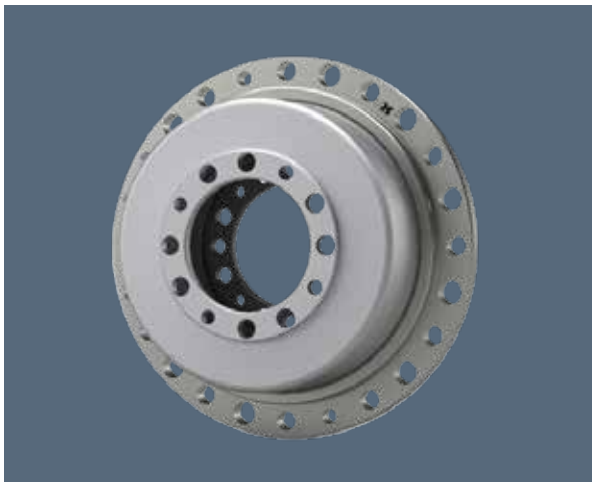
HarmonicDrive®

CSF-LW / CSG-LW Lightweight Component Sets

New Lightweight Versions

The CSF-LW and CSG-LW precision component sets have same basic dimensions as our standard CSF and CSG component sets. The CSF-LW and CSG-LW are not only lighter in weight but also come with an optional big bore (BB option) for applications needing a large through hole or hollow shaft. They retain the same full torque capacity of the CSF and CSG component sets.

Features



CSG/CSF Lightweight Component Sets

Harmonic Drive® zero backlash, precision component sets are available in a wide variety of sizes, ratios and configurations. Lightweight versions with optional big bore through hole maintain the same torque specifications as the standard models. These high accuracy gearing components are often used as the foundation for high performance, custom servo actuators and motion control systems.

Features

- Lightweight configuration
- Zero backlash
- Compact and simple design
- Optional big bore available
- High-torque capacity
- High stiffness
- High positioning and rotational accuracies
- Coaxial input and output

Series

CSG

- New lightweight configuration
- CSG high torque version offers 30% higher torque than CSF series
- Ratios: 50:1 ~160:1
- Peak Torque 23-484 Nm
- Sizes 50~110mm

CSF

- New lightweight configuration
- Ratios 30:1 ~ 160:1
- Peak Torque 1.8-372 Nm
- Sizes 50~110mm

Ordering Code

CSG - 25 - 100 - 2A - GR - LW

Table 02-1

Series	Size	Ratio*1					Model	Special specification
CSG = High Torque	14	50	80	100	—	—	2A-GR = Component Set (2A-R for Size 14, 17)	Blank= Standard product BB = Big Bore LW = Lightweight SP = Special specification code
	17	50	80	100	120	—		
	20	50	80	100	120	160		
	25	50	80	100	120	160		
	32	50	80	100	120	160		

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

CSF - 25 - 100 - 2A - GR - LW

Table 02-2

Series	Size	Ratio*1						Model	Special specification
CSF = Standard Torque	14	30	50	80	100	—	—	2A-GR = Component Set (2A-R for Size 8, 14, 17)	Blank= Standard product LW = Lightweight SP = Special specification code
	17	30	50	80	100	120	—		
	20	30	50	80	100	120	160		
	25	30	50	80	100	120	160		
	32	30	50	80	100	120	160		

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

Technical Data

Rating Table

CSG Series

Table 03-1

Size	Ratio	Rated Torque at 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*5	Grease	Oil*5	Grease	I ×10^{-4}kgm^2	J ×10^{-5}kgfms^2
14	50	7.0	0.7	23	2.3	9.0	0.9	46	4.7	14000	8500	6500	3500	0.033	0.034
	80	10	1.0	30	3.1	14	1.4	61	6.2						
	100	10	1.0	36	3.7	14	1.4	70	7.2						
17	50	21	2.1	44	4.5	34	3.4	91	9	10000	7300	6500	3500	0.079	0.081
	80	29	2.9	56	5.7	35	3.6	113	12						
	100	31	3.2	70	7.2	51	5.2	143	15						
	120	31	3.2	70	7.2	51	5.2	112	11						
20	50	33	3.3	73	7.4	44	4.5	127	13	10000	6500	6500	3500	0.193	0.197
	80	44	4.5	96	9.8	61	6.2	165	17						
	100	52	5.3	107	10.9	64	6.5	191	20						
	120	52	5.3	113	11.5	64	6.5	191	20						
	160	52	5.3	120	12.2	64	6.5	191	20						
25	50	51	5.2	127	13	72	7.3	242	25	7500	5600	5600	3500	0.413	0.421
	80	82	8.4	178	18	113	12	332	34						
	100	87	8.9	204	21	140	14	369	38						
	120	87	8.9	217	22	140	14	395	40						
	160	87	8.9	229	23	140	14	408	42						
32	50	99	10	281	29	140	14	497	51	7000	4800	4600	3500	1.69	1.72
	80	153	16	395	40	217	22	738	75						
	100	178	18	433	44	281	29	841	86						
	120	178	18	459	47	281	29	892	91						
	160	178	18	484	49	281	29	892	91						

