Ordering Code

CSD - 20 - 100 - 2A - GR - SP

Table 063-1

Series	Size	Ratio*				Model	Special specification
CSD	14	50	80	100	—	2A-GR = component type (2A-R for Size 14, 17)	Blank= Standard product SP= Special specification code BB= Big Bore
	17	50	80	100	120		
	20	50	80	100	120		
	25	50	80	100	120		
	32	50	80	100	120		
	40	50	80	100	120		
	50	50	80	100	120		

* The reduction ratio value is based on the following configuration:
Input: wave generator, fixed: circular spline, output: flexspline

Technical Data

CSD-2A Component Set

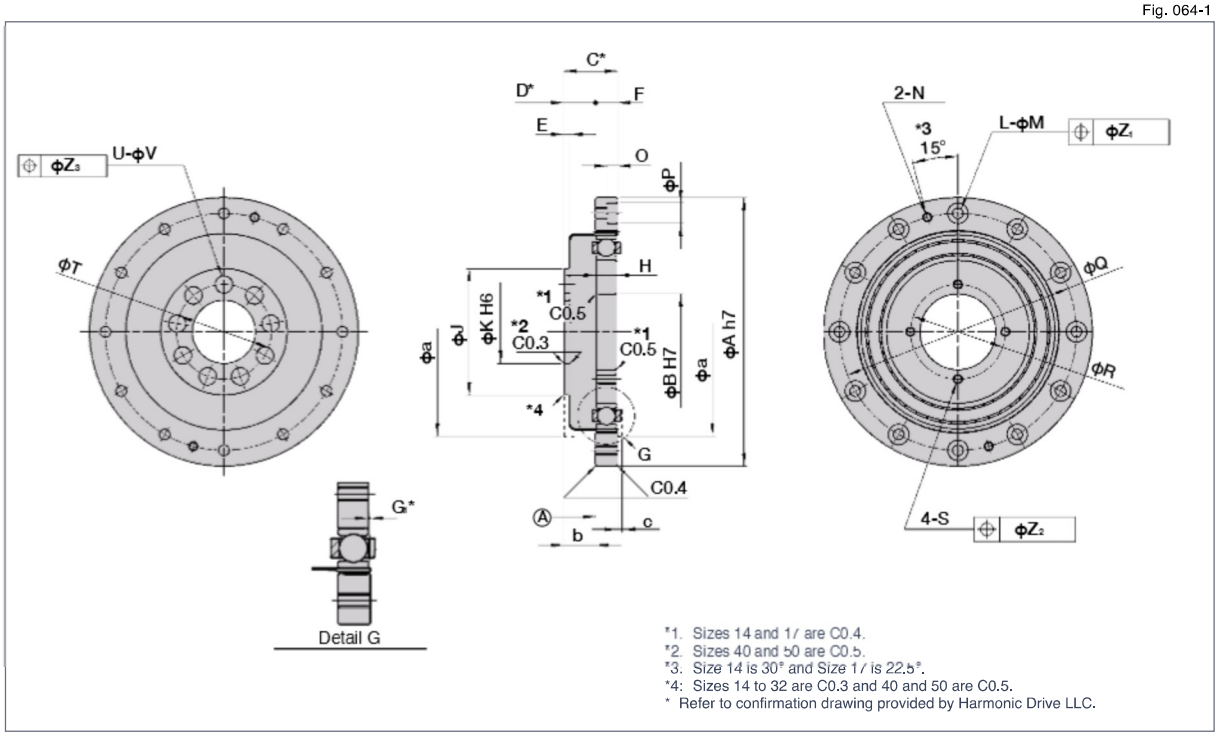
Size	Gear ratio	Rated torque at input speed 2000rpm		Limit for repeated peak torque		Limit for average torque		Limit for momentary peak torque		Maximum input speed (rpm)		Limit for average input speed (rpm)		Moment of inertia	
		Nm	kgfm	Nm	kgfm	Nm	kgfm	Nm	kgfm	Oil	Grease	Oil	Grease	$I \times 10^{-4}kgm^2$	$J \times 10^{-5}kgfms^2$
14	50	3.7	0.38	12	1.2	4.8	0.49	24	2.4	14000	8500	6500	3500	0.021	0.021
	80	5.4	0.55	16	1.6	7.7	0.79	31	3.2						
	100	5.4	0.55	19	1.9	7.7	0.79	31	3.2						
17	50	11	1.1	23	2.3	18	1.8	48	4.9	10000	7300	6500	3500	0.054	0.055
	80	15	1.5	29	3.0	19	1.9	55	5.6						
	100	16	1.6	37	3.8	27	2.8	55	5.6						
	120	16	1.6	37	3.8	27	2.8	55	5.6						
20	50	17	1.7	39	4.0	24	2.4	69	7.0	10000	6500	6500	3500	0.090	0.092
	80	24	2.4	51	5.2	33	3.4	76 (65)	7.7 (6.6)						
	100	28	2.9	57	5.8	34	3.5	76 (65)	7.7 (6.6)						
	120	28	2.9	60	6.1	34	3.5	76 (65)	7.7 (6.6)						
25	50	27	2.8	69	7.0	38	3.9	127	13	7500	5600	5600	3500	0.282	0.288
	80	44	4.5	96	9.8	60	6.1	152 (135)	15 (14)						
	100	47	4.8	110	11	75	7.6	152 (135)	15 (14)						
	120	47	4.8	117	12	75	7.6	152 (135)	15 (14)						
32	50	53	5.4	151	15	75	7.6	268	27	7000	4800	4600	3500	1.09	1.11
	80	83	8.5	213	22	117	12	359 (331)	37 (34)						
	100	96	9.8	233	24	151	15	359 (331)	37 (34)						
	120	96	9.8	247	25	151	15	359 (331)	37 (34)						
40	50	96	9.8	281	29	137	14	480	49	5600	4000	3600	3000	2.85	2.91
	80	144	15	364	37	198	20	685 (580)	70 (59)						
	100	185	19	398	41	260	27	694 (580)	71 (59)						
	120	205	21	432	44	315	32	694 (580)	71 (59)						
50	50	172	18	500	51	247	25	1000	102	4500	3500	3000	2500	8.61	8.78
	80	260	27	659	67	363	37	1300	133						
	100	329	34	686	70	466	48	1440 (1315)	147 (134)						
	120	370	38	756	77	569	58	1441	147 (134)						

