load at an input speed of less than 600 r/min are the same as the values at 600 r/min.
2. Complement the values of the radial load and axial load at an input speed that is not shown in the table, by using the following formula.

Allowable radial load

$$P_{rN} = P_{r2000} \cdot \left(\frac{2000}{N} \right)^{1/3}$$

P_{rN} : Allowable radial load for input speed N

P_{r2000} : Allowable radial load at an input speed of 2000 r/min

Allowable axial load

$$P_{aN} = P_{a2000} \cdot \left(\frac{2000}{N} \right)^{0.44}$$

P_{aN} : Allowable axial load at input speed N

P_{a2000} : Allowable axial load at an input speed of 2000 r/min

Table 11-3 Load position factor L_f

L (mm)	Frame size		
	203	205	107
5	1.01	0.99	0.97
10	1.13	1.10	1.07
15	1.25	1.21	1.18
20	1.37	1.32	1.28
25	1.49	1.43	1.39
30	1.61	1.54	1.49
35	1.73	1.65	1.60
40	-	-	1.70
L (mm) when L_f = 1(mm)	4.6	5.5	6.6

Note : Using linear complementation, calculate the load position factor L_f at load position L which is not shown in the table.

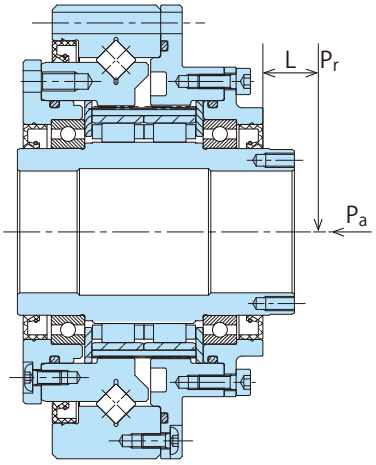


Figure 11-1 High speed shaft load position

Table 11-4 Coupling factor C_f

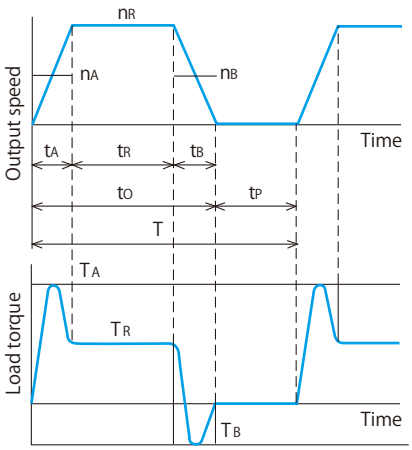
Load connection factor	C_f
Chain	1
Gear	1.25
Timing belt	1.25
V belt	1.5

Table 11-5 Shock factor F_{s1}

Load Classification	F_{s1}
Uniform load (No shock)	1
Moderate shock	1–1.2
Heavy shock	1.4–1.6

12. Selection

Figure 12-1 Load pattern



n_A : Average output speed during acceleration
In the case of the above figure $n_A = \frac{n_R}{2}$

n_R : Output speed during normal running

n_B : Average output speed during deceleration
In the case of the above figure $n_B = \frac{n_R}{2}$

t_A : Acceleration time
t_R : Normal running time
t_B : Deceleration time
t_O : Total running time
t_P : Stand still time
T : Time cycle
T_A : Acceleration peak torque
T_R : Normal running torque
T_B : Peak torque at braking

Evaluation of the load characteristics

Calculation of the average output torque (T_E)

$T_E \leqq T_{aE}$ NO (Select larger frame size or lower the average load torque T_E)

T_{aE} : Maximum value of average load torque (Table 8-1)

Temporary frame size selection

Calculation for average output speed (n_{EO})

Calculation for average input speed (n_{EI})

Evaluation of input speed

NO Maximum input speed ≦ Allowable maximum input speed

P6 (Table 8-1)

NO Average input speed ≦ Allowable average input speed

P6 (Table 8-1)

Evaluation of the peak torque at acceleration and decelaration

NO Peak torque at acceleration and decelaration ≦ Allowable peak torque at acceleration and deceleration

P6 (Table 8-1)

Evaluation of the shock torque

NO Shock torque ≦ Allowable maximum momentary torque

P6 (Table 8-1)

$$N = \frac{10^4}{2 \cdot \frac{n}{60} \cdot t}$$

Evaluation of the radial load and the axial load of the high speed shaft

NO Radial loads of the high speed shaft ≦ Allowable radial load

P12 (Table 11-1)

NO Axial loads of the high speed shaft ≦ Allowable axial load

P12 (Table 11-2)

Evaluation of main bearing

NO Maximum Radial load Fr_{max} ≦ Allowable radial load

P10 (Table 10-1)

NO Maximum axial load Fa_{max} ≦ Allowable axial load

P10 (Table 10-1)

NO Maximum external moment M_{max} ≦ Allowable moment

P10 (Table 10-1)

NO Calculation of the life of the main bearing Calculated life of the main bearing ≦ Your requested life

