Sumitomo Drive Technologies

Motion Control Drives

E CYCLO

High Precision Gearboxes
ECY series

Catalogue 991437 EN-04/2020

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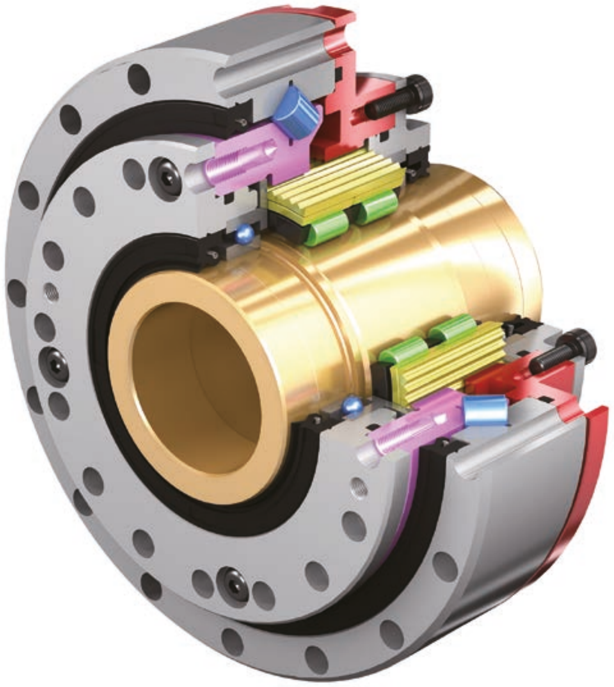
E CYCLO High Precision Gearboxes

ECY series

Sumitomo’s compact E CYCLO High Precision Gearboxes debut!



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

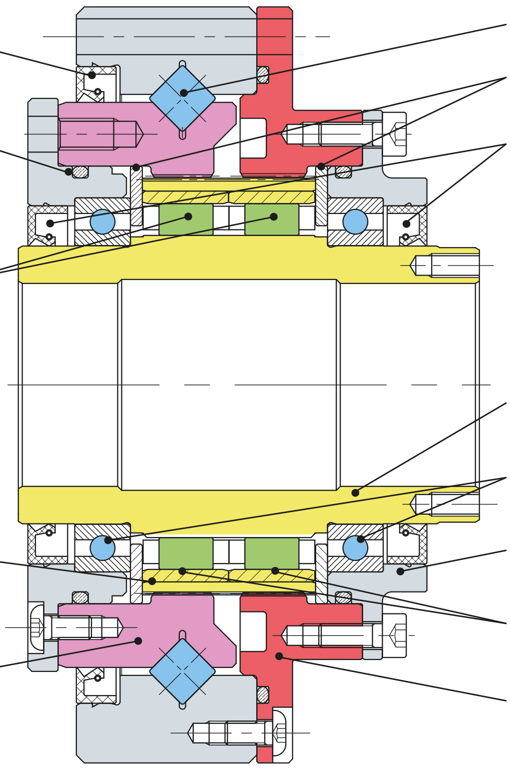
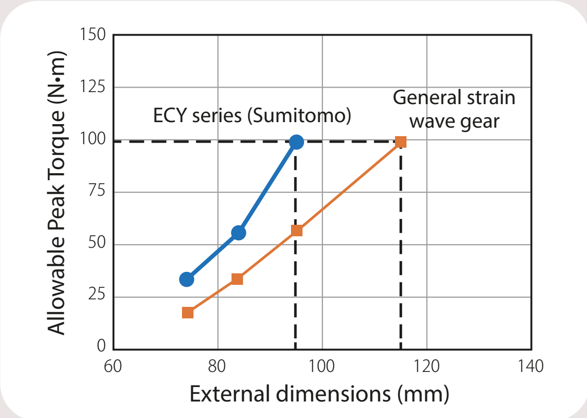


Figure 1-1 Construction

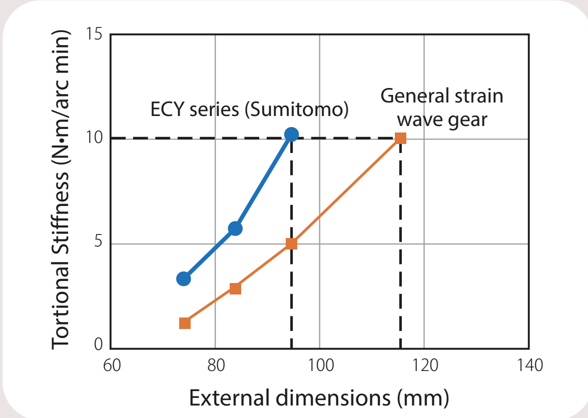
2. Features

Compact, and high torque



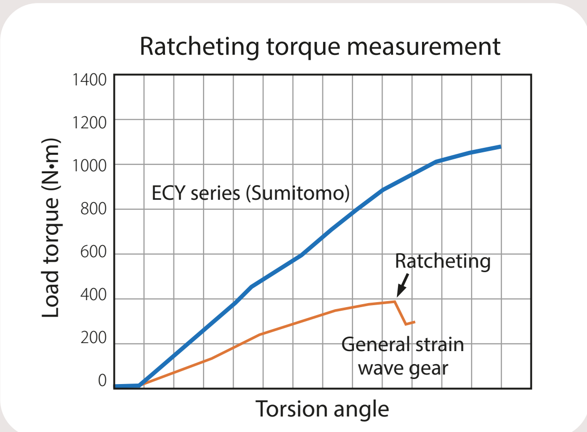
The allowable peak torque is approximately 1.5 times (representative value) that of a general strain wave gear (equivalent size), enabling the device to be miniaturized.

High rigidity



The tortional stiffness is approximately twice (representative value) that of the general strain wave gear (equivalent size), thus enabling the strength of the device to be increased and vibration to be reduced.

Ratcheting resistance (safety in the event of an overload)



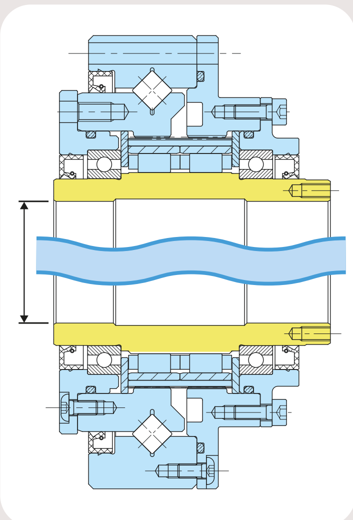
Ratcheting hardly occur, thus ensuring high safety in the event of an overload.

