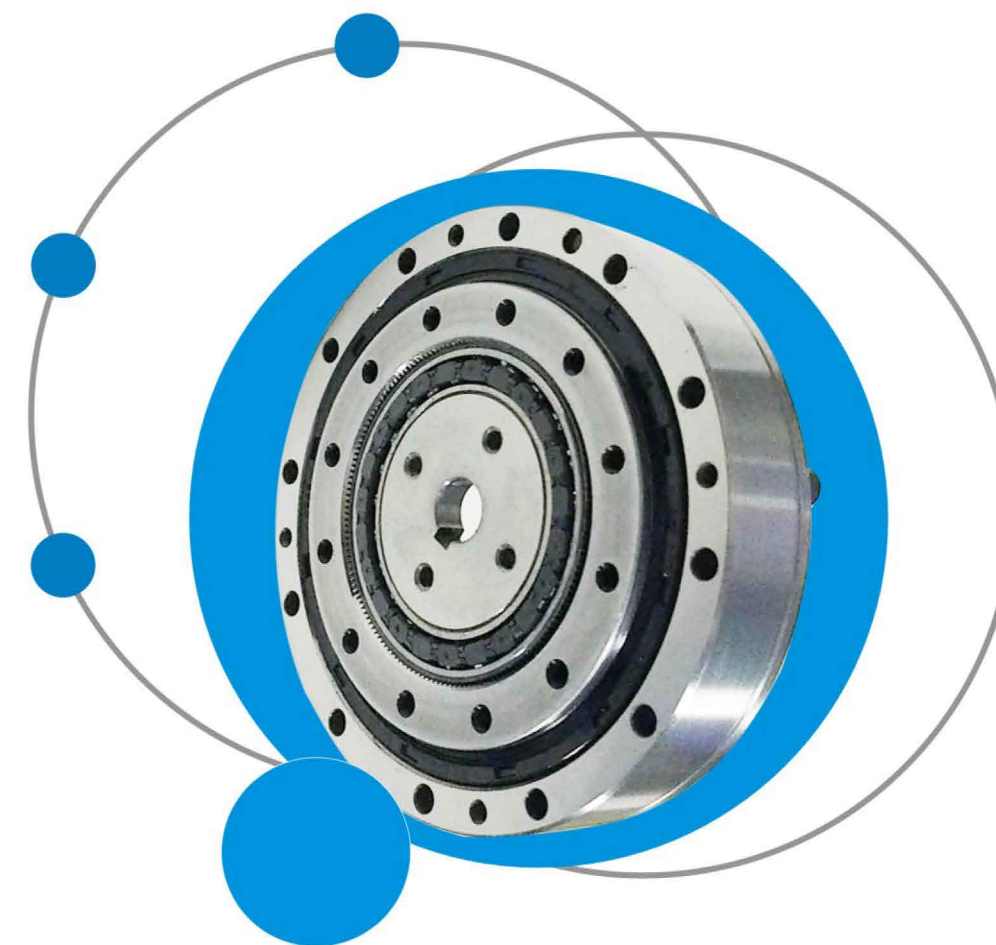


# 谐波减速器产品手册

HARMONIC DRIVER REDUCER PRODUCT MANUALS



First class technology  
First class product  
First class service

四川省伍勒斯精密机械有限公司  
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Harmonic reducer specifications

Model	Number	Reduction ratio						Connect type				Page
		30	50	80	100	120	160	I	II	III	IV	
BCS	14	√	√	√	√	—	—	√	√	—	—	(P10-P13)
	17	√	√	√	√	√	—	√	√	—	—	
	20	√	√	√	√	√	√	√	√	—	—	
	25	√	√	√	√	√	√	√	√	—	—	
	32	—	√	√	√	√	√	√	√	—	—	
	40	—	√	√	√	√	√	√	√	—	—	
	45	—	√	√	√	√	√	√	√	—	—	
BCSG	14	√	√	√	√	—	—	√	√	—	—	(P14-P17)
	17	√	√	√	√	√	—	√	√	—	—	
	20	√	√	√	√	√	√	√	√	—	—	
	25	√	√	√	√	√	√	√	√	—	—	
	32	—	√	√	√	√	√	√	√	—	—	
BHS	14	√	√	√	√	—	—	√	√	√	√	(P20-P27)
	17	√	√	√	√	√	—	√	√	√	√	
	20	√	√	√	√	√	√	√	√	√	√	
	25	√	√	√	√	√	√	√	√	√	√	
	32	—	√	√	√	√	√	√	√	√	√	
	40	—	√	√	√	√	√	√	√	√	√	
	45	—	√	√	√	√	√	√	√	√	√	
BCD BHD	14	√	√	√	√	—	—	√	—	—	—	(P18-P29)
	17	√	√	√	√	√	—	√	—	—	—	
	20	√	√	√	√	√	√	√	—	—	—	
	25	√	√	√	√	√	√	√	—	—	—	
	32	—	√	√	√	√	√	√	—	—	—	

Company profile >>



Woolars Precision Machinery Co., Limited. is a high-tech Chinese enterprise specializing in the research, develop, manufacturing and sale of precision transmission equipment and control system. At present, the company's main products are: Harmonic drive, RV reducer, planetary gear reducer, electric cylinder, Spindle motor and servo motor&drive.

The company specializes in technology research and development. From material to process, the company has mastered the complete set of technology for harmonic reducer manufacturing and has successfully developed and mass produced a variety of reducers with independent intellectual property rights. At present, the various parameters of the reducer produced by the company have reached or even exceeded the national standards, with high precision, large transmission speed ratio, high transmission efficiency and long life.

Applications >>



Aerospace

Robots

Analysis equipment



Medical equipment

Communication device

Processing equipment



## Transmission principle

### 1. The origin of harmonic reducer

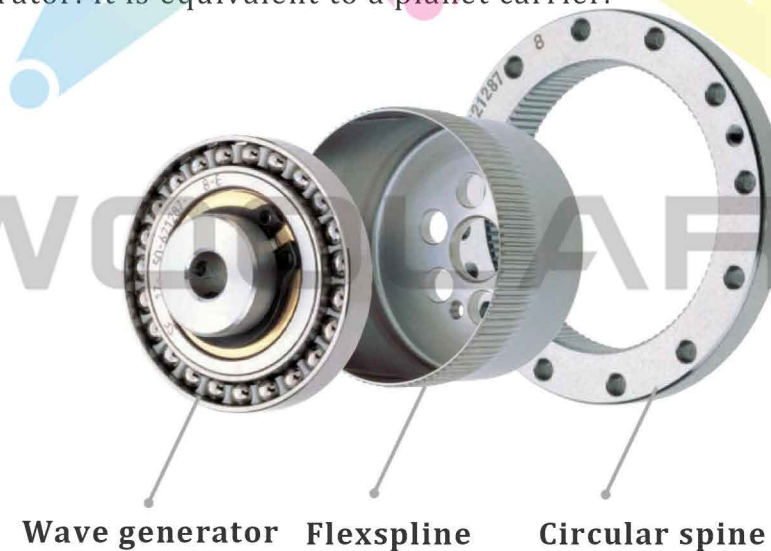
Harmonic transmission is a new type of transmission developed on the basis of the thin shell elastic deformation theory with the development of space science and technology in the mid-1950s. The basic principle of this transmission is C. Walt Musser (1909- 1988) was proposed in 1955. In 1960, C. Walt Musser used the term Harmonic Drive in a paper published in the American Journal of Mechanical Design.

Harmonic transmission is a kind of transmission device that realizes the movement and power transmission through the interaction with the circular spline by the wave generator to produce a controllable elastic deformation wave.

### 2. Basic structure of harmonic reducer

It consists mainly of three basic components:

1. Circular spline: a steel gear with a ring gear, which is equivalent to the center wheel in the planetary system.
2. Flexspline: a flexible gear with an external ring gear, which is equivalent to a planetary gear.
3. Wave generator: it is equivalent to a planet carrier.