1. Moment of inertia: $I = {}^1/_4\ GD^2$
2. *The maximum allowable momentary torque value marked by an asterisk(*) is restricted by the tightening torque of the flexspline.
3. The parenthesized value indicates the value when the bore of the flexspline has the maximum value (BB type).
4. See "Rating Table Definitions" on Page 12 for details of the terms.
5. When the max allowable momentary torque is expected to be applied, see "Bolt tightening of the flexspline" on p. 75.

Outline Dimensions

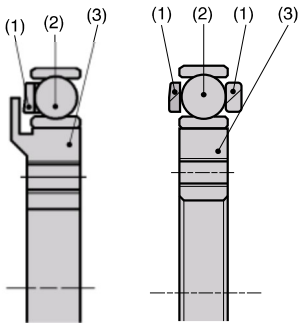
You can download the CAD files from our website: harmonicdrive.net

Fig. 064-1

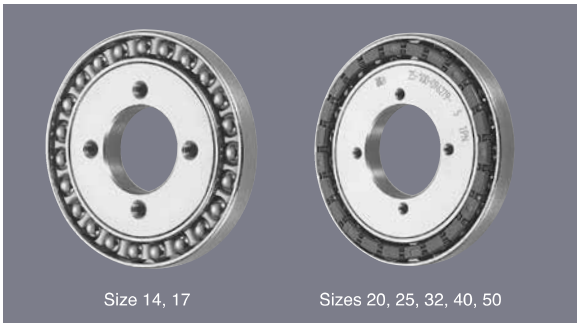


■ Structure and shape of the wave generator

Fig. 064-2



There is a difference in appearance of the the ball separator depending on the size.