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	30 - 50 %	≒ 100 %
Elliptical bearing structure	Ball bearing	Roller bearing

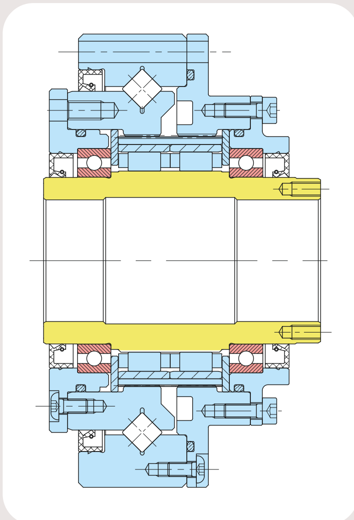
The structure differs from a general strain wave gear, realizing high strength.

Large diameter hollow of high speed shaft



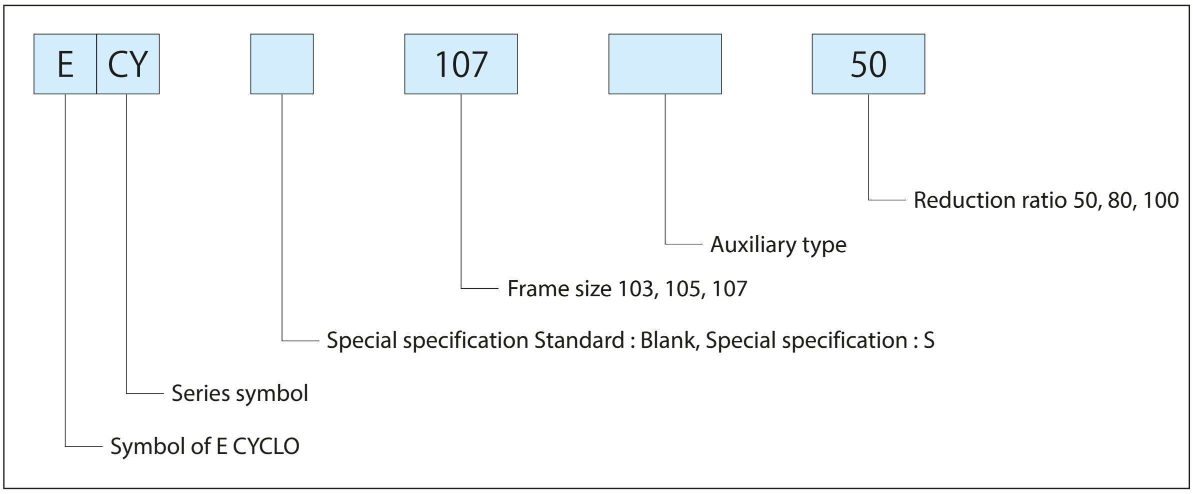
The diameter of the hollow shaft of the high speed shaft has been increased, permitting effective utilization of the space between the wall of the hollow shaft and your cables, shafts, and so on.

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



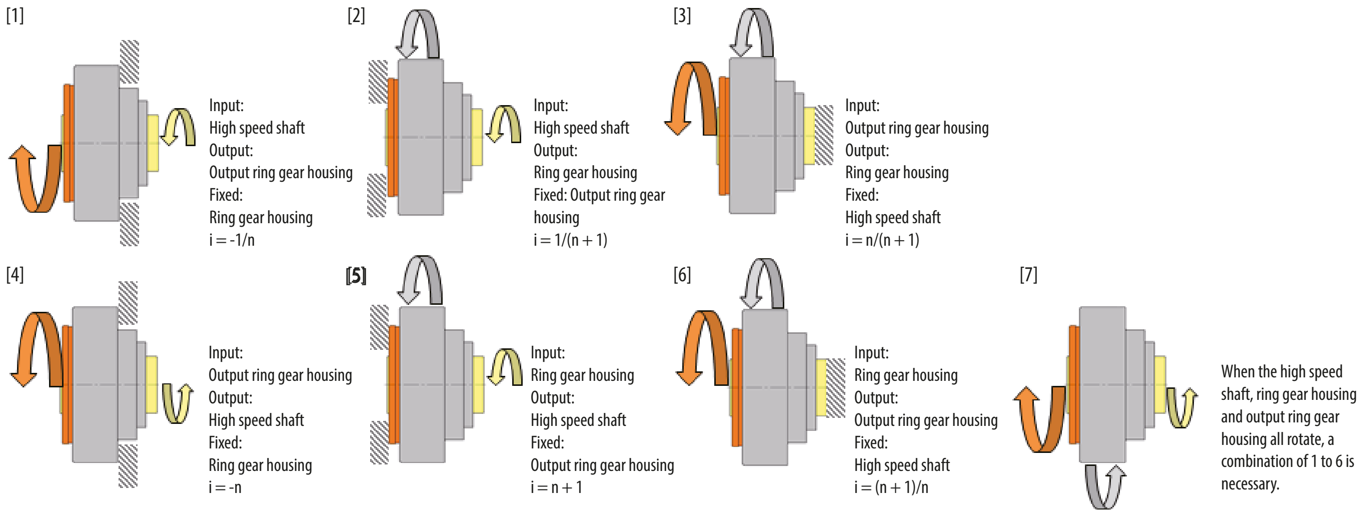
4. Line up

Table 4-1 ●: Production possible range

Frame size	Reduction ratio		
	50	80	100
103	●	●	●
105	●	●	●
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	1000 m 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.