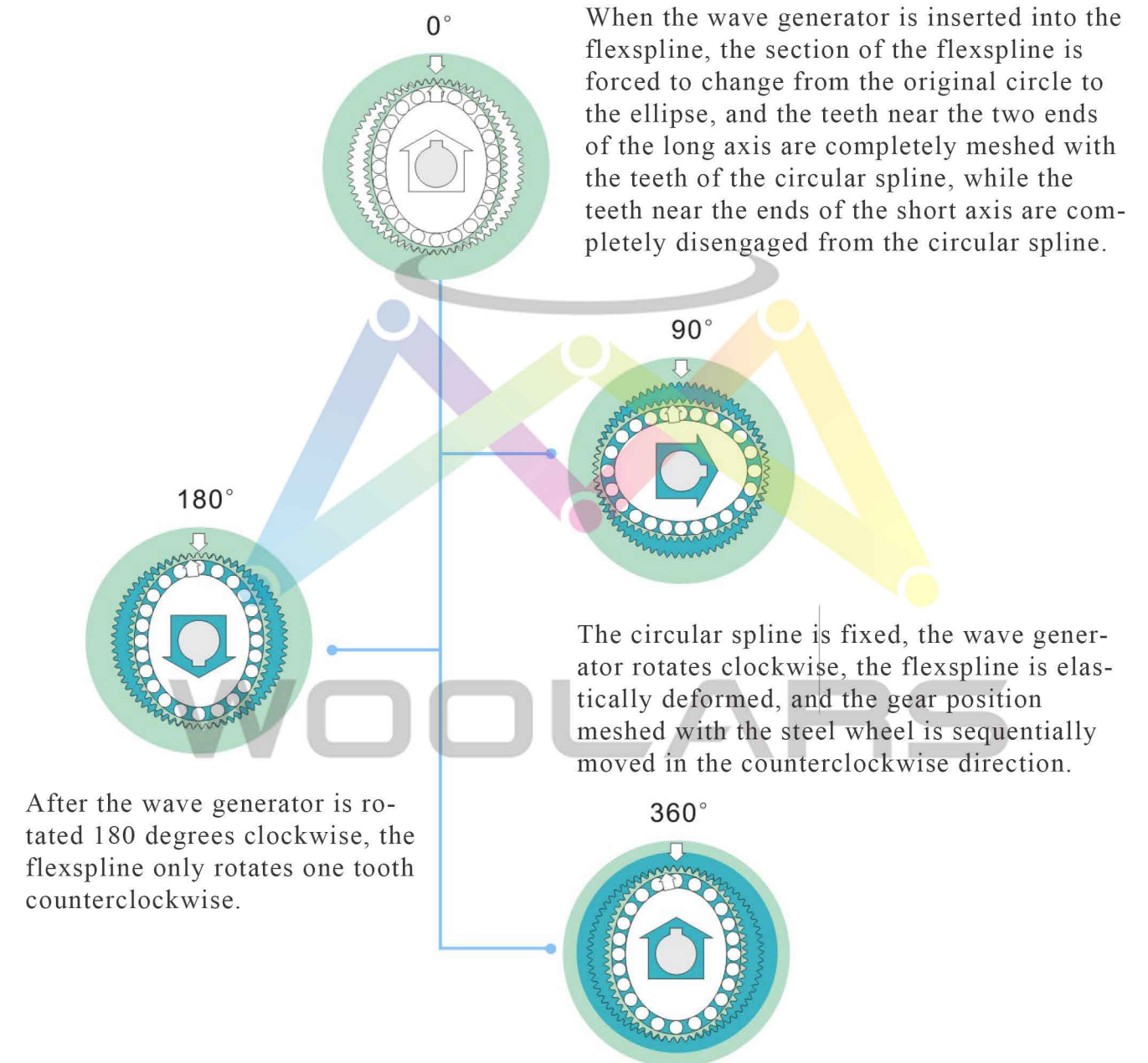
#### Harmonic transmission features:

1. The bearing capacity is high. The tooth and tooth meshing in the harmonic drive is surface contact, and the number of meshing teeth (the number of overlapping teeth) is relatively large.
2. The transmission ratio is large, and the transmission ratio of single-stage harmonic gear transmission can reach  $I=50\sim 500$ .
3. Small size and light weight.
4. High transmission efficiency and long life.
5. Transmission balance, no impact, no noise, high motion accuracy.

### 3. Transmission principle of harmonic reducer

#### Three basic components:

1. Circular spline
2. Flexspline
3. Wave generator





## Harmonic drive classification

According to the shape of the flexspline, the harmonic gear reducer can be divided into two types: cup shape and hollow hat shape. Each type is divided into standard type and short tube according to the length of the flexspline. The same model includes several reduction ratios.

### Model code

The product type code consists of three parts: the shape of the flexspline, the length and torque of the flexspline:

1. The shape of the flexspline is divided into two types: a cup shape and a hollow hat shape. The cup-shaped flexspline is represented by a capital letter C, and the hollow hat shape is represented by a capital letter H.
2. The length of flexspline is divided into two types: standard type and short tube. The standard is indicated by the letter S, and the short flexspline is represented by letter D.
3. Torque is divided into standard and high torque. High torque is indicated by G, otherwise it is standard.

### Structure code

The structure code of the reducer is divided into two types: the whole unite and the parts. The whole unite is represented by a capital letter U, and the parts are represented by P.

### Connect type

Type I: Standard type, the input shaft is matched with the cam hole and connected by a flat key.

Type II: Cross slide coupling type, the input shaft and cam are connected by the cross slide shaft.

Type III: Cylindrical hollow type, the input shaft and the hollow cam are connected by screws.

Type IV: Shaft input type.



## Harmonic characteristics

### BSG series features:

1. Simple and compact structure
2. High rigidity
3. High torque
4. No tooth gap
5. Good positioning and rotation accuracy
6. The input is coaxial with the output.

### BSH series features:

1. Large diameter hollow structure
2. Simple and compact
3. High rigidity
4. High torque
5. No tooth gap
6. Good positioning and rotation accuracy
7. Input and output coaxial

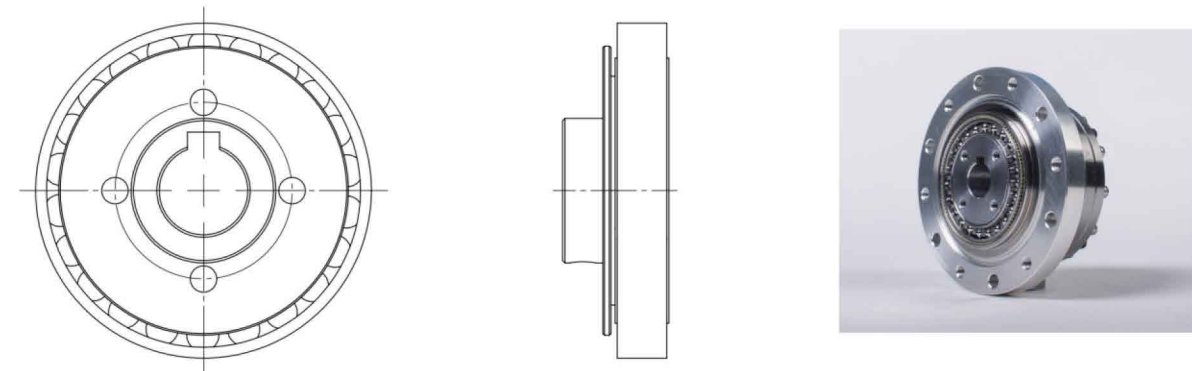
### BCD series features:

1. Ultra-flat structure
2. Small size
3. Light weight
4. High torque
5. No tooth gap
6. Good positioning and rotation accuracy
7. Input and output coaxial

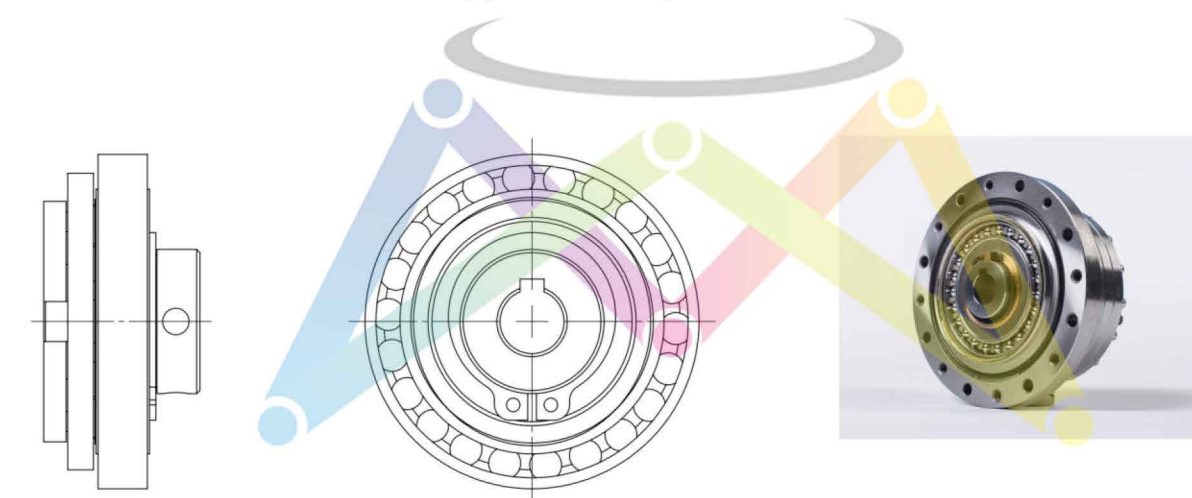
### BHD series features:

1. Ultra-thin hollow flange structure
2. Cross shaft and steel wheel integration
3. Light weight
4. High torque
5. No teeth
6. Good positioning and rotation accuracy
7. Input & output coaxial

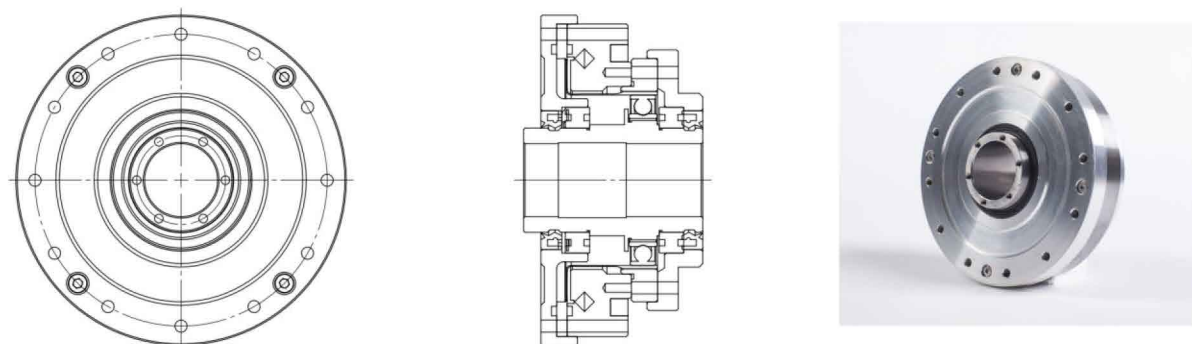
## Type code



Type I: flat key connection

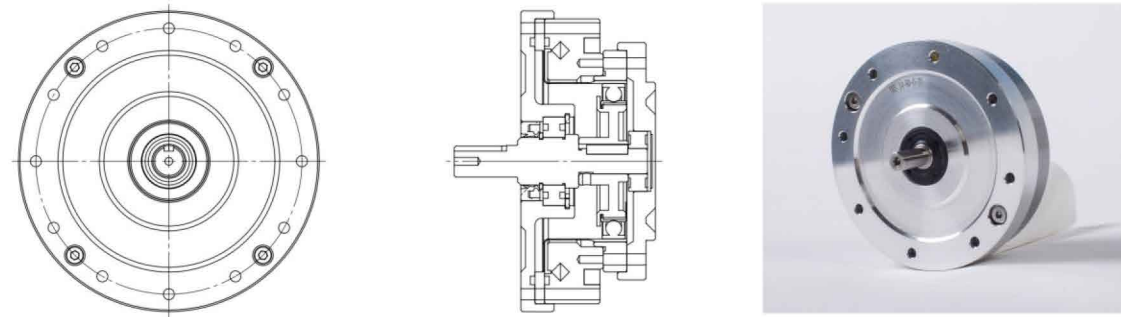


Type II: cross slider connection



Type III: The input shaft is connected to the hollow cam by screws





IV type: shaft input

### Explanation of terms

#### Rated torque

Continuous load torque allowable at output when the input speed is 2000 rpm/min.

#### Maximum torque allowed at start-stop

The maximum allowable value greater than the normal load when at start or stop.

#### Average load allowed maximum

The load average calculated based on the change in input speed and torque, the load average cannot exceed the rated value.

#### Maximum torque allowed in an instant

In addition to the usual load torque and the load torque at the start & stop, there is an unpredictable maximum allowable value of the impact from the outside.

#### Transmission accuracy

In the working state, when the input shaft rotates in one direction, the actual rotation angle of the output shaft is close to the theoretical rotation angle.

#### Design life

The life of the reducer is calculated when the input torque is the rated torque, and input speed is 2000 rpm/min.

The backlash fixes the output to the reducer housing and produces a small angular displacement at the input of the reducer when  $\pm 2\%$  of the rated torque is applied clockwise and counterclockwise when the input is applied.

When the idle axis is in the working state, the input shaft is changed from the forward direction to the reverse rotation, the output shaft has a hysteresis on the rotation angle.

### Model number rules

#### Harmonic reducer code description

The reducer model number consists of type code, specification code, reduction ratio, structure code and connection method.

BCS (G) — 14 — 50 — U — I — \*\*\*  
↓ ↓ ↓ ↓ ↓ ↓ ↓

Model	Number	Reduction ratio						Structure	Connect	Specials
BCS/BCSG	14	30	50	80	100	—	—	U: unit	I: standard	1. Z+ shaft hole dia.
B: general harmonic code	17	30	50	80	100	120	—			
C: cup type flexspline	20	30	50	80	100	120	160	P: parts	II: cross slide coupling type	2. LW: Lightweight. For example: Z-8, Z-14 or LW-8, LW-14.
S: standard length of the flexspline	25	30	50	80	100	120	160			
	32	—	50	80	100	120	160			
	40	—	50	80	100	120	160			
	45	—	50	80	100	120	160			

Model	Number	Reduction ratio						Structure	Connect	Specials
BHS	14	30	50	80	100	—	—	U: unit	I: standard	1. Z+ shaft hole dia.
B: general harmonic code	17	30	50	80	100	120	—			
H: hollow flexspline	20	30	50	80	100	120	160	P: parts	II: cross slide coupling type	2. LW: Lightweight. For example: Z-8, Z-14 or LW-8, LW-14.
S: standard length of the flexspline	25	30	50	80	100	120	160			
	32	—	50	80	100	120	160			
	40	—	50	80	100	120	160		III: cylindrical hollow type	
	45	—	50	80	100	120	160		IV: shaft input type	

Model	Number	Reduction ratio						Structure	Connect	Specials
BCD/BHD	14	30	50	80	100	—	—	U: unit	I: standard	1. Z+ shaft hole dia. Such as Z-7, Z-14
B: general harmonic code	17	30	50	80	100	120	—			
C: cup type soft wheel	20	30	50	80	100	120	160	P: parts		Blank indicates standard
H: hollow flexspline	25	30	50	80	100	120	160			
D: short cup flexspline	32	—	50	80	100	120	160			

The reduction ratio indicates when the wave generator is the input, the circular spline is fixed, and the flexspline is output.  
If: When the wave generator is the input, the flexspline is fixed, and the reduction ratio of the circular spline is +1.



### Selection process

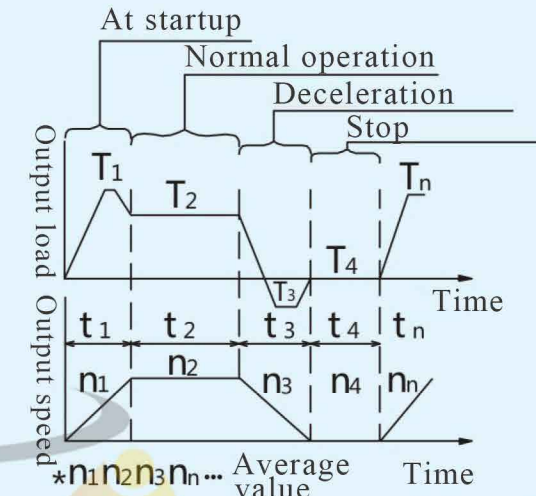
Output average load torque confirmation

$$T_{av} = \sqrt[3]{\frac{n_1 \cdot t_1 \cdot T_1^3 + n_2 \cdot t_2 \cdot T_2^3 + \dots + n_n \cdot t_n \cdot T_n^3}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}} \leq T_{avmax}$$

$T_n$ : load torque  
 $t_n$ : time  
 $n_n$ : output speed  
 $T_{avmax}$ : average load torque allowable maximum (N.m)

Calculate the average load torque according to the above formula, and then select the model temporarily by referring to the rated parameters of each series of harmonic reducers.