P10

Calculation of life

T_{OE} : Rated torque of the selected model

203, 205

$$L_{10} = 10000 \cdot \left(\frac{T_{OE}}{T_E}\right)^{10/3} \cdot \left(\frac{2000}{n_{EI}}\right)$$

107

$$L_{10} = 7000 \cdot \left(\frac{T_{OE}}{T_E}\right)^{10/3} \cdot \left(\frac{2000}{n_{EI}}\right)$$

Calculation for the running pattern in the figure 12-1

○ Average load torque $T_E = \left(\dfrac{t_A \cdot n_A \cdot T_A^{10/3} + t_R \cdot n_R \cdot T_R^{10/3} + t_B \cdot n_B \cdot T_B^{10/3}}{t_A \cdot n_A + t_R \cdot n_R + t_B \cdot n_B} \right)^{0.3}$

○ Average output speed $n_{EO} = \dfrac{t_A \cdot n_A + t_R \cdot n_R + t_B \cdot n_B}{T}$

The longest operation cycle is 10min.

○ Average input speed $n_{EI} = n_{EO} \cdot R$

R : Reduction ratio

Selection Example

Make confirmation assuming , ECY-107-50 for the following specification.

(specification)	T_A : Peak torque at acceleration and decelaration	80N • m	t_A : Acceleration time	0.3s
	T_R : Normal running torque	30N • m	t_R : Normal running time	3.0s
	T_B : Peak torque at braking	60N • m	t_B : Deceleration time	0.3s
	Shock torque :	160N • m	t_P : Stand still time	3.6s
	n_A : Average output speed during acceleration/deceleration	25r/min	t_o : Total running time	3.6s
	n_R : Output speed during normal running	50r/min	T : Time cycle	7.2s
	n_B : Average output speed during deceleration	25r/min	Radial loads of the high speed shaft :	100N
	Necessary life	10000h	Maximum external moment :	150N • m
			Maximum radial load :	500N

When using the E CYCLO, almost no shock is assumed.

(Calculation) Average load torque $T_E = \left(\dfrac{0.3 \cdot 25 \cdot 80^{10/3} + 3 \cdot 50 \cdot 30^{10/3} + 0.3 \cdot 25 \cdot 60^{10/3}}{0.3 \cdot 25 + 3 \cdot 50 + 0.3 \cdot 25} \right)^{0.3} = 40(N \cdot m)$

From Table 8-1, the maximum value of the average load torque of ECY-107-50 is $T_{aE} = 55$ (N • m).

$\Rightarrow$ 40 (N • m) 55 (N • m), consequently ECY-107 is provisionally selected.

Maximum input speed $n_{max} = 50 \cdot 50 = 2500$ (r/min)

Average output speed $n_{EO} = \dfrac{0.3 \cdot 25 + 3 \cdot 50 + 0.3 \cdot 25}{7.2} = 22.9$ (r/min)

Average input speed $n_{EI} = 22.9 \cdot 50 = 1146$ (r/min)

○ Check of maximum input speed 2500(r/min) ≦ 6500(r/min)	P6 (Table 8-1)
○ Check of average input speed 1146(r/min) ≦ 2000(r/min)	P6 (Table 8-1)
○ Check of peak torque at acceleration/deceleration 80(N • m) ≦ 98(N • m)	P6 (Table 8-1)
○ Check of shock torque 160(N • m) ≦ 186(N • m)	P6 (Table 8-1)
○ Check of radial loads of the high speed shaft 100(N) ≦ 361(N) (L_f, C_f, $F_{s1} = 1$)	P12 (Table 11-1)
○ Check of allowable moment 150(N • m) ≦ 219(N • m)	P10 (Table 10-1)
○ Check of allowable radial loads 500(N) ≦ 2050(N)	P10 (Table 10-1)
○ Check of main bearing($f_w = 1.2$) 36334(h) ≧ 10000(h)	P10 (Table 10-2)
○ Confirmation of the static safety coefficient 6.5 ≧ 1.5	P10 (Table 10-3)
○ Check of life	

From Table 8-1, the rated torque of ECY-107-50 is $T_{0E} = 39$ (N • m).

Life $L_{10} = 7000 \cdot \left(\dfrac{39}{40} \right)^{10/3} \cdot \left(\dfrac{2000}{1146} \right) = 11433(h) \geqq 10000(h)$

ECY-107-50 is selected based on the above consideration.

13. Notice for Designing

13-1. Assembly Method

Use spigot Ⓒ when assembling the input parts (pulleys and gears)
Use spigot Ⓑ for the assembly of the reducer output side, and use spigot Ⓐ for assembly of the casing.