Dimensions

Table 065-1
Unit : mm

Symbol \ Size			14	17	20	25	32	40	50
ϕA h7			50 $^{0}_{-0.025}$	60 $^{0}_{-0.030}$	70 $^{0}_{-0.030}$	85 $^{0}_{-0.035}$	110 $^{0}_{-0.035}$	135 $^{0}_{-0.040}$	170 $^{0}_{-0.040}$
ϕB H7			11 $^{+0.018}_{0}$	15 $^{+0.018}_{0}$	20 $^{+0.021}_{0}$	24 $^{+0.021}_{0}$	32 $^{+0.025}_{0}$	40 $^{+0.025}_{0}$	50 $^{+0.025}_{0}$
C＊			11	12.5	14	17	22	27	33
D＊			6.5 $^{+0.2}_{0}$	7.5 $^{+0.2}_{0}$	8 $^{+0.3}_{0}$	10 $^{+0.3}_{0}$	13 $^{+0.3}_{0}$	16 $^{+0.3}_{0}$	19.5 $^{+0.3}_{0}$
E			1.4	1.7	2	2	2.5	3	3.5
F			4.5	5	6	7	9	11	13.5
G_1＊			0.3 $^{+0.2}_{0}$	0.3 $^{+0.2}_{0}$	0.3 $^{+0.2}_{0}$	0.4 $^{+0.2}_{0}$	0.5 $^{+0.2}_{0}$	0.6 $^{+0.2}_{0}$	0.8 $^{+0.2}_{0}$
H			4 $^{0}_{-0.1}$	5 $^{0}_{-0.1}$	5.2 $^{0}_{-0.1}$	6.3 $^{0}_{-0.1}$	8.6 $^{0}_{-0.1}$	10.3 $^{0}_{-0.1}$	12.7 $^{0}_{-0.1}$
ϕJ			23	27.2	32	40	52	64	80
ϕK H6		Standard	11 $^{+0.011}_{0}$	11 $^{+0.011}_{0}$	16 $^{+0.011}_{0}$	20 $^{+0.013}_{0}$	30 $^{+0.013}_{0}$	32 $^{+0.016}_{0}$	44 $^{+0.016}_{0}$
		BB spec.	11 $^{+0.011}_{0}$	11 $^{+0.011}_{0}$	20 $^{+0.013}_{0}$	24 $^{+0.013}_{0}$	32 $^{+0.016}_{0}$	40 $^{+0.016}_{0}$	50 $^{+0.016}_{0}$
L			6	8	12	12	12	12	12
ϕM			3.4	3.4	3.4	3.4	4.5	5.5	6.6
N			M3	M3	M3	M3	M4	M5	M6
O			—	—	3.3	3.3	4.4	5.4	6.5
ϕP			—	—	6.5	6.5	8	9.5	11
ϕQ			44	54	62	75	100	120	150
ϕR			17	21	26	30	40	50	60
S			M3	M3	M3	M3	M4	M5	M6
ϕT		Standard	17	19.5	24	30	41	48	62
		BB spec.	17	19.5	26	32	42	52	65
U		Standard	9	8	9	9	11	10	11
		BB spec.	9	8	12	12	14	14	14
ϕV		Standard	3.4	4.5	4.5	5.5	6.6	9	11
		BB spec.	3.4	4.5	3.4	4.5	5.5	6.6	9
ϕZ_1			0.2	0.2	0.2	0.2	0.25	0.25	0.3
ϕZ_2			0.25	0.25	0.2	0.2	0.25	0.25	0.3
ϕZ_3		Standard	0.2	0.25	0.25	0.25	0.3	0.5	0.5
		BB spec.	0.2	0.25	0.2	0.25	0.25	0.3	0.5
Minimum housing clearance	ϕa		38	45	53	66	86	106	133
	b		6.5	7.5	8	10	13	16	19.5
	c		1	1	1.5	1.5	2	2.5	3.5
Mass (kg)			0.06	0.10	0.13	0.24	0.51	0.92	1.9

(Note) Standard dimension for size 14 and 17 is the maximum bore.

- Surface A is the recommended mounting surface.
- The following dimensions can be modified to accommodate customer-specific requirements.

  Wave Generator: B
  Flexspline: U and V
  Circular Spline: L and M

- *C, D and G_1 values indicate relative position of individual gearing components (wave generator, flexpline, circular spline). Please strictly adhere to these values when designing your housing and mating parts.
- Due to the deformation of the Flexspline during operation, it is necessary to provide a minimum housing clearance, dimensions ϕa, b, c

The wave generator, flexspline, and circular spline are not assembled when delivered.

Positional accuracy

See "Engineering data" for a description of terms.

Table 066-1

Ratio		14	17	20	25	32	40	50
Positional Accuracy	$\times 10^{-4}$rad	4.4	4.4	2.9	2.9	2.9	2.9	2.9
	arc min	1.5	1.5	1.0	1.0	1.0	1.0	1.0

Hysteresis loss

See "Engineering data" for a description of terms.