CSF Series

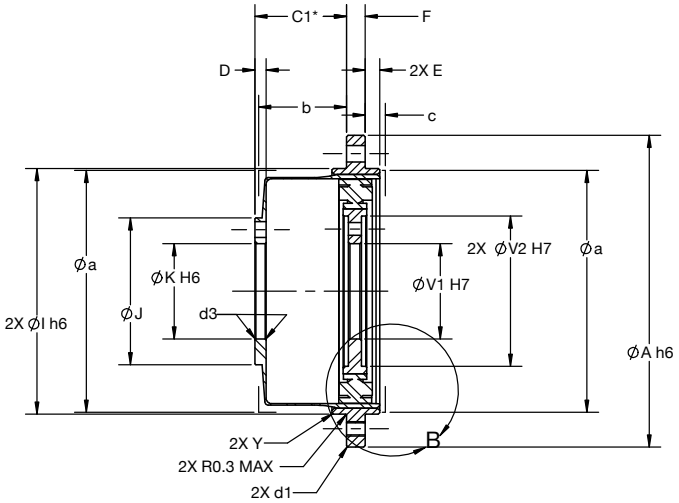
Table 03-2

Size	Ratio	Rated Torque at 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	Grease	Grease	I ×10^{-4}kgm^2	J ×10^{-5}kgfms^2
14	30	4.0	0.41	9.0	0.92	6.8	0.69	17	1.7	8500	3500	0.033	0.0034
	50	5.4	0.55	18	1.8	6.9	0.70	35	3.6				
	80	7.8	0.80	23	2.4	11	1.1	47	4.8				
	100	7.8	0.80	28	2.9	11	1.1	54	5.5				
17	30	8.8	0.9	16	1.6	12	1.2	30	3.1	7300	3500	0.079	0.081
	50	16	1.6	34	3.5	26	2.6	70	7.1				
	80	22	2.2	43	4.4	27	2.7	87	8.9				
	100	24	2.4	54	5.5	39	4.0	108	11				
	120	24	2.4	54	5.5	39	4.0	86	8.8				
20	30	15	1.5	27	2.8	20	2.0	50	5.1	6500	3500	0.193	0.197
	50	25	2.5	56	5.7	34	3.5	98	10				
	80	34	3.5	74	7.5	47	4.8	127	13				
	100	40	4.1	82	8.4	49	5.0	147	15				
	120	40	4.1	87	8.9	49	5.0	147	15				
	160	40	4.1	92	9.4	49	5.0	147	15				
25	30	27	2.8	50	5.1	38	3.9	95	9.7	5600	3500	0.413	0.421
	50	39	4.0	98	10	55	5.6	186	19				
	80	63	6.4	137	14	87	8.9	255	26				
	100	67	6.8	157	16	108	11	284	29				
	120	67	6.8	167	17	108	11	304	31				
	160	67	6.8	176	18	108	11	314	32				
32	30	54	5.5	100	10	75	7.7	200	20	4800	3500	1.69	1.72
	50	76	7.8	216	22	108	11	382	39				
	80	118	12	304	31	167	17	535	58				
	100	137	14	333	34	216	22	535	66				
	120	137	14	353	36	216	22	535	70				
	160	137	14	372	38	216	22	535	70				

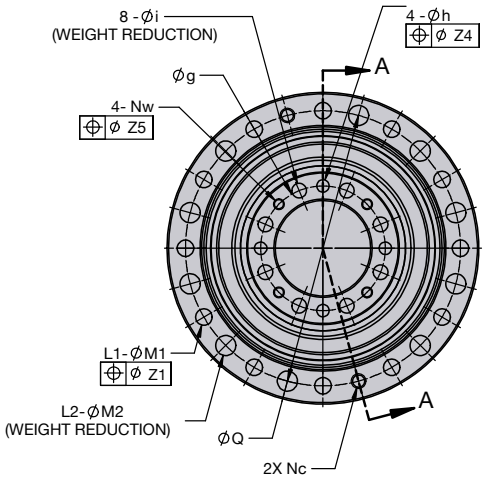
(Note) 1. Oil lubrication is required for size 50 or higher with a reduction ratio of 50:1. Use grease lubrication within half the rated torque.
2. Moment of inertia: $I = \frac{1}{4} GD^2$
3. See Rating Table Definitions in the reducer catalog for details of the terms.
4. If maximum allowable momentary torque is applied, see "Installation of the flexspline" of each series.