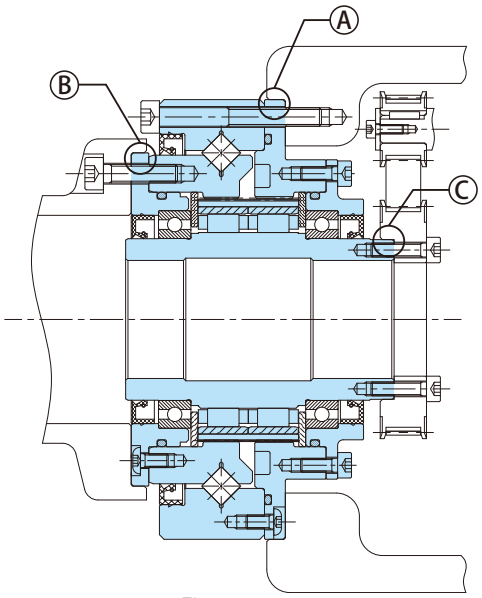


Figure 13-1

13-2. Bolt Tightening Torque and Allowable Transmission Torque

Allowable transmission torque by bolt
Table 13 -1 shows the number, size and tightening torque of bolts when fastening the output part and input part of the E CYCLO with bolts.
At this time, it is possible to transmit the allowable maximum momentary torque shown in Table 13 -1.

Table 13-1

Frame size	Tightening of the output ring gear housing					
	Number and size of bolts	Bolt PCD mm	Bolt tightening torque		Allowable transmission torque by bolt	
			N·m	kgf·cm	N·m	kgf·cm
203	16-M3	48.0	1.96	20	163	17
205	16-M3	55.5	1.96	20	189	19
107	16-M4	63.0	4.61	47	374	38

Frame size	Tightening of the cross roller					
	Number and size of bolts	Bolt PCD mm	Bolt tightening torque		Allowable transmission torque by bolt	
			N·m	kgf·cm	N·m	kgf·cm
203	16-M3	68.0	1.96	20	232	24
205	16-M3	78.0	1.96	20	266	27
107	16-M4	87.5	4.61	47	520	53

Frame size	Tightening of the eccentric high speed shaft					
	Number and size of bolts	Bolt PCD mm	Bolt tightening torque		Allowable transmission torque by bolt	
			N·m	kgf·cm	N·m	kgf·cm
203	6-M2	22	0.55	5.6	14	1.4
205	8-M2	24	0.55	5.6	20	2.0
107	6-M3	30	1.96	20	45	5.0

- Bolt: Use hexagon socket head bolts of strength class 12.9 of JIS B 1176.
- Measure to prevent loosening of bolts: Use adhesive (Loctite 262, etc.) or a conical spring washer (JIS B 1252 Type 2).
  Also, in order to prevent damage to the seating face of the bolts when tightening the E CYCLO, it is recommended that you use a conical spring washer intended for a hexagonal socket head bolt.
- Coefficient of friction: 0.15

13-3. Assembly Procedure

[1]

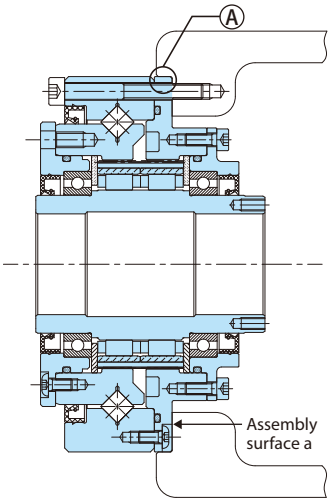


Figure 13-2

Fix the reducer to the casing of machine with bolts.
(Spigot Ⓐ)
* Ensure that the width of spigot Ⓐ is no more than the width of the fixed ring gear housing.
Apply liquid gasket to the assembly surface a, if necessary.

[2]

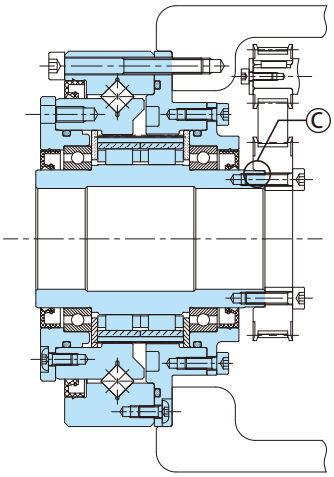


Figure 13-3

The pulley and other input parts are bolted to the high speed shaft.
(Spigot Ⓒ)

[3]

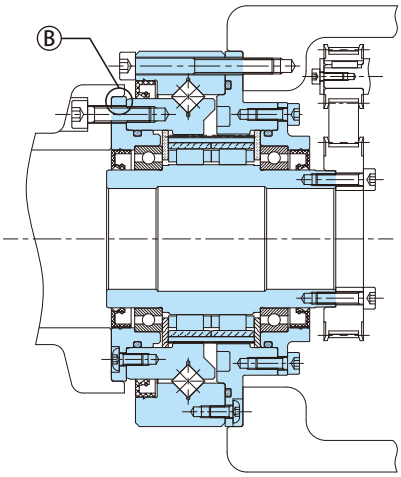


Figure 13-4

Bolt the outside cover (including the output ring gear housing) to the output shaft of the device.
(Spigot Ⓑ)

Notes : 1. The bolts for mounting of the gear reducer shall be fastened by the specified fastening torque (See Table 3-1).
2. When bolting the output shaft of the device to the external cover (including the output ring gear housing), set the bolt length shorter than the tapping depth indicated on enlarged part A of the outline drawing (refer to P18 to 20).