Table 066-2

Ratio \ Size		14	17	20	25	32	40	50
50	$\times 10^{-4}$rad	7.3	5.8	5.8	5.8	5.8	5.8	5.8
	arc min	2.5	2.0	2.0	2.0	2.0	2.0	2.0
80 or more	$\times 10^{-4}$rad	5.8	2.9	2.9	2.9	2.9	2.9	2.9
	arc min	2.0	1.0	1.0	1.0	1.0	1.0	1.0

Torsional stiffness

See "Engineering data" for a description of terms.

Table 066-3

Symbol \ Size			14	17	20	25	32	40	50
T_1		Nm	2.0	3.9	7.0	14	29	54	108
		kgfm	0.2	0.4	0.7	1.4	3.0	5.5	11
T_2		Nm	6.9	12	25	48	108	196	382
		kgfm	0.7	1.2	2.5	4.9	11	20	39
Reduction ratio 50	K_1	$\times 10^4$Nm/rad	0.29	0.67	1.1	2.0	4.7	8.8	17
		kgfm/arc min	0.085	0.2	0.32	0.6	1.4	2.6	5.0
	K_2	$\times 10^4$Nm/rad	0.37	0.88	1.3	2.7	6.1	11	21
		kgfm/arc min	0.11	0.26	0.4	0.8	1.8	3.4	6.3
	K_3	$\times 10^4$Nm/rad	0.47	1.2	2.0	3.7	8.4	15	30
		kgfm/arc min	0.14	0.34	0.6	1.1	2.5	4.5	9
	θ_1	$\times 10^{-4}$rad	6.9	5.8	6.4	7.0	6.2	6.1	6.4
		arc min	2.4	2.0	2.2	2.4	2.1	2.1	2.2
	θ_2	$\times 10^{-4}$rad	19	14	19	18	18	18	18
		arc min	6.4	4.6	6.6	6.1	6.1	5.9	6.2
Reduction ratio 80 or more	K_1	$\times 10^4$Nm/rad	0.4	0.84	1.3	2.7	6.1	11	21
		kgfm/arc min	0.12	0.25	0.4	0.8	1.8	3.2	6.3
	K_2	$\times 10^4$Nm/rad	0.44	0.94	1.7	3.7	7.8	14	29
		kgfm/arc min	0.13	0.28	0.5	1.1	2.3	4.2	8.5
	K_3	$\times 10^4$Nm/rad	0.61	1.3	2.5	4.7	11	20	37
		kgfm/arc min	0.18	0.39	0.75	1.4	3.3	5.8	11
	θ	$\times 10^{-4}$rad	5.0	4.6	5.4	5.2	4.8	4.9	5.1
		arc min	1.7	1.6	1.8	1.8	1.7	1.7	1.7
	θ	$\times 10^{-4}$rad	16	13	15	13	14	14	13
		arc min	5.4	4.3	5.0	4.5	4.8	4.8	4.6

* The values in this table are reference values. The minimum value is approximately 80% of the displayed value.

Starting torque

See "Engineering data" for a description of terms. Please use as reference values; the values vary based on use conditions.

Table 067-1
Unit: Ncm

Ratio \ Size	14	17	20	25	32	40	50
50	3.7	5.7	7.3	14	28	50	94
80	2.7	3.8	4.8	8.8	19	32	63
100	2.4	3.3	4.3	7.9	18	29	56
120	—	3.1	3.8	7.2	16	27	53

Backdriving torque

See "Engineering data" for a description of terms. Please use as reference values; the values vary based on use conditions.

Table 067-2
Unit: Nm

Ratio \ Size	14	17	20	25	32	40	50
50	2.5	3.8	4.4	8.3	17	30	57
80	2.6	3.7	4.9	8.8	19	32	62
100	3.1	4.1	5.2	9.6	21	35	67
120	—	4.5	5.7	11	22	38	74

Ratcheting torque

See "Engineering data" for a description of terms.

Table 067-3
Unit: Nm

Ratio \ Size	14	17	20	25	32	40	50
50	60	105	150	315	685	1260	2590
80	75	140	245	475	980	1960	3780
100	55	110	180	350	700	1470	2870
120	—	80	165	325	685	1330	2660

Buckling torque

See "Engineering data" for a description of terms.

Table 067-4
Unit: Nm

Size	14	17	20	25	32	40	50
All ratios	190	330	560	1000	2200	4300	8000

No-load running torque

No-load running torque is the torque which is required to rotate the input side (high speed side), when there is no load on the output side (low speed side).

Measurement condition

Table 068-1

Ratio 100:1			
Lubricant	Grease lubrication	Name	Harmonic Grease SK-1A (size 20 or larger)
			Harmonic Grease SK-2 (size 14, 17)
		Quantity	Recommended quantity (See page 71)
Torque value is measured after 2 hours at 2000rpm input.			