Load operation mode



Calculate the average

$$n_{oav} = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + t_3 + \dots + t_n}$$

Determine the reduction ratio

$$R \leq \frac{n_{imax}}{n_{omax}}$$

$n_{imax}$ : Max input speed  
 $n_{omax}$ : Max output speed

Calculate the average input speed

$$n_{iav} = n_{oav} \cdot R \quad (\text{r/min})$$

Calculate the highest input speed

$$n_{imav} = n_{omav} \cdot R \quad (\text{r/min})$$

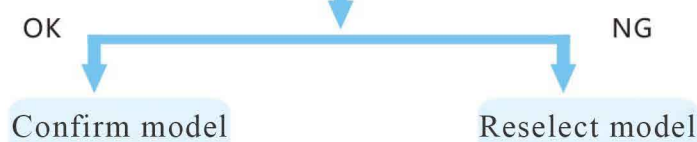
Temporarily select model needs to meet the following conditions:

$$n_{iav} \leq n_{iavallw} \quad n_{iavallw}: \text{Allowed average input speed}$$

$$n_{imax} \leq n_{imaxallw} \quad n_{imaxallw}: \text{Allowed maximum input speed}$$

Confirm that the maximum torque at start and stop is within the maximum allowed (N.m)

Confirm that the applied moment impact torque is within the allowed max value (N.m)



### BCS-I series

Cup shape combination (integral cam)

BCS type harmonic reducer type I connection mode, the flexspline is a standard cup type structure, the input shaft is directly connected with the shaft hole of the wave generator, and the flat key and the motor shaft are used for positioning and transmission. The installation application mode is generally: wave generator Input, the end face of the circular spline is fixed, and the end face of the bearing connected by the flexspline is output.

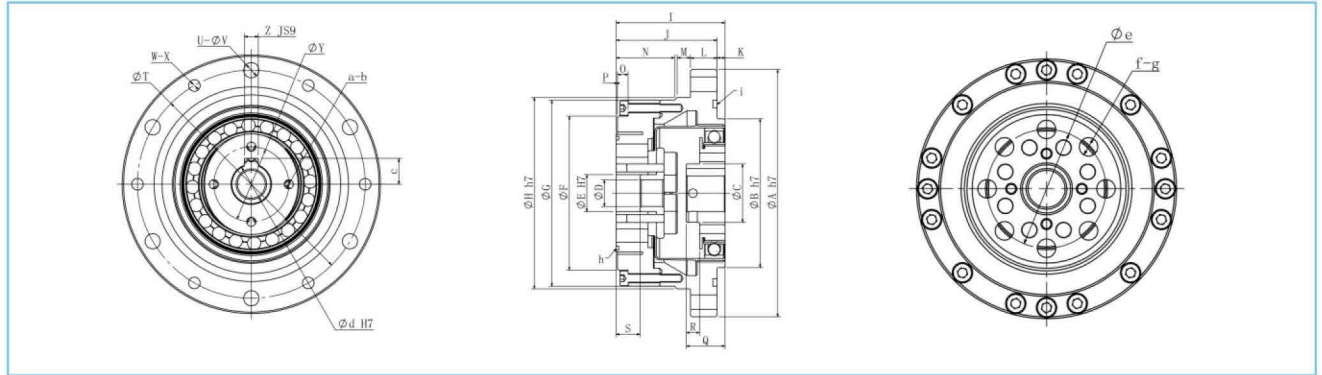


### BCS-I series data sheet

No.	Ratio	Rated torque	Star/stop max torque	Average load torque max allowable value	Instant max allowed	Instant max input speed (lubricating oil)	Allow average input speed (grease)	Backlash Arc Sec	Weight kg	Service life hour
		Nm	Nm	Nm	Nm	r/min	r/min			
14	30	3.8	8.5	6.7	16.5	7000	3500	≤20	0.52	12000
	50	5.1	16	6.8	33.5					
	80	7.3	23	11	46					
	100	7.3	27	11	53					
17	30	8.6	15	12	28	6000	3500	≤20	0.67	12000
	50	15.4	32	26	68					
	80	21.5	42	27	84					
	100	23	50	36	105					
20	30	13	25	18	47	5200	3500	≤20	0.95	12000
	50	26	52	32	95					
	80	32	71	45	123					
	100	39	77	47	142					
25	30	25	47	35	89	4500	3500	≤20	1.5	12000
	50	38	94	52	181					
	80	61	130	83	245					
	100	65	148	105	275					
32	30	39	82	47	142	4500	3500	≤10	3.16	15000
	50	39	88	47	142					
	80	115	292	162	552					
	100	132	325	210	625					
40	30	132	342	210	662	4000	3000	≤10	4.96	15000
	50	132	358	210	662					
	80	198	502	272	962					
	100	252	554	360	1062					
45	30	166	482	252	934	4000	3000	≤20	5.55	12000
	50	166	482	252	934					
	80	301	690	378	1250					
	100	341	740	482	1550					
160	120	392	810	610	1750	4000	3000	≤10	5.55	15000
	160	392	865	620	1890					



**BCS-I series**



**BCS-I series size**

No.	14	17	20	25	32	40	45
Code							
ØA h7	73	79	93	107	138	160	180
ØB h7	38	48	56	67	90	110	124
ØC	14	18	22	22	30	32	42
ØD	8	7	10	15	20	24	25
ØE H7	11	10	14	20	26	32	32
ØF	42.5	49.5	58	73	96	109	127
ØG	55	62	70	85	112	126	147
ØH h7	56	63	72	86	113	127	148
I	36	39	41	49	60	70.5	78
J	34	37	38	46	57	66.5	74
K	2	2	3	3	3	4	4
L	7	8	10	10	12	16	16
M	3.5	3.5	5	4.5	4.5	4.5	5.5
N	23	25	22	31	40	45.5	52
O	4	4	4	4	4.5	6	6
P	0.5	0.5	0.5	0.5	1	1.5	1
Q	12.4	13.2	14.6	14.3	16.3	19	25
R	5	5	5	5	5	5.5	10
S	9.4	5.9	9	12	15.2	15.5	16
T	65	71	82	96	125	144	164
U	6	6	6	8	12	8	16
ØV	4.5	4.5	5.5	5.5	6.5	9	9
W	6	6	6	8	12	8	16
X	M4	M4	M5	M5	M6	M8	M8
Y	18	22	27	32	36	50	50
Z	3	4	5	5	5	5	6
a	4	4	4	4	4	4	4
b	M3	M4	M4	M4	M4	M4	M5
c	5.3 <sup>+0.1</sup>	7.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	12.5 <sup>+0.1</sup>
Ød H7	8	8	11	14	14	14	19
e	23	27	32	42	55	68	82
f	6	6	8	8	8	8	8
g	M4	M5	M6	M8	M10	M10	M12
h	28*1	34*1	40*1	53*1	68*2	81*2	97*2
i	48*2	54*2	64*2	76*2	102*2	122*2	142*2

**BCS-II series**

**BCS-II series**

Cup combination (cross slider)  
BCS type harmonic reducer type II connection mode series, the flexspline is a standard cup type structure, the input shaft is directly connected with the wave generator shaft hole, the flat key and the motor shaft are used for positioning transmission. The wave generator is characterized by the structure of the cross-slider coupling, and has the function of automatically adjusting the concentricity. The installation and application modes are generally: wave generator input, the end face of the circular spline is fixed, and the bearing end face which connect to flexspline output.