Recommended liquid gasket: ThreeBond Co., Ltd., Liquid gasket ThreeBond 1215

13-4. Lubrication

The E CYCLO is shipped after Nippeco's HGO-3 No.00has been sealed.
Replace grease every 20,000 hours of operation time or every three to five years.

Table 13-2

Frame size	203		205 (Reduction ratio 50,80 / 100)		107	
	g	mL	g	mL	g	mL
Grease amount	7	8	14 / 10	16 / 12	16	18

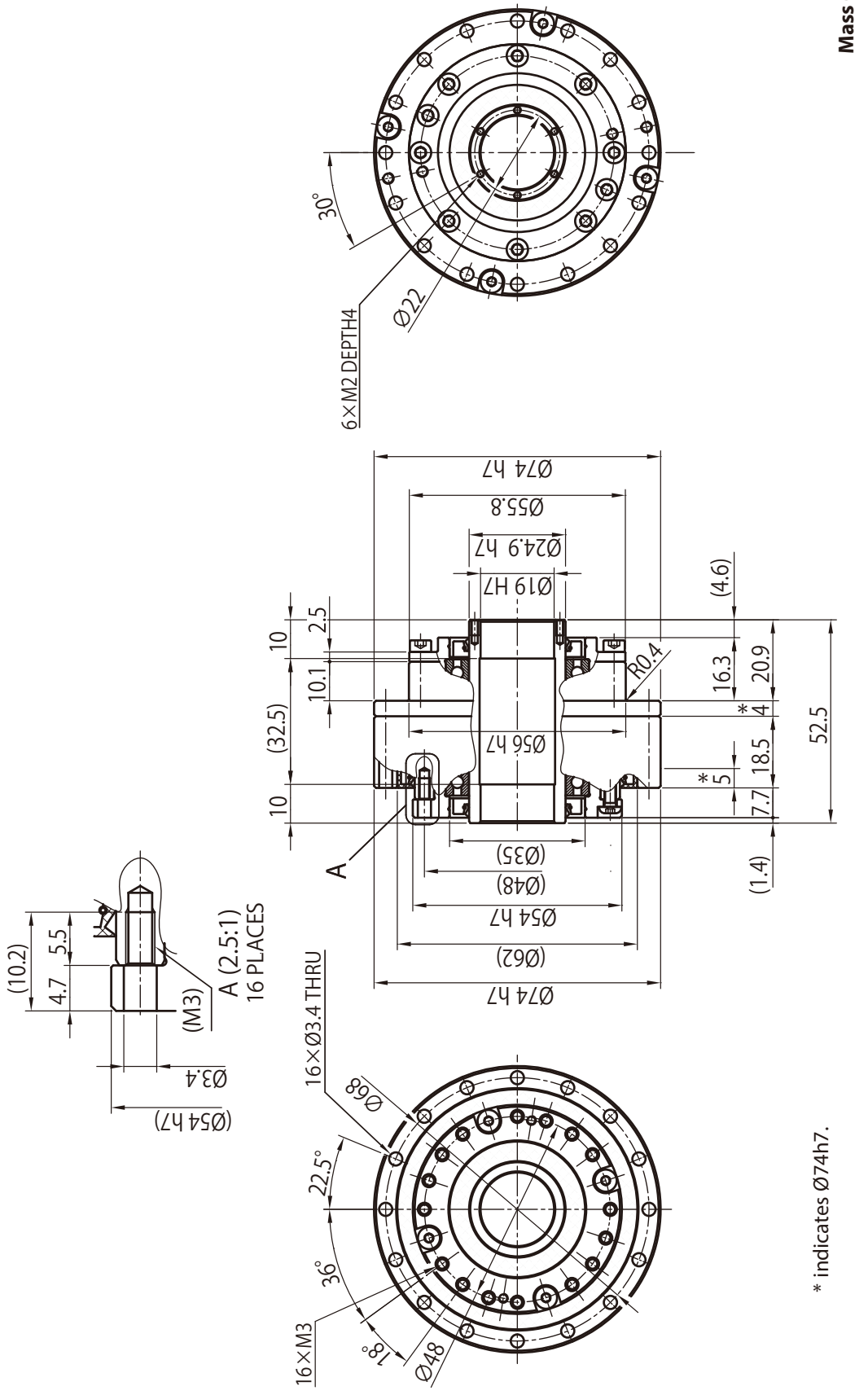
The specific gravity is assumed to be 0.87 g/mL.