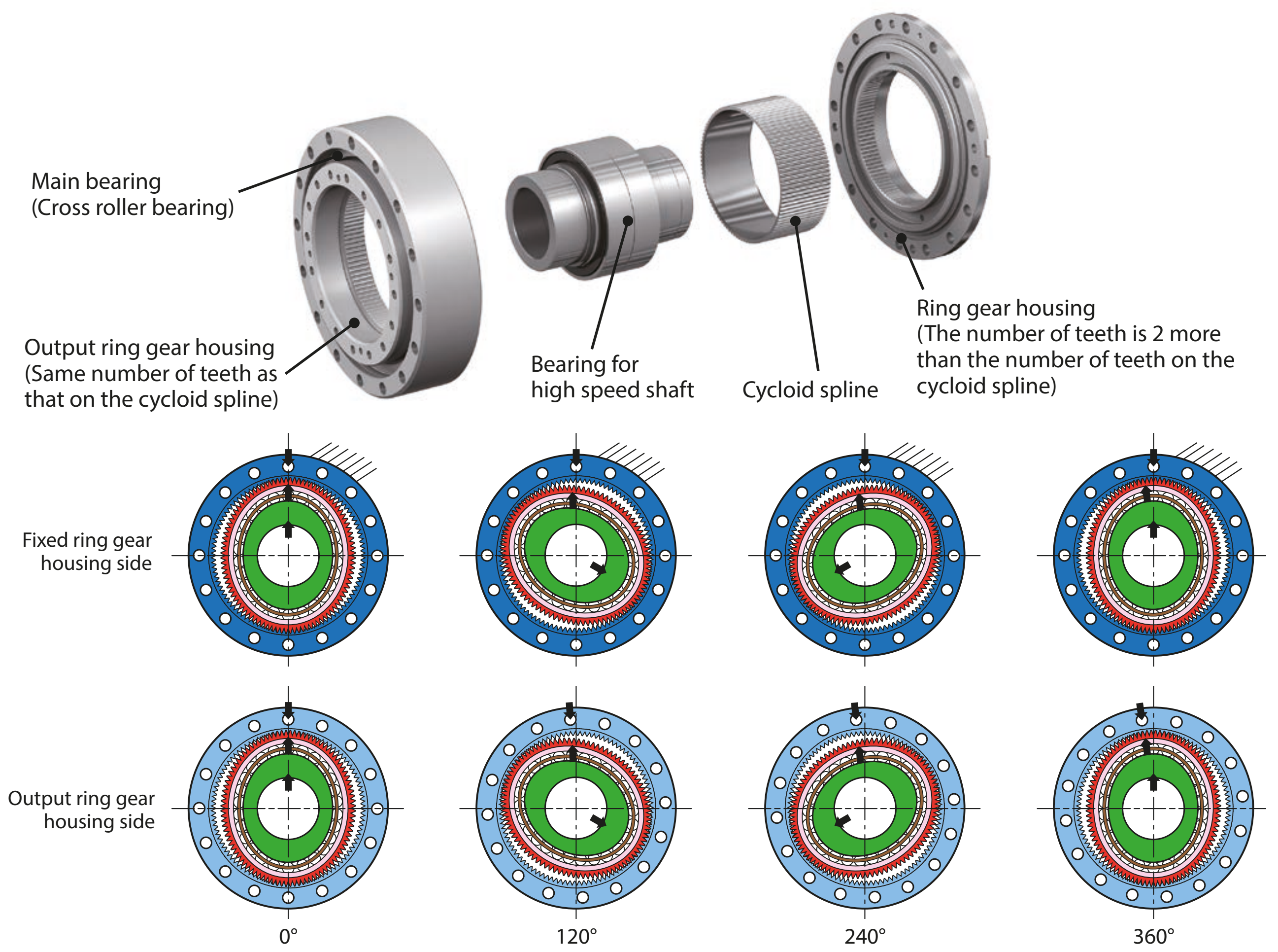


Figure 7-1

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 decelaration (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)
								($X10^{-4}kg \cdot m^2$)	($X10^{-4}kgf \cdot m^2$)	
103	50	16 1.6	34 3.5	26 2.7	70 7.1	8500	2500	0.13	0.52	0.9
	80	22 2.2	43 4.4	27 2.8	87 8.9					
	100	24 2.4	54 5.5	39 4.0	110 11.2					
105	50	25 2.5	56 5.7	34 3.5	98 10.0	7300	2500	0.30	1.20	1.2
	80	34 3.5	74 7.5	47 4.8	127 12.9					
	100	40 4.1	82 8.4	49 5.0	147 15.0					
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.

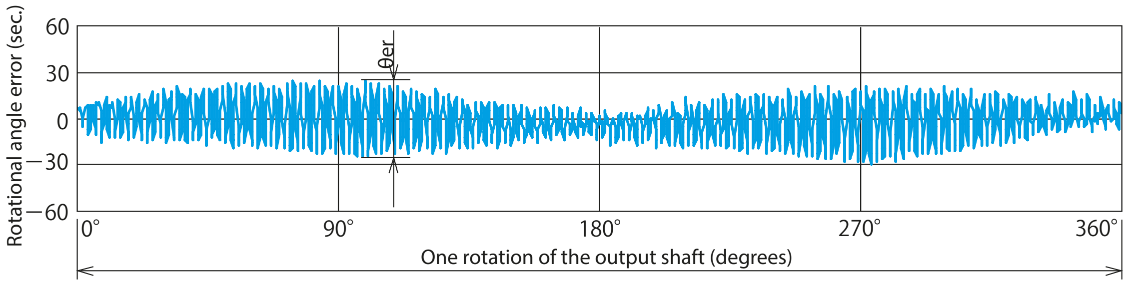
9. Engineering Data

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		
	103	105	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		
	103	105	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

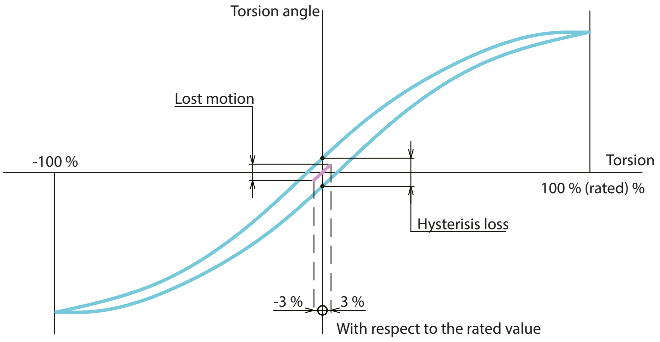


Figure 9-2 Hysteresis curve

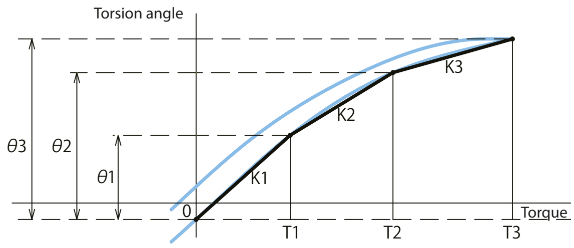


Figure 9-3 Classification of stiffness

Table 9-3 Lost motion (arc min)

Reduction ratio	Frame size		
	103	105	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		
	103	105	107
50	2.0	2.0	2.0
80	2.0	1.5	1.5
100	2.0	1.5	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		
			103	105	107
T1		N•m	3.9	7.0	14
T2		N•m	12	25	48
50	T3	N•m	34	43	54
	K1	N•m/arc min	3.3	5.3	10.1
		X10^{4}N•m/rad	1.1	1.8	3.5
	K2	N•m/arc min	3.5	5.5	10.3
		X10^{4}N•m/rad	1.2	1.9	3.5
	K3	N•m/arc min	4.4	7.1	12.0
		X10^{4}N•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	7.7	6.1	4.5
80	T3	N•m	56	74	82
	K1	N•m/arc min	3.9	6.6	11.6
		X10^{4}N•m/rad	1.3	2.3	4.0
	K2	N•m/arc min	4.0	7.4	12.5
		X10^{4}N•m/rad	1.4	2.5	4.3
	K3	N•m/arc min	5.0	8.5	14.4
		X10^{4}N•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	11.2	8.7	5.7
100	T3	N•m	98	137	157
	K1	N•m/arc min	3.8	7.7	10.7
		X10^{4}N•m/rad	1.3	2.6	3.7
	K2	N•m/arc min	4.3	8.2	11.0
		X10^{4}N•m/rad	1.5	2.8	3.8
	K3	N•m/arc min	5.4	9.5	15.9
		X10^{4}N•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	18.1	14.4	9.9

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.