* Contact us for oil lubrication.

■ Compensation value in each ratio

No load running torque of the gear varies with ratio.
The graphs indicate a value for ratio 100.
For other gear ratios, add the compensation values from table on the right.

Compensation coefficient for no-load running torque

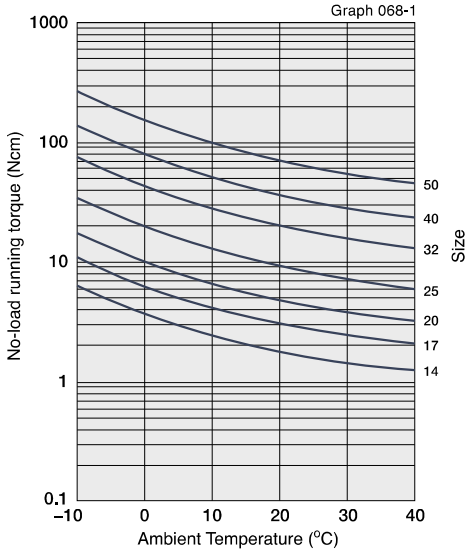
Table 068-2
Unit: Ncm

Size \ Ratio	50
14	+0.56
17	+0.95
20	+1.4
25	+2.6
32	+5.4
40	+9.6
50	+18

■ No-load running torque for a reduction ratio of 100

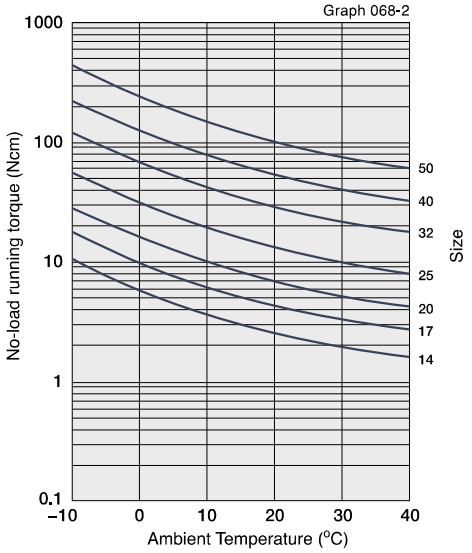
Input rotational speed: 500rpm

Graph 068-1



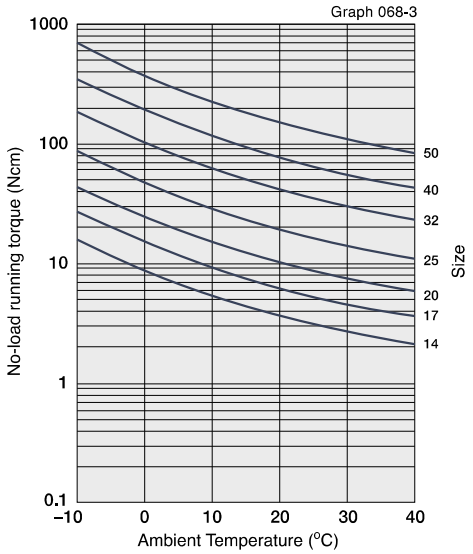
Input rotational speed: 1000rpm

Graph 068-2



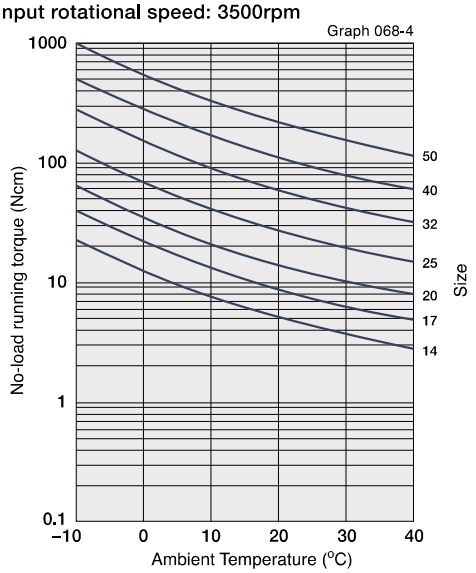
Input rotational speed: 2000rpm

Graph 068-3



Input rotational speed: 3500rpm

Graph 068-4



* The values in this graph are average value "$\bar{X}$".

Efficiency

The efficiency varies depending on the following conditions.