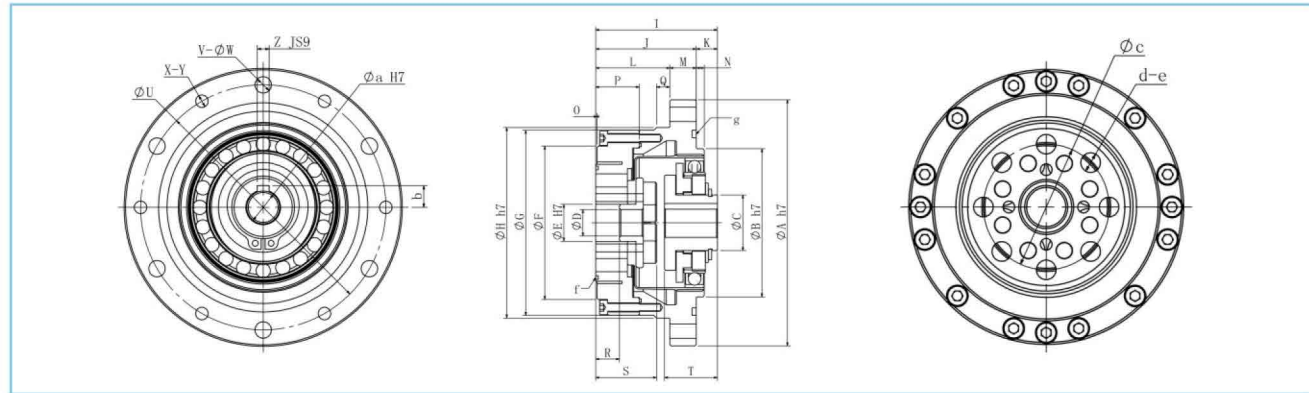


**BCS-II series data sheet**

No.	Ratio	Rated torque	Star/stop max torque	Average load torque max allowable value	Instant max allowed	Instant max input speed (lubricating oil)	Allow average input speed (grease)	Backlash Arc Sec	Weight kg	Service life hour
		(2000r/min) Nm	Nm	Nm	Nm	r/min	r/min			
14	30	4	9	6	15	7000	3500	≤20	0.55	12000
	50	5.2	16	6	32					
	80	7.5	21	10	45					
	100	7.5	26	10	52					
17	30	8	15	11	28	6000	3500	≤20	0.69	12000
	50	15	32	24	68					
	80	20	46	25	84					
	100	23	50	36	105					
20	30	12	25	18	52	5200	3500	≤20	0.99	12000
	50	28	52	32	95					
	80	32	71	45	123					
	100	39	77	47	142					
25	30	25	47	35	92	4500	3500	≤20	1.55	12000
	50	38	94	52	181					
	80	61	130	83	245					
	100	65	148	105	275					
32	30	39	82	47	142	4500	3500	≤10	3.2	15000
	50	73	210	106	367					
	80	115	292	162	552					
	100	132	325	210	625					
40	30	132	342	210	662	4000	3000	≤10	5	15000
	50	132	358	210	662					
	80	132	385	186	664					
	100	198	502	272	962					
45	30	252	554	360	1062	4000	3000	≤10	5.75	15000
	50	282	602	442	1162					
	80	282	634	442	1162					
	100	392	810	610	1750					
45	120	166	482	252	934	4000	3000	≤20	5.75	12000
	160	301	690	378	1250					
45	120	341	740	482	1550	4000	3000	≤10	5.75	15000
	160	392	865	620	1890					



### BCS-II series



#### BCS-II series size

Code	No.	14	17	20	25	32	40	45
ØA h7		73	79	93	107	138	160	180
ØB h7		38	48	56	67	90	110	124
ØC		14	18	21	26	26	32	32
ØD		8	7	10	15	20	24	25
ØE H7		11	10	14	20	26	32	32
ØF		42.5	49.5	58	73	96	109	127
ØG		55	62	70	85	112	126	147
ØH h7		56	63	72	86	113	127	148
I		41.5	45.5	46	53	63	72.5	79.5
J		34	37	38	46	57	66.5	74
K		7.5	8.5	8	7	6	6	5.5
L		27	29	28	36	45	50.5	58
M		7	8	10	10	12	16	16
N		2	2	3	3	3	4	4
O		0.5	0.5	0.5	0.5	1	1.5	1
P		16.5	16.5	16.5	18.5	22.5	24	27
Q		3.5	3.5	5	4.5	4.5	4.5	5.5
R		9.5	9.5	9	12	15.2	15.5	16
S		21.5	23.5	23	28	31.2	35.5	39.5
T		17.5	19.5	20	20.5	22.1	27.5	28
ØU		65	71	82	96	125	144	164
V		6	6	6	8	12	8	16
ØW		4.5	4.5	5.5	5.5	6.5	9	9
X		6	6	6	8	12	8	16
Y		M4	M4	M5	M5	M6	M8	M8
Z		3	3	5	5	5	5	6
Øa H7		8	8	11	14	14	14	19
b		5.3 <sup>+0.1</sup>	5.3 <sup>+0.1</sup>	7.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	12.5 <sup>+0.1</sup>
Ø c		23	27	32	42	55	68	82
d		6	6	8	8	8	8	8
e		M4	M5	M6	M8	M10	M10	M12
f		28*1	34*2	40*1	53*1	68*2	81*2	97*2
g		48*2	54*2	64*2	76*2	102*2	122*2	142*2

### BCSG-I series

#### BCSG-I series

Cup shape combination (integral cam)

BCSG type harmonic reducer type I connection series, the flexspline is a standard cup type structure, the input shaft is directly connected with the shaft hole of the wave generator, and the flat key and the motor shaft are used for positioning and transmission. The installation application is generally: wave generator input, the end face of the circular spline is fixed, and the end face of the bearing connected by the flexspline is output.

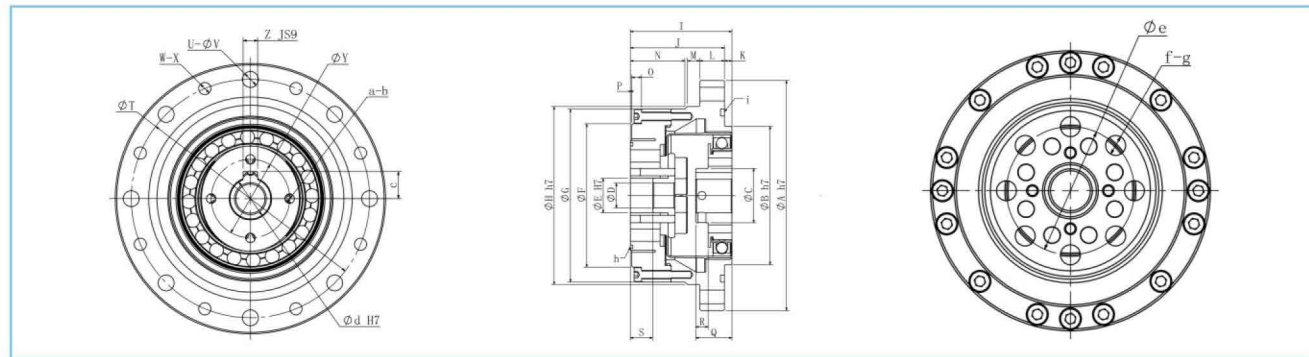


#### BCSG-I series data sheet

No.	Ratio	Rated torque	Star/stop max torque	Average load torque max allowable value	Instant max allowed	Instant max input speed (lubricating oil)	Allow average input speed (grease)	Backlash Arc Sec	Weight kg	Service life hour
		(2000r/min)	Nm	Nm	Nm	Nm	r/min			
14	50	6.2	21	8	44	7000	3500	≤20	0.52	12000
	80	9.2	28	14	58					
	100	7.5	35	14	68					
17	50	20	43	34	88	6000	3500	≤20	0.67	12000
	80	28	54	35	110					
	100	32	68	47	136					
20	50	34	70	44	124	5200	3500	≤20	0.95	15000
	80	43	93	61	160					
	100	52	106	65	188					
25	50	50	125	70	236	4500	3500	≤20	1.5	15000
	80	82	173	109	320					
	100	89	201	138	356					
32	50	98	272	140	482	4500	3500	≤20	3.16	15000
	80	154	382	212	714					
	100	178	442	276	856					
	160	178	467	276	856					



### BCSG-I series



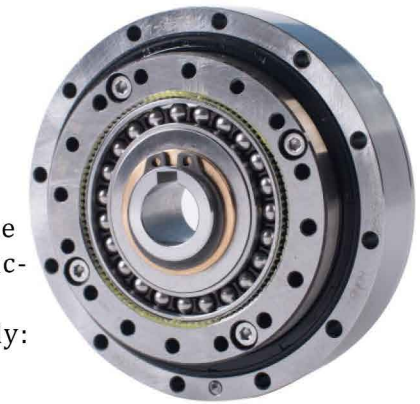
#### BCSG-I series size

Code	No.	14	17	20	25	32
ØA h7		73	79	93	107	138
ØB h7		38	48	56	67	90
ØC		14	18	22	22	30
ØD		8	7	10	15	20
ØE H7		11	10	14	20	26
ØF		42.5	49.5	58	73	96
ØG		55	62	70	85	112
ØH h7		56	63	72	86	113
I		36	39	41	49	60
J		34	37	38	46	57
K		2	2	3	3	3
L		7	8	10	10	12
M		3.5	3.5	5	4.5	4.5
N		23	25	22	31	40
O		4	4	4	4	4.5
P		0.5	0.5	0.5	0.5	1
Q		12.5	13.2	14.6	14.3	16.3
R		5	5	5	5	5
S		9.4	9.5	9	12	15.2
T		65	71	82	96	125
U		8	8	8	10	12
ØV		4.5	4.5	5.5	5.5	6.5
W		8	8	8	10	12
X		M4	M4	M5	M5	M6
Y		18	22	27	32	36
Z		3	4	5	5	5
a		4	4	4	4	4
b		M3	M4	M4	M4	M4
c		5.3 <sup>+0.1</sup>	7.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>
Ød H7		8	8	11	14	14
e		23	27	32	42	55
f		6	6	8	8	8
g		M4	M5	M6	M8	M10
h		28*1	34*1	40*1	53*1	68*2
i		48*2	54*2	64*2	76*2	102*2