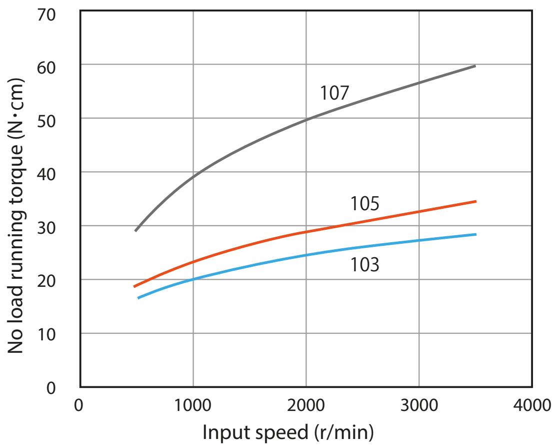


Figure 9-4

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 at the surface of the E-CYCLO 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.

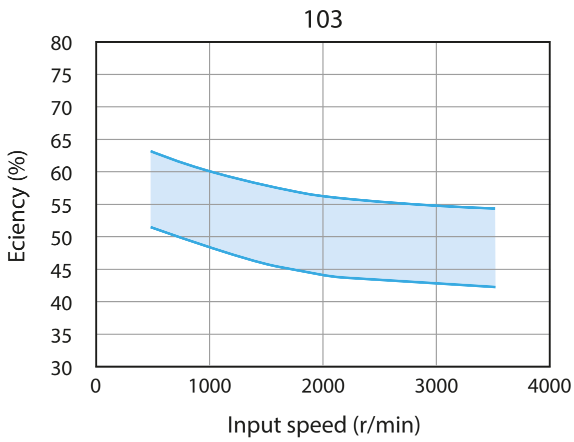


Figure 9-5

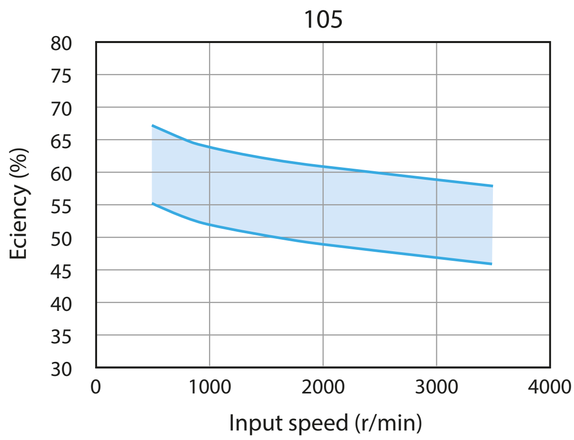


Figure 9-6

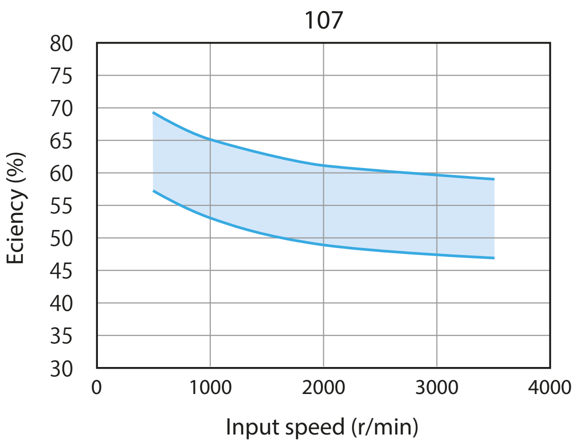


Figure 9-7

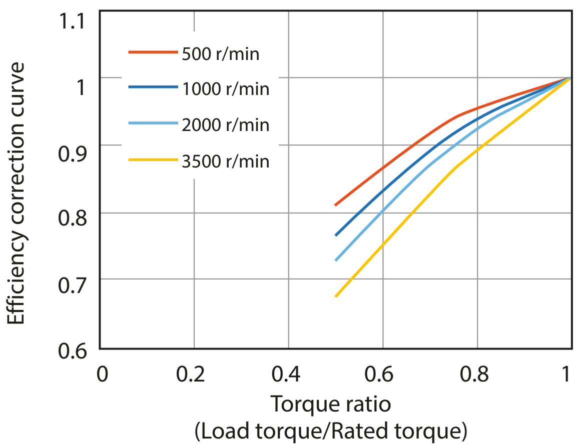


Figure 9-8

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 of the E CYCLO's surface: 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	$\times 10^4$ N•m/rad	N•m/arc min
	m	m	N	N					
103	0.0547	0.01835	9000	18300	105	1300	1590	10.1	29.4
105	0.0630	0.01900	12900	19700	159	1700	1590	14.5	42.2
107	0.0720	0.01945	18100	30400	219	2050	3000	20.3	59.1

Maximum radial load (Fr_{max}) ≦ Allowable radial load — NO

Fr_{max} = Maximum radial load

Maximum axial load (Fa_{max}) ≦ Allowable axial load — NO

Fa_{max} = Maximum axial load

Maximum external moment (M_{max}) ≦ Allowable moment — NO

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

* 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.