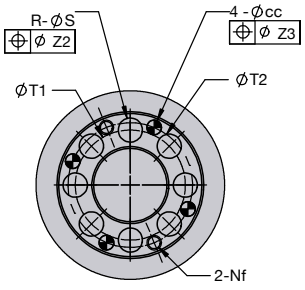
Outline Dimensions - Lightweight Version

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

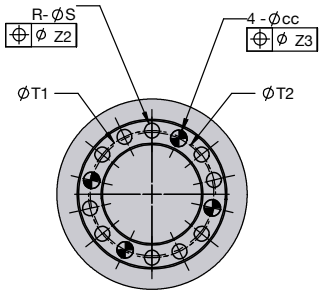


SECTION A-A

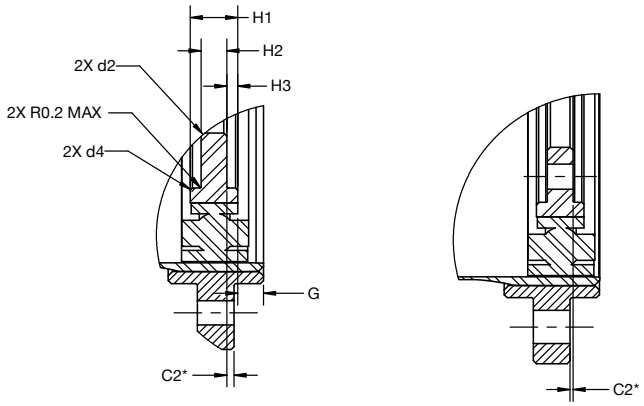




CSG-LW
FLEXSPLINE



CSG-BB-LW / CSF-LW
FLEXSPLINE



DETAIL B
SCALE 2 : 1

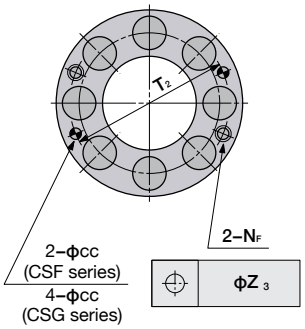
*Please refer to the confirmation drawing for detailed dimensions.

■ Dowel Pins

In cases where the gear will see loads near the Momentary Peak Torque level, the use of additional dowel pins in addition to the screws is recommended. Dowel pin holes are manufactured by reamer and the dimensions are shown. Note: the CSF has a different number of dowel pin holes than the CSG.

It is important to note that Dowel Pins are always included with LW versions.

Fig.04-1



* Provision is possible for the holes under pins. Please specify when ordering.