Table 13-3 Grease specifications

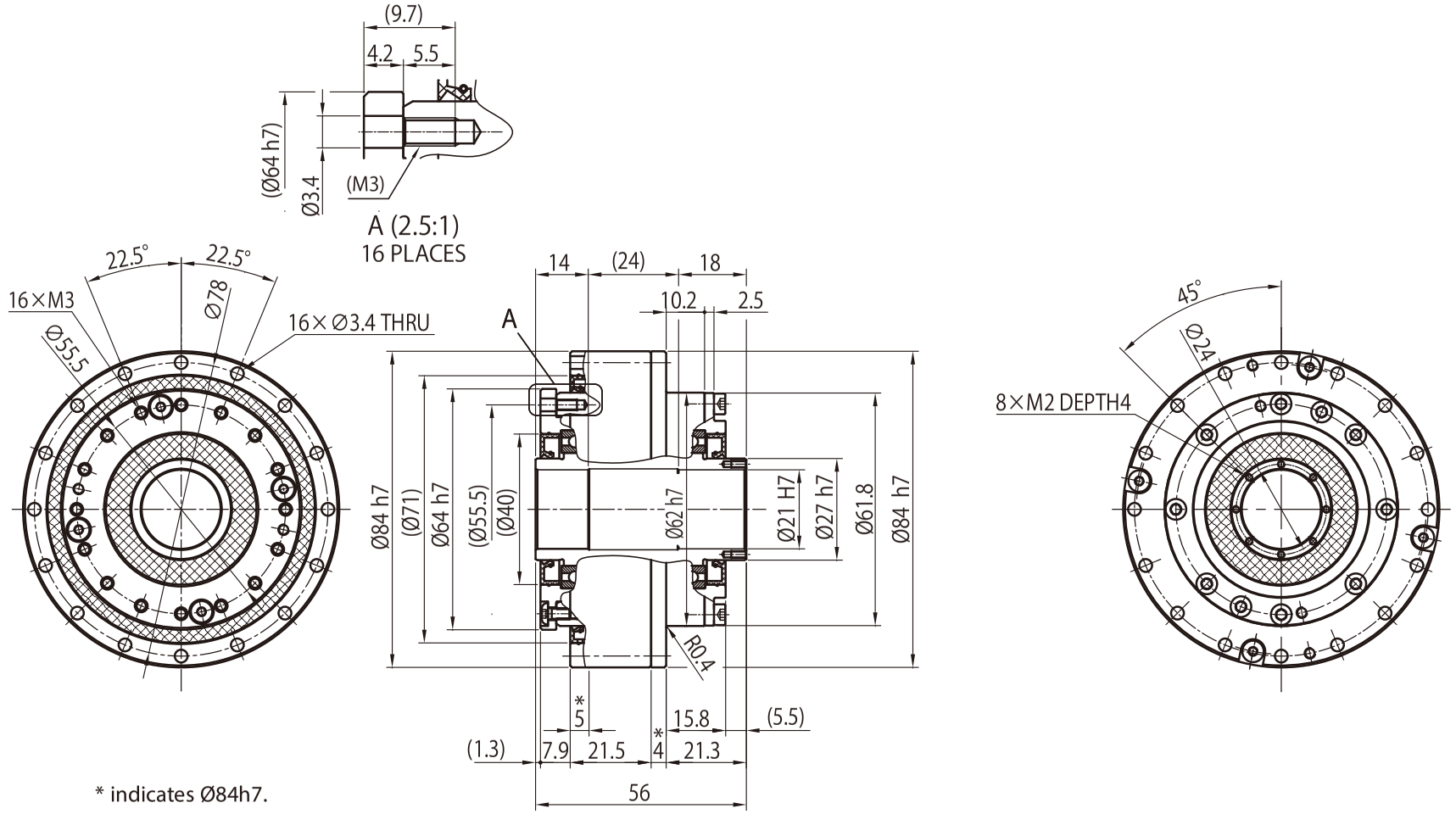
Grease name	HGO-3
Base oil	Refined mineral oil
Thickener	Lithium soap
Additive	Extreme pressure additives, etc.
Consistency No.	No.00
Consistency (at 25°C)	400–430
Appearance	Light brown