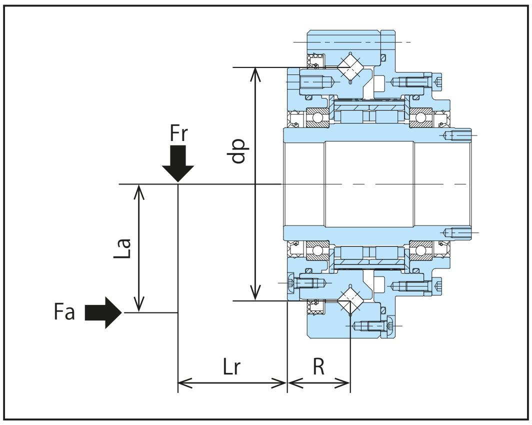


Figure 10-1

Average radial load (Fra)
Average axial load (Faa)
Average external moment (Ma)

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

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

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

Average output speed (n_{Eo})

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

Dynamic equivalent radial load (Pc)

Dynamic radial factor Xc and dynamic axial factor Yc

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

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

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

Calculation of the life of the main bearing (L_{10})

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

Table 10-2 Load factor f_w

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

Static equivalent radial load (Po)

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

Table 10-3 Static safety factor f_s

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

Static safety coefficient (fs)

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

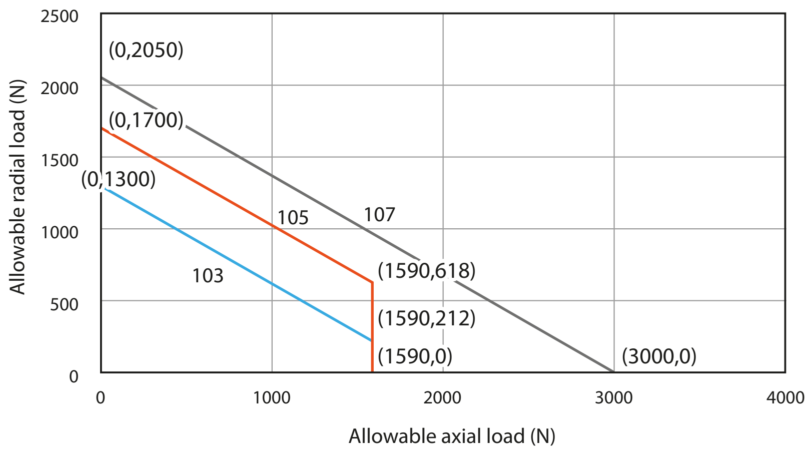

2500
2000
1500
1000
500
0
Allowable radial load (N)
(0,2050)
(0,1700)
(0,1300)
105
107
103
(1590,618)
(1590,212)
(1590,0)
(3000,0)
0
1000
2000
3000
4000
Allowable axial load (N)

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

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

[2] Axial load P_a

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

[3] When a radial load and axial load coexist

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

P_r : Actual radial load (N)

T_l : 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
103	198	218	232	250	261	275	315	347	373
105	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
103	169	191	207	228	242	259	308	349	385
105	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		
	103	105	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.

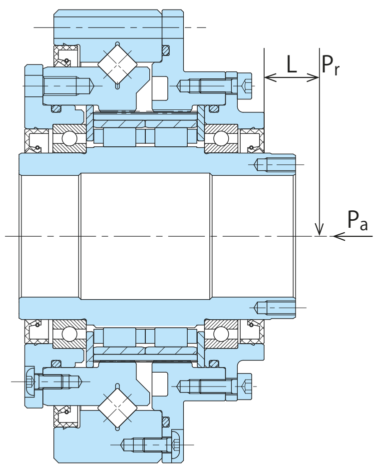


Figure 11-1 High speed shaft load position

Table 11-4 Coupling factor C_f

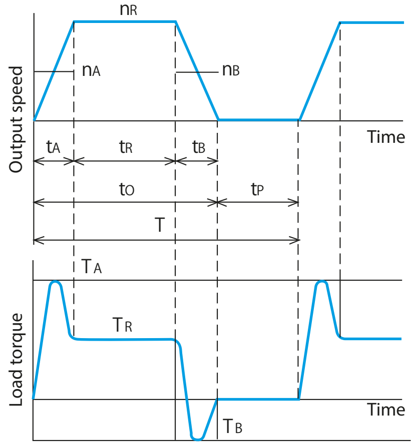
Load connection factor	C_f
Chain	1
Gear	1.25
Timing belt	1.25
V belt	1.5