Outline Dimensions - Lightweight Version

Table 05-1
Unit: mm

Symbol \ Size		14	17	20	25	32
ϕA h6		50	60	70	85	110
C_1		18 $^{+0.4}_{-0}$	20.25 $^{+0.5}_{-0}$	21.75 $^{+0.6}_{-0}$	25 $^{+0.6}_{-0}$	30.5 $^{+0.6}_{-0}$
C_2	CSG Series	1.1 $^{+0.4}_{-0}$	1.1 $^{+0.45}_{-0}$	0.8 $^{+0.4}_{-0}$	1 $^{+0.5}_{-0}$	1.2 $^{+0.55}_{-0}$
	CSF Series	0.1 $^{+0.4}_{-0}$	- 0.2 $^{+0}_{-.45}$	- 0.6 $^{+0}_{-.5}$	- 0.4 $^{+0}_{-.5}$	- 0.5 $^{+0}_{-.55}$
D		2.4	3	3	3	3.2
E		2.5	2.75	3.25	4	5.5
F		3	3.5	4	5	6
G	CSG Series	1.4	1.6	1.5	3.5	4.2
	CSF Series	0.4	0.3	0.1	2.1	2.5
H_1		7.4	7.6	8.3	6.5	8.8
H_2		1.9	2.3	3.2	3.5	3.8
H_3		2.2	2.25	2.55	1.5	2.5
ϕI h6		38	48	54	67	90
ϕJ		23	27.2	32	40	52
ϕK H6	CSG Series	–	10	16	20	26
	CSF/CSG-BB	13.5	18	21	26	36
L_1	CSG Series	12	12	12	16	16
	CSF Series	12	12	12	12	12
L_2	CSG Series	10	10	10	14	14
	CSF Series	10	10	10	10	10
ϕM_1		3.4	3.4	3.4	4.5	5.5
ϕM_2	CSG Series	3.4	3.4	3.4	4.5	5.5
	CSF Series	4	3.4	4.5	5.5	6.6
N_C		M3	M3	M3	M4	M5
N_F	CSG Series	–	M3	M3	M4	M5
	CSF/CSG-BB	N/A	N/A	N/A	N/A	N/A
N_W		M2	M2	M2.5	M3	M4
Q (PCD)		44	54	62	75	100
R	CSG Series	–	6	8	8	8
	CSG-BB	8	10	8	8	8
	CSF Series	10	10	8	8	8
ϕS	CSG Series	–	5.5	5.5	6.6	9
	CSF/CSG-BB	2.7	2.7	3.2	4.3	5.3
T_1 (PCD)	CSG Series	–	19	24	30	40
	CSF/CSG-BB	18.9	23.1	27	33.6	44.9
T_2 (PCD)	CSG Series	–	21.5	27	34	45
	CSF/CSG-BB	18.3	22.5	27	33.6	44.9
ϕV_1		13.5	18	21	26	36
ΦV_2		22.6	27	32	41	53
Y		0.3	0.4	0.4	0.4	0.4
ΦZ_1		0.2	0.2	0.2	0.25	0.25
ϕZ_2	CSG Series	–	0.25	0.25	0.3	0.5
	CSG-BB	0.1	0.1	0.1	0.15	0.15
	CSF Series	0.1	0.1	0.1	0.15	0.15
ϕZ_3		0.02	0.02	0.02	0.02	0.02
ΦZ_4		0.2	0.2	0.2	0.2	0.2
ΦZ_5		0.2	0.2	0.2	0.2	0.2
ϕa		38	45	53	66	86
b		17.6	19.25	20.25	24	29.3
c		3.5	3.75	4.5	5.5	7
ϕcc H7	CSG Series	3	3	3	4	5
	CSF/CSG-BB	3	3	3	4	4
d_1		0.4	0.4	0.4	0.4	0.4
d_2		0.3	0.3	0.4	0.4	0.4
d_3	CSG Series	–	0.5	0.5	0.5	0.5
	CSF/CSG-BB	0.25	0.25	0.25	0.25	0.5
d_4		0.4	0.4	0.5	0.3	0.5
g		18	22.5	26.75	34	44.5
h		2.4	2.4	2.9	3.4	4.5
i		3	3	3.5	4	5
mass (kg) [based on drawing]		0.056	0.10	0.15	0.24	0.54

Positional Accuracy

See "Engineering data" for a description of terms.

Table 06-1

Ratio	Specification	Size	14	17	20	25	32
30	Standard	×10⁻⁴rad	5.8	4.4	4.4	4.4	4.4
		arc min	2	1.5	1.5	1.5	1.5
	Special	×10⁻⁴rad	—	—	2.9	2.9	2.9
		arc min	—	—	1	1	1
50 or more	Standard	×10⁻⁴rad	4.4	4.4	2.9	2.9	2.9
		arc min	1.5	1.5	1	1	1
	Special	×10⁻⁴rad	2.9	2.9	1.5	1.5	1.5
		arc min	1	1	0.5	0.5	0.5

Hysteresis Loss

See "Engineering data" for a description of terms.

Table 06-2

Ratio	Size	14	17	20	25	32
30	×10⁻⁴rad	8.7	8.7	8.7	8.7	8.7
	arc min	3.0	3.0	3.0	3.0	3.0
50	×10⁻⁴rad	5.8	5.8	5.8	5.8	5.8
	arc min	2.0	2.0	2.0	2.0	2.0
80 or more	×10⁻⁴rad	2.9	2.9	2.9	2.9	2.9
	arc min	1.0	1.0	1.0	1.0	1.0

Backlash

See "Engineering data" for a description of terms.