- Reduction ratio
- Input rotational speed
- Load torque
- Temperature
- Lubrication (Type and quantity)

Measurement condition

Table 069-1

Installation	Based on recommended tolerance		
Load torque	The rated torque shown in the rating table (see page 63)		
* When load torque is smaller than rated torque, the efficiency value is lowered. See efficiency compensation coefficient below.			
Lubricant	Grease lubrication	Name	Harmonic Grease SK-1A (size 20 or larger)
			Harmonic Grease SK-2 (size 14, 17)
		Quantity	Recommended quantity (see page 71)

* Contact us for oil lubrication.

■ Efficiency compensation coefficient

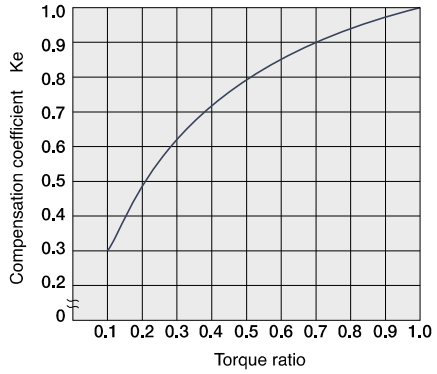
If the load torque is lower than the rated torque, the efficiency value decreases. Calculate the compensation coefficient Ke from Graph 069-1 to calculate the efficiency using the following calculation example.

* Efficiency Compensation coefficient Ke=1 holds when the load torque is greater than the rated torque.

Efficiency compensation coefficient

Graph 069-1

Torque ratio α is the value of load torque/rated torque (Rating table: page 063).

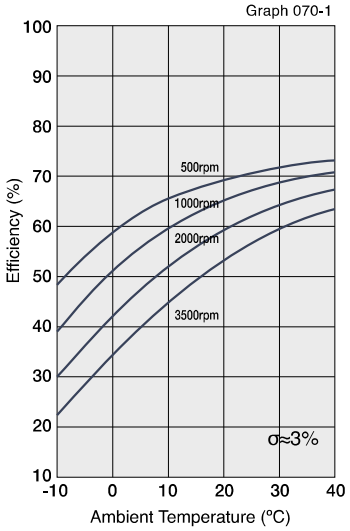


■ Efficiency at rated torque

Reduction ratio 50:1

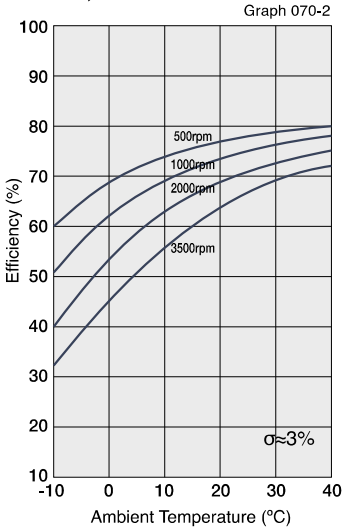
Size 14

Graph 070-1



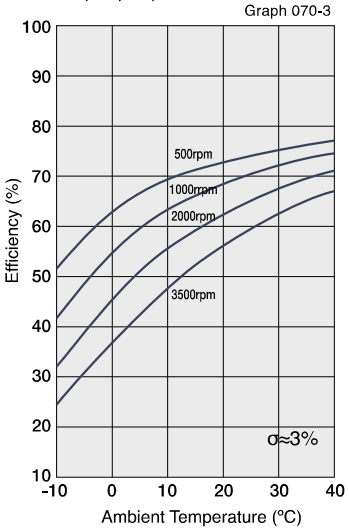
Size 17, 20

Graph 070-2



Size 25, 32, 40, 50

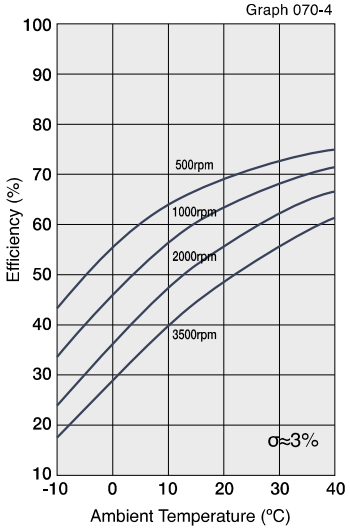
Graph 070-3



Reduction ratio 80, 100, 120:1

Size 14

Graph 070-4



Size 17, 20, 25, 32, 40, 50

Graph 070-5