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

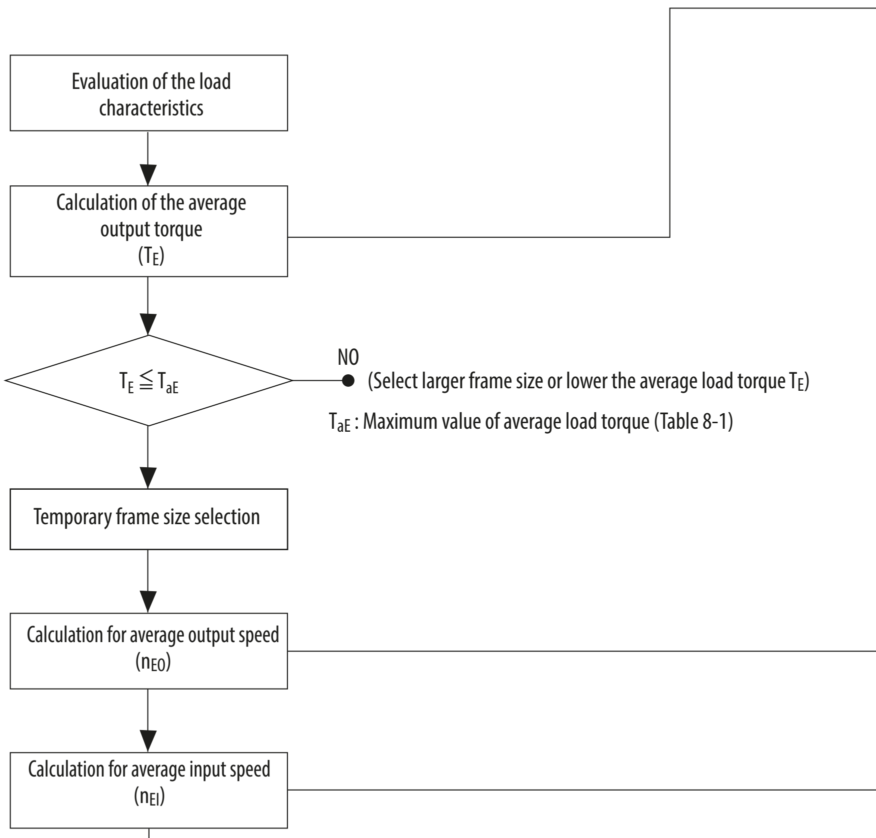
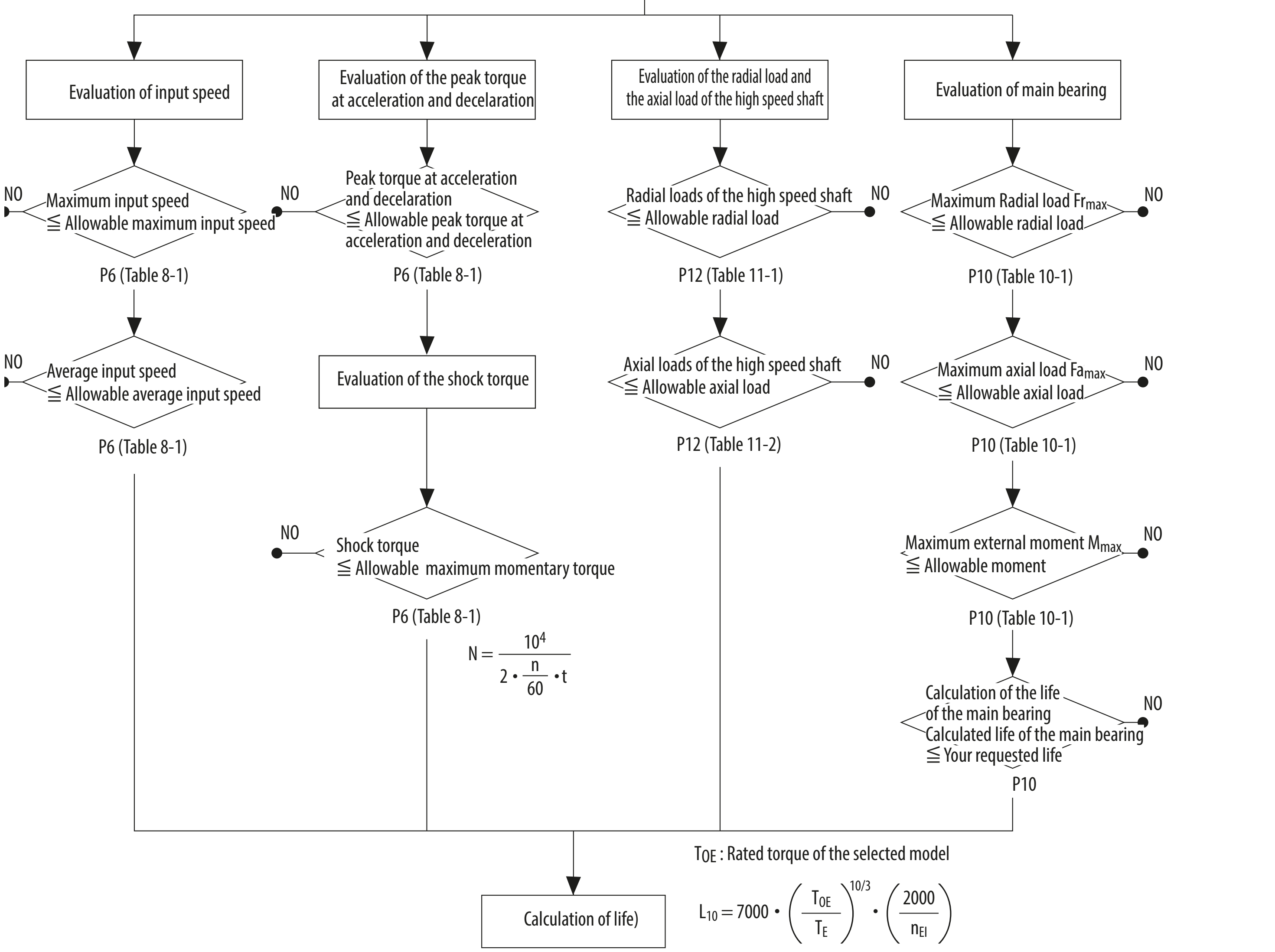


n_A : Average output speed during acceleration
In the case of the above figure $n_A = \frac{n_R}{2}$

n_R : Output speed during normal running

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

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 brakin

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 10 min.

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

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).

⇒ 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) (Lf, Cf, Fs1 = 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 $T_{OE} = 39$ (N•m).

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

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

13. Notice for Designing

13-1. Assembly Method

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

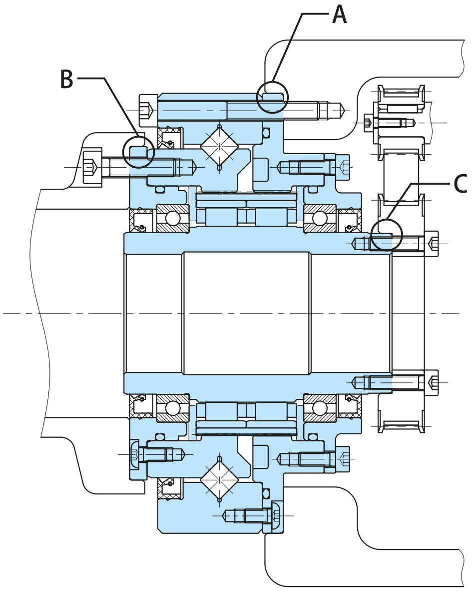


Figure 13-1

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	PCD mm	Bolt tightening torque		Allowable transmission torque by bolt	
			N•m	kgf･cm	N•m	kgf･cm
103	16-M3	48.0	1.96	20	163	17
105	16-M3	55.5	1.96	20	189	19
107	16-M4	63.0	4.61	47	374	38

Frame size	Tightening the cross roller					
	Number and size of bolts	PCD mm	Bolt tightening torque		Allowable transmission torque by bolt	
			N•m	kgf･cm	N•m	kgf･cm
103	16-M3	68.0	1.96	20	232	24
105	16-M3	78.0	1.96	20	266	27
107	16-M4	87.5	4.61	47	520	53

Frame size	Eccentric high speed shaft					
	Number and size of bolts	PCD mm	Bolt tightening torque		Allowable transmission torque by bolt	
			N•m	kgf･cm	N•m	kgf･cm
103	6-M2	22	0.55	5.6	14	1.4
105	8-M2	24	0.55	5.6	20	2.0
107	6-M3	30	1.96	20.0	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]

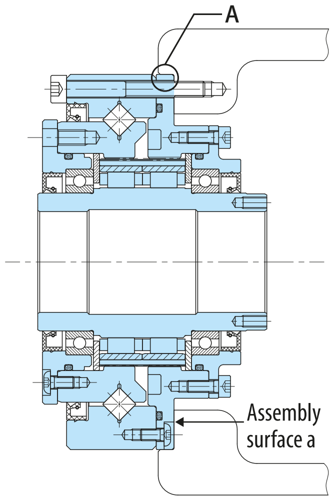


Figure 13-2

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

[2]