Table 06-3

Ratio	Size	14	17	20	25	32
30	×10⁻⁵rad	29.1	16.0	13.6	13.6	11.2
	arc sec	60	33	28	28	23
50	×10⁻⁵rad	17.5	9.7	8.2	8.2	6.8
	arc sec	36	20	17	17	14
80	×10⁻⁵rad	11.2	6.3	5.3	5.3	4.4
	arc sec	23	13	11	11	9
100	×10⁻⁵rad	8.7	4.8	4.4	4.4	3.4
	arc sec	18	10	9	9	7
120	×10⁻⁵rad	—	3.9	3.9	3.9	2.9
	arc sec	—	8	8	8	6
160	×10⁻⁵rad	—	—	2.9	2.9	2.4
	arc sec	—	—	6	6	5

Torsional Stiffness

See "Engineering data" for a description of terms.

Table 06-4

Symbol		Size	14	17	20	25	32
T_1		Nm	2.0	3.9	7.0	14	29
		kgfm	0.20	0.40	0.70	1.4	3.0
T_2		Nm	6.9	12	25	48	108
		kgfm	0.7	1.2	2.5	4.9	11
Ratio 30	K_1	×10⁴Nm/rad	0.19	0.34	0.57	1.0	2.4
		kgfm/arc min	0.056	0.10	0.17	0.30	0.70
	K_2	×10⁴Nm/rad	0.24	0.44	0.71	1.3	3.0
		kgfm/arc min	0.07	0.13	0.21	0.40	0.89
	K_3	×10⁴Nm/rad	0.34	0.67	1.1	2.1	4.9
		kgfm/arc min	0.10	0.20	0.32	0.62	1.5
	θ_1	×10⁻⁴rad	10.5	11.5	12.3	14	12.1
		arc min	3.6	4.0	4.1	4.7	4.3
	θ_2	×10⁻⁴rad	31	30	38	40	38
		arc min	10.7	10.2	12.7	13.4	13.3
Ratio 50	K_1	×10⁴Nm/rad	0.34	0.81	1.3	2.5	5.4
		kgfm/arc min	0.1	0.24	0.38	0.74	1.6
	K_2	×10⁴Nm/rad	0.47	1.1	1.8	3.4	7.8
		kgfm/arc min	0.14	0.32	0.52	1.0	2.3
	K_3	×10⁴Nm/rad	0.57	1.3	2.3	4.4	9.8
		kgfm/arc min	0.17	0.4	0.67	1.3	2.9
	θ_1	×10⁻⁴rad	5.8	4.9	5.2	5.5	5.5
		arc min	2.0	1.7	1.8	1.9	1.9
	θ_2	×10⁻⁴rad	16	12	15.4	15.7	15.7
		arc min	5.6	4.2	5.3	5.4	5.4

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

Table 07-1

Symbol \ Size			14	17	20	25	32
Reduction ratio 50	T_1	Nm	2.0	3.9	7.0	14	29
		kgfm	0.2	0.4	0.7	1.4	3.0
	T_2	Nm	6.9	12	25	48	108
		kgfm	0.7	1.2	2.5	4.9	11
Reduction ratio 80 or more	K_1	×10⁴Nm/rad	0.47	1	1.6	3.1	6.7
		kgfm/arc min	0.14	0.3	0.47	0.92	2.0
	K_2	×10⁴Nm/rad	0.61	1.4	2.5	5.0	11
		kgfm/arc min	0.18	0.4	0.75	1.5	3.2
	K_3	×10⁴Nm/rad	0.71	1.6	2.9	5.7	12
		kgfm/arc min	0.21	0.46	0.85	1.7	3.7
	θ_1	×10⁻⁴rad	4.1	3.9	4.4	4.4	4.4
		arc min	1.4	1.3	1.5	1.5	1.5
	θ_2	×10⁻⁴rad	12	9.7	11.3	11.1	11.6
		arc min	4.2	3.3	3.9	3.8	4.0

* 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. Values shown vary depending on condition. Please use values as a reference.

CSG Series

Table 07-2
Unit: Ncm

Ratio \ Size	14	17	20	25	32
30	—	—	—	—	—
50	3.6	5.6	7.3	13	29
80	2.6	3.6	4.5	8.5	18
100	2.3	3.2	4.1	7.6	17
120	—	3.0	3.6	6.9	14
160	—	—	3.2	6.1	13

CSF Series

Table 07-3
Unit: Ncm

Ratio \ Size	14	17	20	25	32
30	4.3	6.5	11	19	45
50	3.3	5.1	6.6	12	26
80	2.4	3.3	4.1	7.7	16
100	2.1	2.9	3.7	6.9	15
120	—	2.7	3.3	6.3	13
160	—	—	2.9	5.5	12

Backdriving Torque

See "Engineering data" for a description of terms. Values shown vary depending on condition. Please use values as a reference.