14. Outline Drawing

ECY-203 Outline Drawing



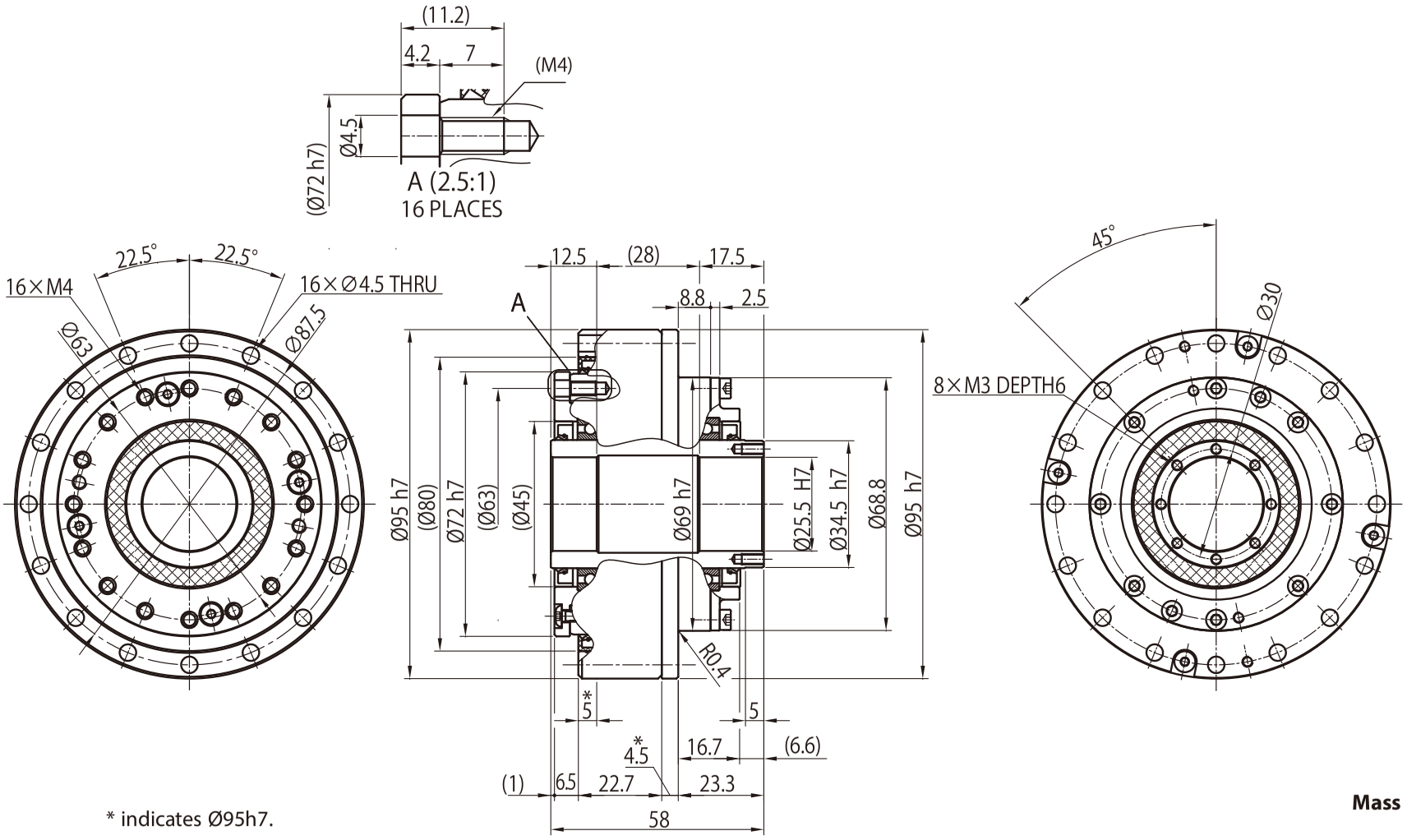
ECY-205 Outline Drawing



* indicates Ø84h7.

Mass 1.2kg

ECY-107 Outline Drawing



* indicates Ø95h7.

Mass 1.6kg

15. Other

The specification shown in this document is based on our evaluation method. Evaluate the performance and durability in the condition of installation in the drive considering the field usage conditions, etc. and confirm that there is no problem, by yourself, before using this product.
Be sure not to perform disassembly, inspection, repair, and maintenance with disassembly in cases of abnormalities of this product by yourself because they have to be performed by our skilled workers with special jigs and tools and expertise.
Note that the specifications and dimensions shown in this document may be changed without notice to customers.

Warranty standard

The scope of warranty of our delivered products is limited only to what we manufactured.

Warranty Period	The warranty period for the Products shall be 18 months after the commencement of delivery or 18 months after the shipment of the Products from the seller's works or 12 months from the Products coming into operation, whether comes first.
Warranty Condition	In the event that any problem or damage to the Product arises during the"Warranty Period"from defects in the Product whenever the Product is properly installed and combined with the Buyer's equipment or machines, maintained as specified in the maintenance manual, and properly operated under the conditions described in the catalog or as otherwise agree upon in writing between the Seller and the Buyer or its customers; the Seller will provide, at its sole discretion, appropriate repair or replacement of the Product without charge at a designted facility, except as stipulated in the"Warranty Exclusions"as described below. However, if the Product is installed or integrated into the Buyer's equipment or machines, the Seller shall not reimburse the cost of : removal or re-installation of the Product or other incidental costs related thereto, any lost opportunity, any profit loss or other incidental or consequential losses or damages incurred by the Buyer or its customers.
Warranty Exclusions	Notwithstanding the above warranty, the warranty as set forth herein shall not apply to any problem or damage to the Product that is caused by : 1. installation, connection, combination or integration of the Product in or to the other equipment or machine that is rendered by any person or entity other than the Seller ; 2. insufficient maintenance or improper operation by the Buyer or its customers, such that the Product is not maintained in accordance with the maintenance manual provided or designated by the Seller ; 3. improper use or operation of the Product by the Buyer or its customers that is not informed to the Seller, including, without limitation, the Buyer's or its customers, operation of the Product not in conformity with the specifications, or use of lubricating oil in the Product that is not recommended by the Seller ; 4. any problem or damage on any equipment or machine to which the Product is installed, connected or combined or on any specifications particular to the Buyer or its customers ; 5. any changes, modifications, improvements or alterations to the Product or those functions that are rendered on the Product by any person or entity other than the Seller ; 6. any parts in the Product that are supplied or designated by the Buyer or its customers ; 7. earthquake, fire, flood, sea-breeze, gas, thunder, acts of God or any other reasons beyond the control of the Seller ; 8. normal wear and tear, or deterioration of the Product's parts, such as bearings, oil-seals ; 9. any other troubles, problems or damage to the Product that are not attributable to the Seller.