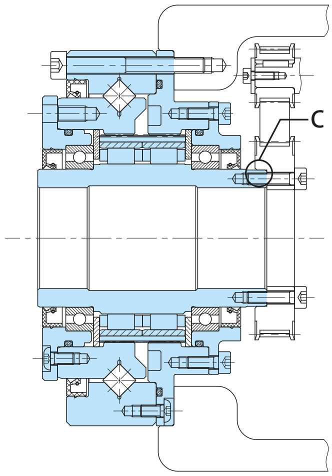


Figure 13-3

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

[3]

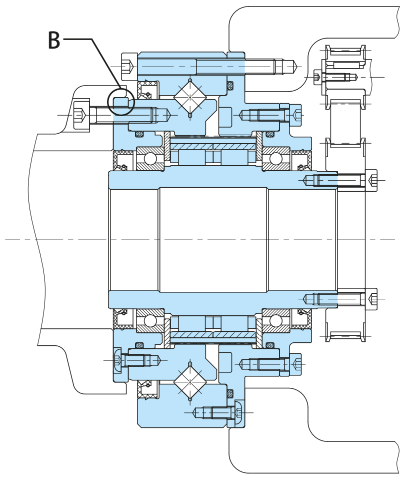


Figure 13-4

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

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

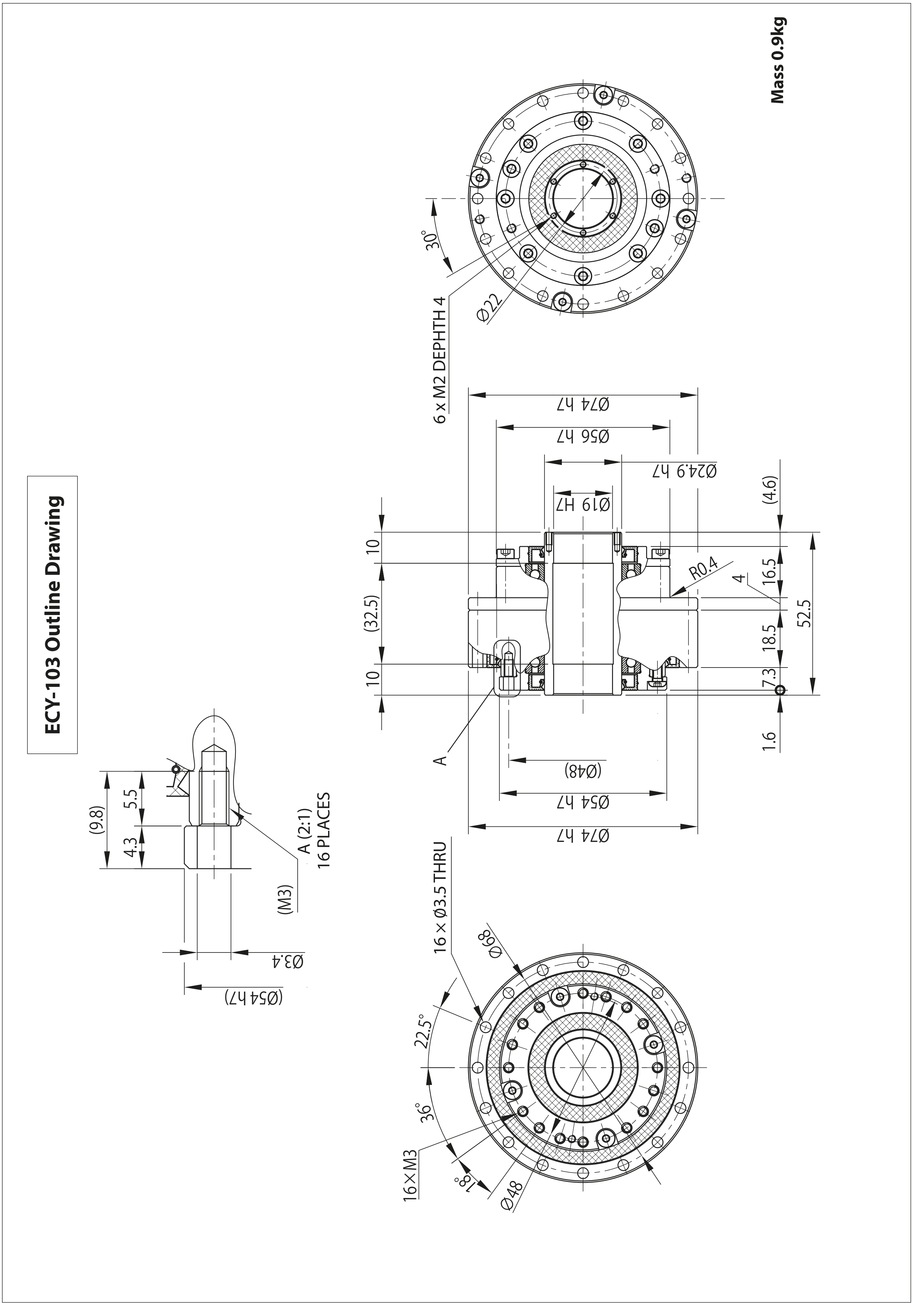
Frame size	103		105 (Reduction ratio 50,80 / 100)		107	
	g	mL	g	mL	g	mL
Grease amount	7	8	14 / 10	16 / 12	16	18