### BCSG-II series

#### BCSG-II series

Cup type combination (cross slider type)  
BCSG type harmonic reducer type II connection series, the flex-spline is a standard cup type structure, the input shaft is directly connected with the shaft hole of the wave generator, and the flat key and the motor shaft are used for positioning transmission. The wave generator is characterized by a European coupling. The structure of the section has the function of automatically adjusting the concentricity. The installation and application modes are generally: the wave generator input, the end face of the circular spline is fixed, and the flexspline connected bearing end face output.

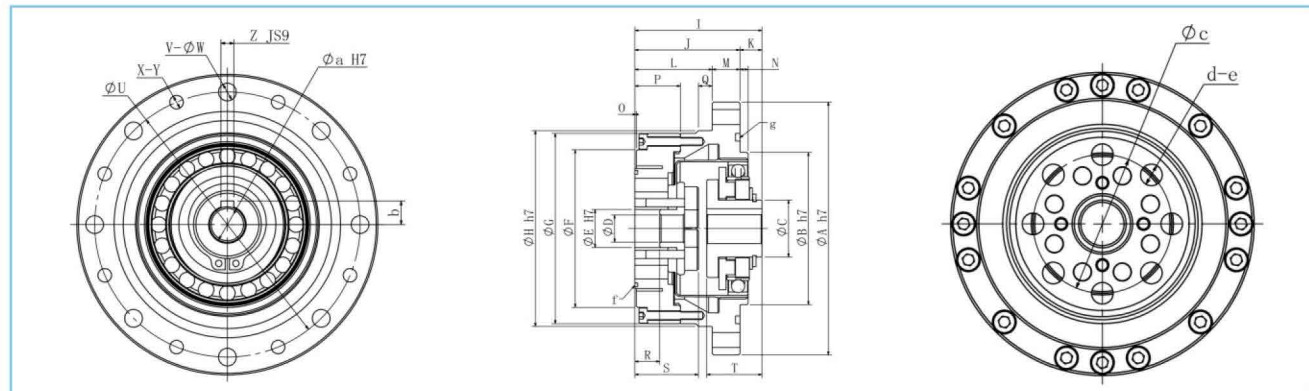


#### BCSG-II series data sheet

No.	Ratio	Rated torque	Star/stop max torque	Average load torque	Instant max allowed	Instant max input speed	Allow average input speed	Backlash	Weight	Service life
		(2000r/min)	max torque	max allowable value	max allowed	speed (lubricating oil)	input speed (grease)			
		Nm	Nm	Nm	Nm	r/min	r/min	Arc Sec	kg	hour
14	50	7	21	8	43	7000	3500	≤20	0.55	12000
	80	9	28	12	58			≤10		15000
	100	9	34	12	66			≤10		15000
17	50	19	42	32	86	6000	3500	≤20	0.69	12000
	80	26	53	32	109			≤10		15000
	100	28	66	47	135			≤10		15000
20	50	31	68	40	121	5200	3500	≤20	0.99	12000
	80	41	92	57	158			≤10		15000
	100	49	102	59	182			≤10		15000
25	120	49	107	59	182	4500	3500	≤10	1.55	15000
	160	49	117	59	182			≤20		12000
	80	77	170	104	322			≤20		12000
32	50	91	270	132	367	4500	3500	≤20	3.2	12000
	80	144	382	208	552			≤10		15000
	100	169	420	272	829			≤10		15000
32	120	169	445	272	870	4500	3500	≤10	3.2	15000
	160	169	472	272	870			≤10		15000



### BCSG-II series



#### BCSG-II series size

Code	No.	14	17	20	25	32
ØA h7		73	79	93	107	138
ØB h7		38	48	56	67	90
ØC		14	18	21	26	26
ØD		8	7	10	15	20
ØE H7		11	10	14	20	26
ØF		42.5	49.5	58	73	96
ØG		55	62	70	85	112
ØH h7		56	63	72	86	113
I		41.5	45.5	46	53	63
J		34	37	38	46	57
K		7.5	8.5	8	7	6
L		27	29	28	36	45
M		7	8	10	10	12
N		2	2	3	3	3
O		0.5	0.5	0.5	0.5	1
P		16.5	16.5	16.5	18.5	22.5
Q		3.5	3.5	5	4.5	4.5
R		9.5	9.5	9	12	15.2
S		21.5	23.5	23	28	31.2
T		17.5	19.5	20	20.5	22.1
ØU		65	71	82	96	125
V		8	8	8	10	12
ØW		4.5	4.5	5.5	5.5	6.5
X		8	8	8	10	12
Y		M4	M4	M5	M5	M6
Z		3	3	5	5	5
Øa H7		8	8	11	14	14
b		5.3 <sup>+0.1</sup>	5.3 <sup>+0.1</sup>	7.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>
Øc		23	27	32	42	55
d		6	6	8	8	8
e		M4	M5	M6	M8	M10
f		28*1	34*1	40*1	53*1	68*1
g		48*2	54*2	64*2	76*2	102*2

### BCD-I series

#### BCD-I series

Short cup combination type (ultra-thin type)

BCD type harmonic reducer I type connection series, the flexspline is a short cup type structure, the input shaft is directly connected with the wave generator shaft hole, and the installation application mode is generally: wave generator input, the circular spline end face is fixed, the end face of the bearing connected by flexspline is output.

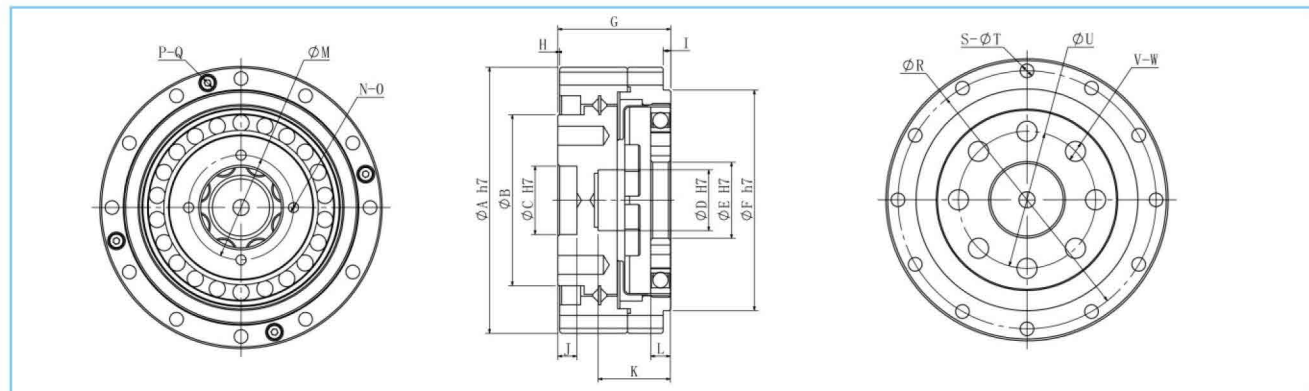


#### BCD-I series data sheet

No.	Ratio	Rated torque	Star/stop	Average	Instant	Instant	Allow average	Backlash	Weight	Service life
		(2000r/min)	max torque	load torque	max allowed	max input	input			
		Nm	Nm	max allowable value	Nm	speed (lubricating oil)	speed (grease)	Arc Sec	kg	hour
14	50	3.6	11.7	4.7	23	8500	3500	≤20	0.46	12000
	80	5.1	15	6.2	29			≤10		15000
	100	5.4	19	7.4	34			≤10		15000
17	50	10.6	23	18	47	7300	3500	≤20	0.54	12000
	80	14	29	21	54			≤10		15000
	100	16	36	27	69			≤10		15000
20	120	17	38	24	69	6500	3500	≤20	0.66	12000
	50	16	37	23	66			≤10		15000
	80	23	49	28	78			≤10		15000
25	100	26	57	34	90	5600	3500	≤20	1.26	12000
	120	26	56	32	90			≤10		15000
	160	26	62	34	90			≤10		15000
32	50	51	146	73	262	4800	3500	≤20	2.42	12000
	80	81	208	115	388			≤10		15000
	100	94	242	149	412			≤10		15000
32	120	94	256	149	436	4800	3500	≤10	2.42	15000
	160	94	276	149	436			≤10		15000