Safety Precautions

- Observe the safety rules necessary for the installation location and device in use.
  (Ordinance on Industrial Safety and Health, facility's electrical codes, interior wiring code, plant explosion proofing guide, Building Standards Act, etc.)
- Carefully read the maintenance manual before use. When you don't have the maintenance manual, please make sure to contact the nearest agent, distributor, or sales office. Make sure that the maintenance manual is delivered to the customer who actually use the product.
- This product is designed and produced for uses in general industries. Therefore, in the case the product is used for applications which can seriously affect human bodies, human lives, and public facilities (nuclear, aerospace, public transportation, any application related to medical treatment, etc.), consideration is required on all such occasions. Contact our sales office.
- Select the product suitable for your operating environment and purpose.
- If you use the product for any devices for which a breakdown of the product is expected to cause a great loss of human life or facility such as systems for human transport, hoisting equipment, etc., install a protection device in the device side for safety.
- When the unit is used in food processing applications, machines for cleanroom and so on, vulnerable to oil contamination, install an oil pan or other such device to cope with oil leakage due to breakdown or failure;

M E M O

M E M O

M E M O

Worldwide Locations

U.S.A

Sumitomo Machinery Corporation of America (SMA)
4200 Holland Blvd. Chesapeake, VA 23323, U.S.A.
TEL (1)757-485-3355 FAX (1)757-485-7490

Canada

SM Cyclo of Canada, Ltd. (SMC)
1453 Cornwall Road, Oakville, Canada ON L6J 7T5
TEL (1)905-469-1050 FAX (1)905-469-1055

Mexico

SM Cyclo de Mexico, S.A. de C.V. (SMME)
Av. Desarrollo 541, Col. Finsa, Guadalupe,
Nuevo León, México, CP67132
TEL (52)81-8144-5130 FAX (52)81-8144-5130

Brazil

Sumitomo Industrias Pesadas do Brasil Ltda. (SHIB)
Rodovia do Acucar (SP-075) Km 26
Itu, Sao Paulo, Brasil
TEL (55)11-4886-1000 FAX (55)11-4886-1000

Chile

SM-Cyclo de Chile Ltda. (SMCH)
Camino Lo Echevers 550, Bodegas 5 y 6,
Quilicura, Región Metropolitana, Chile
TEL (56)2-892-7000 FAX (56)2-892-7001

Argentina

SM-Cyclo de Argentina S.A. (SMAR)
Ing Delpini 2230, B1615KGB Grand Bourg,
Malvinas Argentinas, Buenos Aires, Argentina
TEL (54)3327-45-4095 FAX (54)3327-45-4099

Guatemala

SM Cyclo de Guatemala Ensambladora, Ltda. (SMGT)
Parque Industrial Unisur, 0 Calle B 19-50 Zona 3,
Bodega D-1 Delta Bárcenas en Villa Nueva, Guatemala
TEL (502)6648-0500 FAX (502)6631-9171

Colombia

SM Cyclo Colombia, S.A.S. (SMCO)
Parque Industrial Celta, Km 7.0 Autopista Medellín,
Costado Occidental, Funza, Cundinamarca, Colombia
TEL (57)1-300-0673

Peru

SM Cyclo de Perú, S.A.C (SMPE)
Jr. Monte Rosa 255, Oficina 702, Lima,
Santiago de Surco, Perú
TEL (51)1-713-0342 FAX (51)1-715-0223

Germany

Sumitomo (SHI) Cyclo Drive Germany GmbH (SCG)
Cyclostraße 92, 85229 Markt Indersdorf, Germany
TEL (49)8136-66-0 FAX (49)8136-5771

Austria

Sumitomo (SHI) Cyclo Drive Germany GmbH (SCG)
SCG Branch Austria Office
Gruentalerstraße 30A, 4020 Linz, Austria
TEL (43)732-330958 FAX (43)732-331978

Belgium

Hansen Industrial Transmissions NV (HIT)
Leonardo da Vincilaan 1, Edegem, Belgium
TEL (32)34-50-12-11 FAX (32)34-50-12-20

France

SM-Cyclo France SAS (SMFR)
8 Avenue Christian Doppler, 77700 Serris, France
TEL (33)164171717 FAX (33)164171718