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

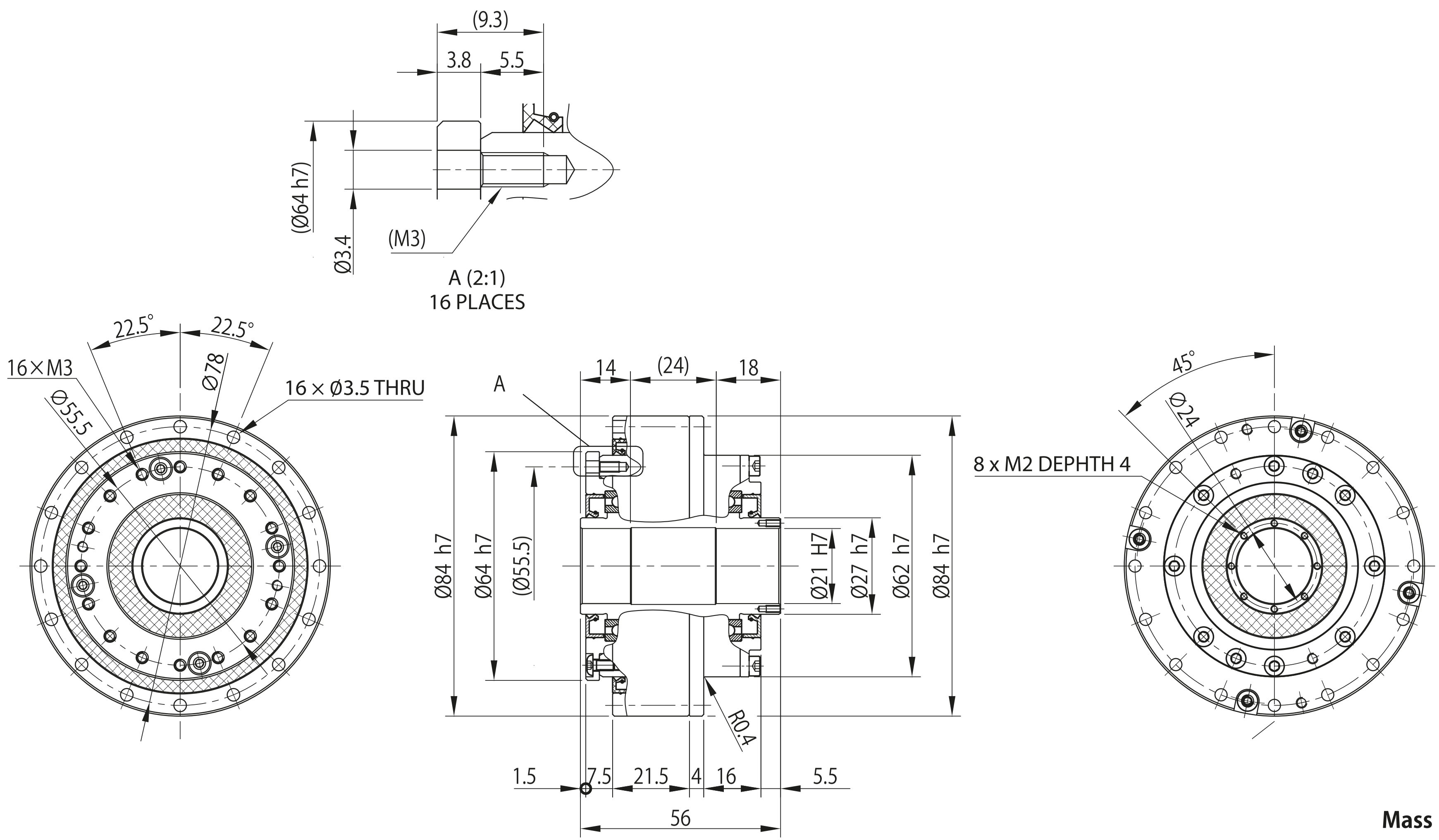
Table 13-3 Grease specifications

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

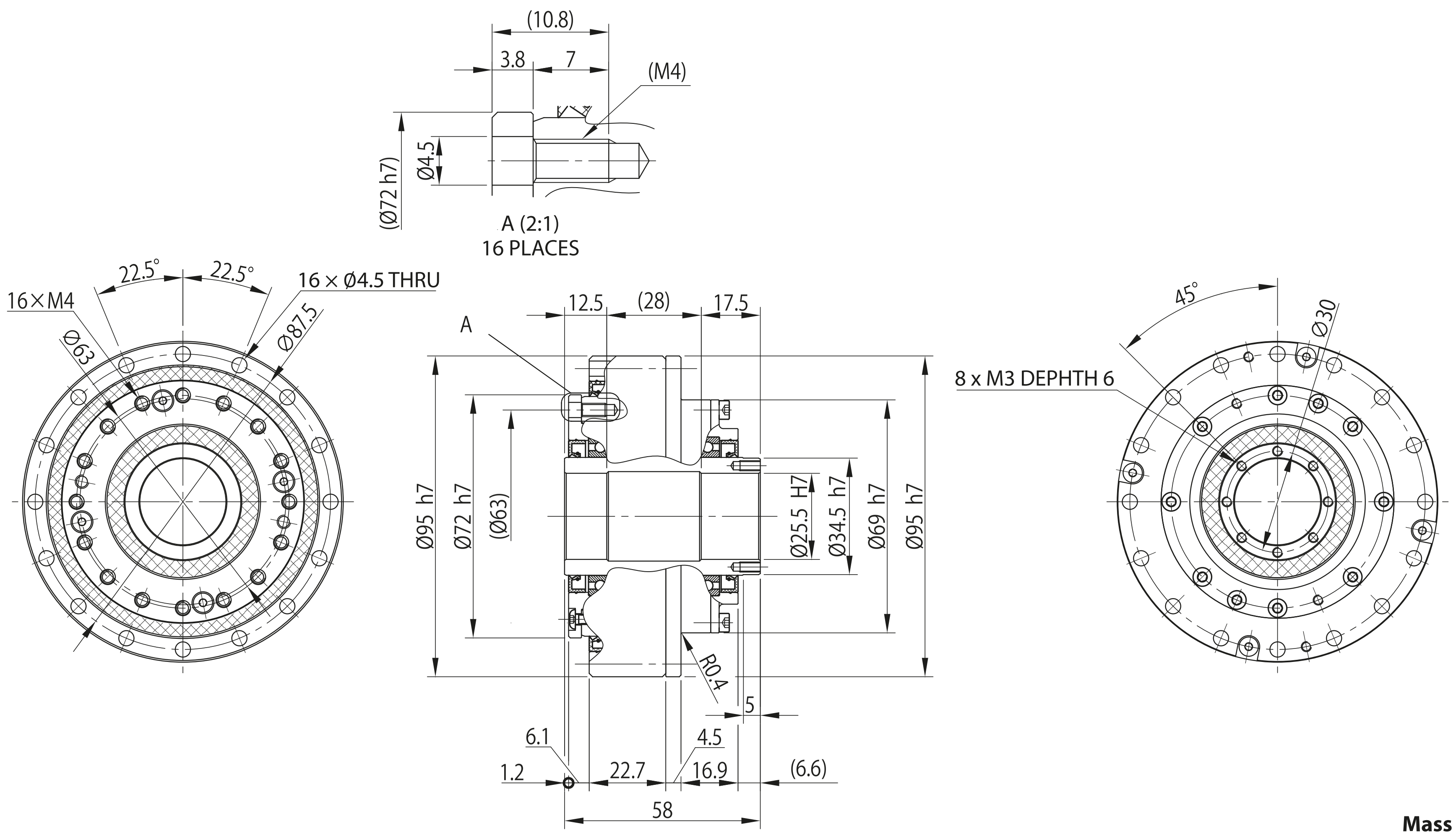


ECY-105 Outline Drawing



Mass 1.2kg

ECY-107 Outline Drawing



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 overhaul 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.)
- 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;

MEMO

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