CSG Series

Table 07-4
Unit: Nm

Ratio \ Size	14	17	20	25	32
30	—	—	—	—	—
50	1.5	2.8	4.4	8.3	18
80	1.5	2.8	4.6	8.5	18
100	1.9	3.1	5.0	9.2	20
120	—	3.4	5.4	10	21
160	—	—	6.4	12	25

CSF Series

Table 07-5
Unit: Nm

Ratio \ Size	14	17	20	25	32
30	2	3.2	5.5	10	21
50	1.4	2.5	4	7.5	16
80	1.4	2.5	4.2	7.7	16
100	1.7	2.8	4.5	8.4	18
120	—	3.1	4.9	9.2	19
160	—	—	5.8	11	23

Ratcheting Torque

See "Engineering data" for a description of terms.

CSG Series

Table 08-1
Unit: Nm

Ratio \ Size	14	17	20	25	32
50	110	190	280	580	1200
80	140	260	450	880	1800
100	100	200	330	650	1300
120	—	150	310	610	1200
160	—	—	280	580	1200

CSF Series

Table 08-2
Unit: Nm

Ratio \ Size	14	17	20	25	32
30	59	100	170	340	720
50	88	150	220	450	980
80	110	200	350	680	1400
100	84	160	260	500	1000
120	—	120	240	470	980
160	—	—	220	450	980

Buckling Torque

See "Engineering data" for a description of terms.

CSG Series

Table 08-3
Unit: Nm

Size	14	17	20	25	32
All ratios	260	500	800	1700	3500

CSF Series

Table 08-4
Unit: Nm

Size	14	17	20	25	32
All ratios	190	330	560	1000	2200

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).

* Contact us for detailed values.

Measurement Condition

Table 08-5

Ratio 100:1			
Lubricant	Grease lubrication	Name	Harmonic Grease SK-1A
			Harmonic Grease SK-2
		Quantity	Recommended quantity
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.

Component Set No-Load Torque Compensation

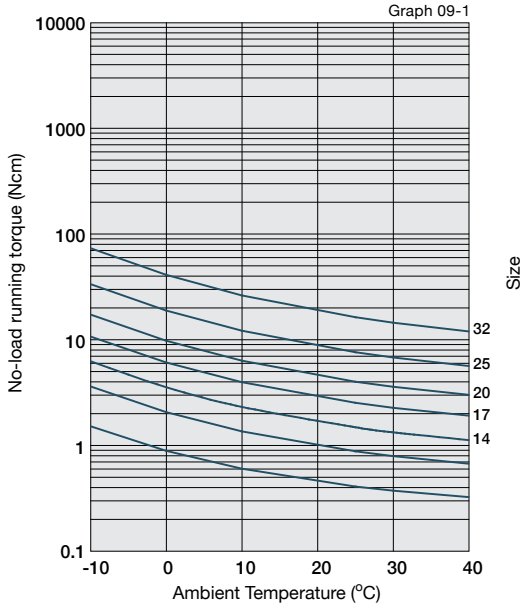
Table 08-6
Unit: Ncm

Size \ Ratio	30	50	80	120	160
14	1.1	0.5	0.1	—	—
17	1.8	0.8	0.1	-0.1	—
20	2.7	1.2	0.2	-0.1	-0.3
25	5.0	2.2	0.3	-0.2	-0.6
32	10	4.5	0.7	-0.5	-1.2