### BCD-I series



#### BCD-I series size

Code	No.	14	17	20	25	32
ØA h7		55	62	10	85	112
ØB		31	38	45	58	78
ØC H7		12	14	18	24	32
ØD H7		11	11	16	20	30
ØE H7		11	15	20	24	32
ØF h7		42.5	49.5	58	73	96
G		25	26.5	29.7	37.1	43
H		0.5	0.5	0.5	0.5	1
I		2	2	2	3	3
J		5	5	5	5.5	5.5
K		15	16.6	19	23.9	30.9
L		5.4	6.5	5.2	5.2	8.6
ØM		17	21	26	30	40
N		4	4	4	4	4
O		M3	M3	M3	M3	M4
P		3	5	4	6	6
Q		M2	M2	M2	M2	M3
ØR		49	56	64	79	104
S		6	10	12	18	18
ØT		3.5	3.5	3.5	3.5	4.5
ØU		25	27	34	42	57
V		10	8	8	8	10
W		M3	M5	M6	M8	M8

### BHS-I series

#### BHS-I series

Hat combination (Integral cam)

BHS-I type harmonic reducer connection mode series, the flexspline is a standard hollow hat type structure. The input shaft is directly connected with the shaft hole of the wave generator. The flat key and the motor shaft are used for positioning and transmission.

There are two installation methods:

1. Wave generator input, the end face of the circular spline is fixed, and the end face of the bearing connected by the flexspline is output.
2. The wave generator input, the end of the flexspline is fixed, and the end face of the circular spline is output.

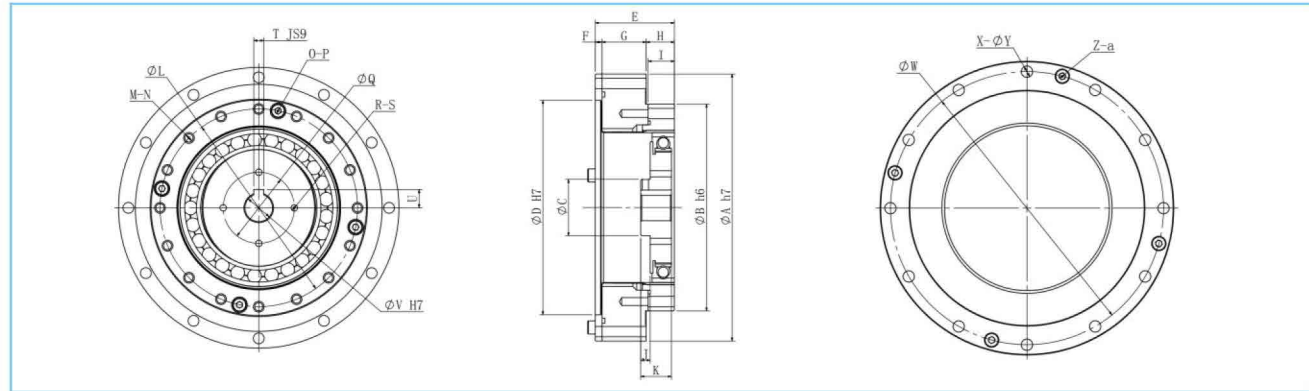


#### BHS-I series data sheet

No.	Ratio	Rated torque	Star/stop max torque	Average load torque	Instant max allowed	Instant max input speed	Allow average input speed	Backlash	Weight	Service life
		(2000r/min)		max allowable value		(lubricating oil)	(grease)			
		Nm	Nm	Nm	Nm	r/min	r/min	Arc Sec	kg	hour
14	30	3.8	8.5	7.6	16.5	7000	3500	≤20	0.52	12000
	50	5.1	16	6.8	33.5					
	80	7.3	23	11	46					
	100	7.3	27	11	53					
17	30	8.6	15	12	28	6000	3500	≤20	0.67	12000
	50	15.4	32	25	68					
	80	21.5	42	26	84					
	100	23	50	36	105					
20	120	23	50	36	82	5200	3500	≤10	0.95	15000
	30	13	25	18	47					
	50	24	52	32	95					
	80	32	71	45	123					
25	100	39	77	47	142	4500	3500	≤10	1.5	15000
	120	39	82	47	142					
	160	39	88	47	142					
	30	25	47	35	89					
32	50	38	94	52	181	4500	3500	≤20	3.16	15000
	80	61	130	83	245					
	100	65	148	105	275					
	120	65	160	105	298					
40	160	65	171	105	305	4000	3000	≤20	4.96	15000
	50	73	210	106	367					
	80	115	292	162	552					
	100	132	325	210	625					
45	120	132	342	210	662	4000	3000	≤10	5.55	15000
	160	132	358	210	662					
	50	132	385	186	664					
	80	198	502	272	962					
	100	252	554	360	1062	4000	3000	≤10	5.55	15000
	120	282	602	442	1162					
	160	282	634	442	1162					
	50	166	482	252	934					
	80	301	690	378	1250	4000	3000	≤10	5.55	15000
	100	341	740	482	1550					
	120	392	810	610	1750					
	160	392	865	620	1890					



### BHS-I series



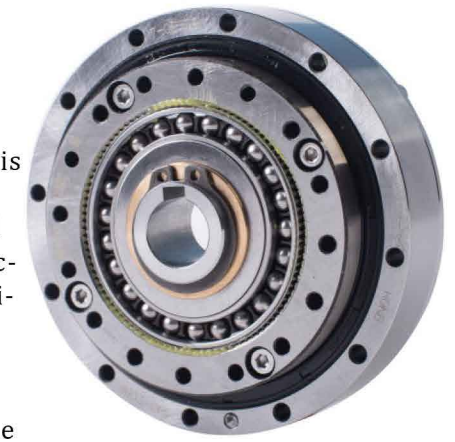
### BHS-I series size

Code	No.	14	17	20	25	32	40	45
ØA h7		70	80	90	110	142	170	190
ØB h6		50	60	70	85	110	135	155
ØC		14	18	22	22	30	32	42
ØD H7		48	60	70	88	114	140	158
E		23.5	26.5	29	34	42	51	56.5
F		2.4	3	3	3.3	3.6	4	4.5
G		14.1	16	17.5	18.7	23.4	29	32
H		7	7.5	8.5	12	15	18	20
I		6	6.5	7.5	10	14	17	19
J		5	5	5	5	5	5.5	10
K		12.4	13.2	14.6	14.3	16.3	19	25
ØL		44	54	62	77	100	122	140
M		8	16	16	16	16	16	12
ØN		3.5(M3)	3.5(M3)	3.5(M3)	4.5(M4)	5.5(M5)	6.6(M6)	9(M8)
O		4	4	4	4	4	4	4
P		M3	M3	M3	M4	M4	M5	M5
ØQ		18	22	27	32	36	50	50
R		4	4	4	4	4	4	4
S		M3	M4	M4	M4	M4	M4	M4
T		3	4	5	5	5	5	6
U		5.3 <sup>+0.1</sup>	7.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	12.3 <sup>+0.1</sup>
ØV H7		8	11	14	14	14	14	19
ØW		64	74	84	102	132	158	180
X		8	8	12	12	12	12	18
ØY		3.5	3.5	3.5	4.5	5.5	6.6	6.6
Z		2	4	4	4	4	6	6
a		M3	M3	M3	M3	M4	M4	M4

### BHS-II series

#### BHS-II series

Hat shape combination (cross slider type)  
BHS-II type harmonic reducer connection mode series, the flexspline is a standard hollow type hat structure. The input shaft is directly connected with the shaft hole of the wave generator, and the flat key and the motor shaft are used for positioning and transmission. The characteristic of the wave generator is Euro type coupling, it could automatically adjust the concentricity. The installation application method is:  
1. Wave generator input, the end face of the circular spline is fixed, and the end face of the bearing connected by the flexspline is output.  
2. Wave generator input, the end face of the flexspline is fixed, and the end face of the circular spline is input.