Italy

SM-Cyclo Italy Srl (SMIT)
Via dell' Artigianato 23, 20010 Cornaredo (MI), Italy
TEL (39)293-481101 FAX (39)293-481103

Spain

SM-Cyclo Iberia, S.L.U. (SMIB)
C/Gran Vía Nº 63 Bis, Planta 1, Departamento 1B
48011 Bilbao–Vizcaya, Spain
TEL (34)9448-05389 FAX (34)9448-01550

United Kingdom

SM-Cyclo UK Ltd. (SMUK)
Unit 29, Bergen Way, Sutton Fields Industrial Estate,
Kingston upon Hull, HU7 0YQ, East Yorkshire,
United Kingdom
TEL (44)1482-790340 FAX (44)1482-790321

Turkey

SM Cyclo Turkey Güç Aktarım Sis. Tic. Ltd. Sti. (SMTR)
Barbaros Mh. Çiğdem Sk. Ağaoğlu, Office Mrk. No:1 Kat:4 D.18
Ataşehir, İstanbul, Turkey
TEL (90)216-250-6069 FAX (90)216-250-5556

India

Sumi-Cyclo Drive India Private Limited (SDI)
Gat No. 186, Raisoni Industrial Park, Alandi Markal Road,
Fulgaon-Pune, Maharashtra, India
TEL (91)96-0774-5353

China

Sumitomo (SHI) Cyclo Drive Shanghai, Ltd. (SCS)
11F, SMEG Plaza, No. 1386 Hongqiao Road,
Changning District, Shanghai, China 200336
TEL (86)21-3462-7877 FAX (86)21-3462-7922

Hong Kong

SM-Cyclo of Hong Kong Co., Ltd. (SMHK)
Room 19, 28th Floor, Metropole Square, No.2 On
Yiu Street, Shatin, New Territories, Hong Kong
TEL (852)2460-1881 FAX (852)2460-1882

Korea

Sumitomo (SHI) Cyclo Drive Korea, Ltd. (SCK)
Royal Bldg Room #913, 19, Saemunan-ro 5-gil,
Jongno-gu, Seoul, 03173, Korea
TEL (82)2-730-0151 FAX (82)2-730-0156

Taiwan

Tatung SM-Cyclo Co., Ltd. (TSC)
22 Chungshan N. Road 3rd., Sec. Taipei, Taiwan 104,
R.O.C.
TEL (886)2-2595-7275 FAX (886)2-2595-5594

Singapore

Sumitomo (SHI) Cyclo Drive Asia Pacific Pte. Ltd. (SCA)
15 Kwong Min Road, Singapore 628718
TEL (65)6591-7800 FAX (65)6863-4238

Philippines

Sumitomo (SHI) Cyclo Drive Asia Pacific Pte. Ltd. Philippines Branch Office (SMPH)
C4 & C5 Buildings Granville Industrial Complex, Carmona,
Cavite 4116, Philippines
TEL (63)2-584-4921 FAX (63)2-584-4922

Vietnam

SM-Cyclo (Vietnam) Co., Ltd. (SMVN)
Factory 2B, Lot K1-2-5, Road No. 2-3-5A,
Le Minh Xuan Industrial Park, Binh Chanh Dist.,
HCMC, Vietnam
TEL (84)8-3766-3709 FAX (84)8-3766-3710

Malaysia

SM-Cyclo (Malaysia) Sdn. Bhd. (SMMA)
No.7C, Jalan Anggerik Mokara 31/56, Kota Kemuning,
Seksyen 31, 40460 Shah Alam, Selangor Darul Ehsan,
Malaysia
TEL (60)3-5121-0455 FAX (60)3-5121-0578

Indonesia

PT. SM-Cyclo Indonesia (SMID)
Jalan Sungkai Blok F 25 No. 09 K, Delta Silicon III,
Lippo Cikarang, Bekasi 17530, Indonesia
TEL (62)21-2961-2100 FAX (62)21-2961-2211

Thailand

SM-Cyclo (Thailand) Co., Ltd. (SMTH)
195 Empire Tower, Unit 2103-4, 21st Floor, South
Sathorn Road, Yannawa, Sathorn, Bangkok 10120,
Thailand
TEL (66)2670-0998 FAX (66)2670-0999

Australia

Sumitomo (SHI) Hansen Australia Pty. Ltd. (SHAU)
181 Power St, Glendenning, NSW 2761, Australia
TEL (61)2-9208-3000 FAX (61)2-9208-3050

Japan

Sumitomo Heavy Industries, Ltd. (SHI)
ThinkPark Tower, 1-1 Osaki 2-chome, Shinagawa-ku,
Tokyo 141-6025, Japan
TEL (81)3-6737-2511 FAX (81)3-6866-5160

Sumitomo Heavy Industries, Ltd.

Power Transmission & Controls Group
Headquarter ThinkPark Tower, 1-1 Osaki 2-chome, Shinagawa-ku, Tokyo 141-6025, Japan

No.F1001E-2.0
EA14 Printed 2022.05