■ No-Load Running Torque for a Reduction Ratio of 100:1

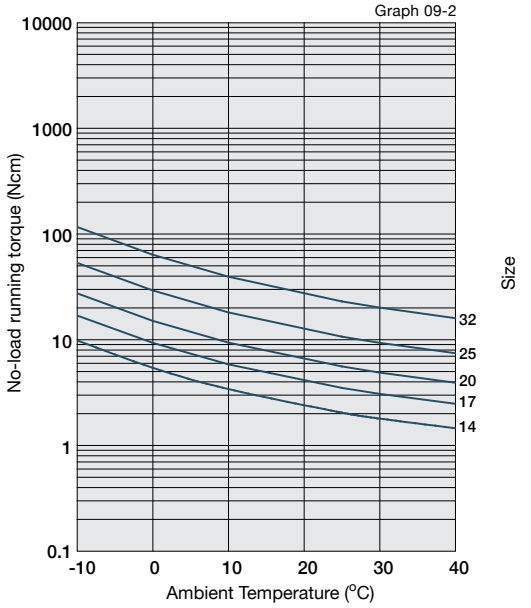
Input speed: 500rpm

Graph 09-1



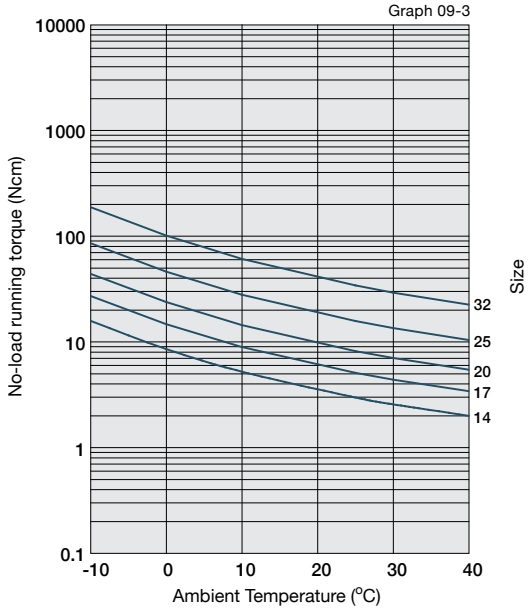
Input speed: 1000rpm

Graph 09-2



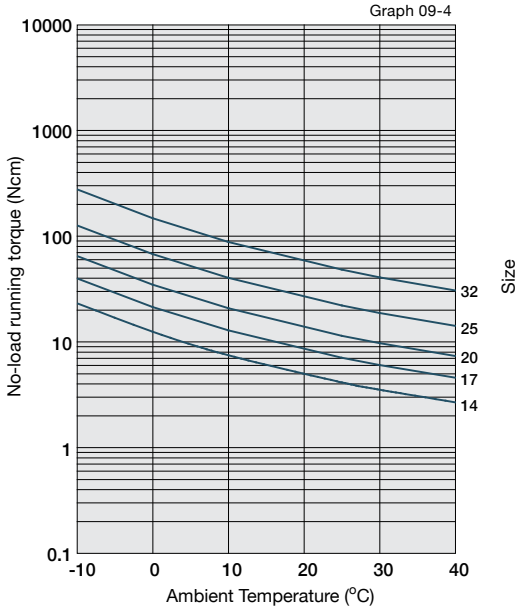
Input speed: 2000rpm

Graph 09-3



Input speed: 3500rpm

Graph 09-4



*The values in this graph are average values ($\bar{X}$). σ≈20%

Efficiency

The efficiency varies depending on the following conditions.

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

Measurement Condition

Table 010-1

Installation	Based on recommended tolerance.		
Load torque	The rated torque		
Lubricant	Grease lubrication	Name	Harmonic Grease SK-1A
			Harmonic Grease SK-2
		Quantity	Recommended quantity

* Contact us for oil lubrication.

■ Efficiency Compensation Coefficient

Find the Compensation Coefficient (Ke) and calculate the efficiency.

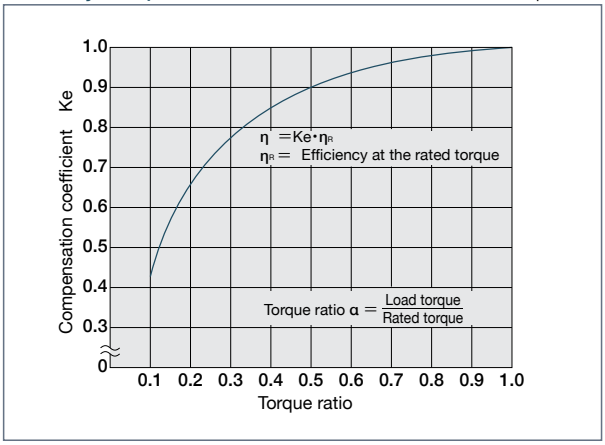
Example of Calculation

Efficiency η (%) under the following condition is obtained from the example of CSF-20-80-2A-GR.
Input speed: 1000 rpm
Load torque: 19.6 Nm
Lubrication: Harmonic Grease SK-1A
Lubricant temperature: 20°C
Since the rated torque of size 20 with a reduction ratio of 80 is 34 Nm (Ratings: Page 05), the torque ratio α is 0.58.
(α=19.6/34=0.58)

- The efficiency compensation coefficient is Ke=0.93 from Graph 010-1.
- Efficiency η at load torque 19.6 Nm: η=Ke•ηR=0.93 x 78=73%

Efficiency Compensation Coefficient

Graph 010-1



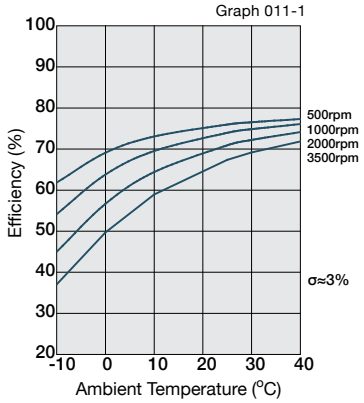
* Efficiency compensation coefficient Ke=1 holds when the load torque is greater than the rated torque.

■ Efficiency at Rated Torque

Size: 14

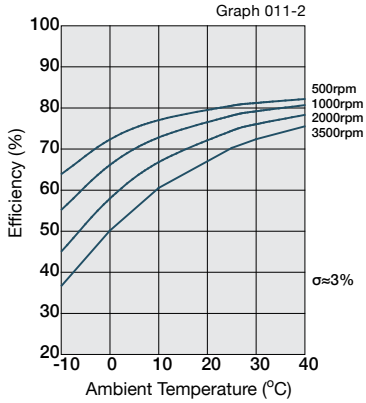
Reduction ratio 30

Graph 011-1



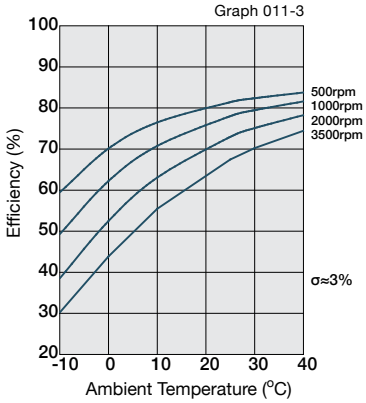
Reduction ratio 50, 80

Graph 011-2



Reduction ratio 100

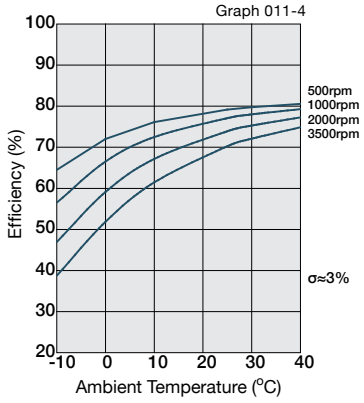
Graph 011-3



Size: 17 to 32

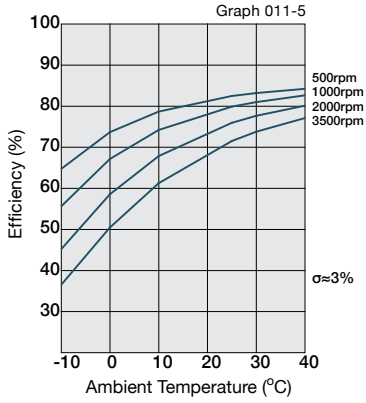
Reduction ratio 30

Graph 011-4



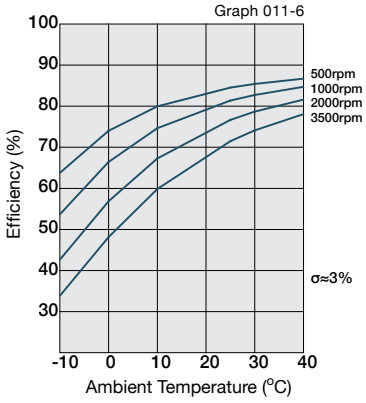
Reduction ratio 50

Graph 011-5



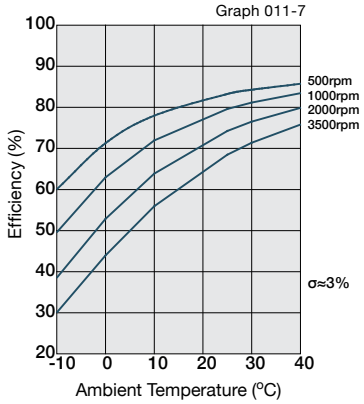
Reduction ratio 80, 100

Graph 011-6



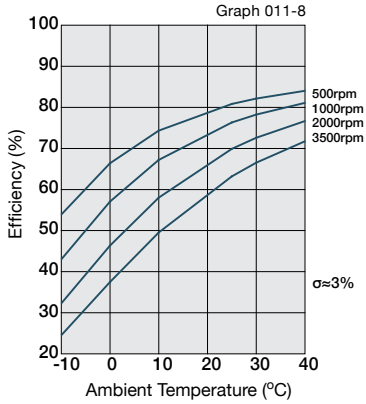
Reduction ratio 120

Graph 011-7



Reduction ratio 160

Graph 011-8



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Rev 20221212