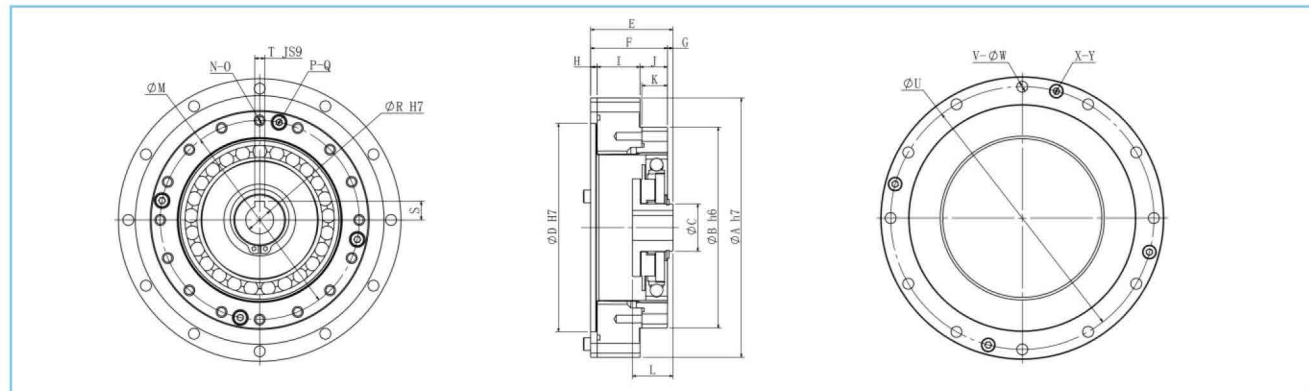


#### BHS-II series data sheet

No.	Ratio	Rated torque	Star/stop max torque	Average load torque max allowable value	Instant max allowed	Instant max input speed (lubricating oil)	Allow average input speed (grease)	Backlash Arc Sec	Weight kg	Service life hour
		(2000r/min) Nm	Nm	Nm	Nm	r/min	r/min			
14	30	3.8	8.5	6.7	16.5	7000	3500	≤20	0.52	12000
	50	5.1	16	6.8	33.5					
	80	7.6	22	10.5	46					
	100	7.6	27	10.5	53					
17	30	8.6	15	11	28	6000	3500	≤20	0.67	12000
	50	15.4	32	25	68					
	80	21.5	42	26	84					
	100	23	50	36	105					
20	120	23	50	36	82	5200	3500	≤10	0.95	15000
	30	13	25	18	47					
	50	24	52	32	95					
	80	32	71	45	123					
25	100	39	77	47	142	4500	3500	≤10	1.5	15000
	120	39	82	47	142					
	160	39	88	47	142					
	30	25	47	35	89					
32	50	38	94	52	181	4500	3500	≤20	3.16	15000
	80	61	130	83	245					
	100	65	148	105	275					
	120	65	160	105	298					
40	160	65	171	105	305	4000	3000	≤10	4.96	15000
	50	73	210	106	367					
	80	115	292	162	552					
	100	132	325	210	625					
45	120	132	342	210	662	4000	3000	≤10	5.55	15000
	160	132	358	210	662					
	50	132	385	186	664					
	80	198	502	272	962					
45	100	252	554	360	1062	4000	3000	≤10	5.55	15000
	120	282	602	442	1162					
	160	282	634	442	1162					
	50	166	482	252	934					
45	80	301	690	378	1250	4000	3000	≤10	5.55	15000
	100	341	740	482	1550					
	120	392	810	610	1750					
	160	392	865	620	1890					



### BHS-II series



#### BHS-II series size

Code	No.	14	17	20	25	32	40	45
ØA h7		70	80	90	110	142	170	190
ØB h6		50	60	70	85	110	135	155
ØC		14	18	22	22	30	32	42
ØD H7		48	60	70	88	114	140	158
E		28.5	33	34	37.5	45	53	58
F		23.5	26.5	29	34	42	51	56.5
G		5	6.5	5	3.5	3	2	1.5
H		2.4	3	3	3.3	3.6	4	4.5
I		14.1	16	17.5	18.7	23.4	29	32
J		7	7.5	8.5	12	15	18	20
K		6	6.5	7.5	10	14	17	19
L		17.5	19.5	20	20.2	22.1	27.5	28
ØM		44	54	62	77	100	122	140
N		8	16	16	16	16	16	12
O		3.5 (M3)	3.5 (M3)	3.5 (M3)	4.5 (M4)	5.5 (M5)	6.5 (M6)	9 (M8)
P		4	4	4	4	4	4	4
Q		M3	M3	M3	M4	M4	M5	M5
ØR		8	11	14	14	14	14	19
S		5.3 <sup>+0.1</sup>	7.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	9.3 <sup>+0.1</sup>	12.3 <sup>+0.1</sup>
T		3	4	5	5	5	5	6
ØU		64	74	84	102	132	158	180
V		8	8	12	12	12	12	18
ØW		3.5	3.5	3.5	4.5	5.5	6.6	6.6
X		2	4	4	4	4	6	6
Y		M3	M3	M3	M3	M4	M4	M4

### BHS-III series

#### BHS-III series

Hat shape combination (hollow shaft)

BHS-III type harmonic reducer connection mode series, the flexspline is standard hollow hat structure. The characteristic is that the input shaft of the wave generator is a hollow shaft type, which can allow power calbe through the input shaft while install harmonics, and the hollow shaft end face connect timing pulley for transmission, general installation method is:

The hollow shaft wave generator is input, the end face of the flexspline is fixed, and the end face of the circular spline is output.

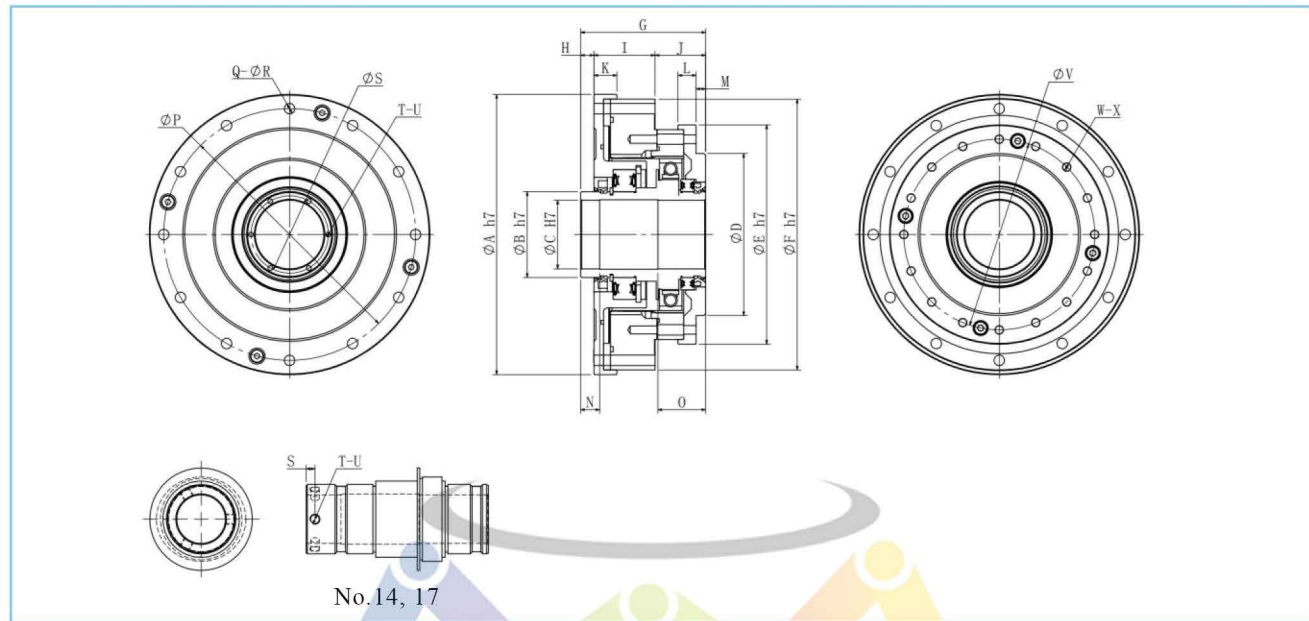


#### BHS-III series data sheet

No.	Ratio	Rated torque	Star/stop max torque	Average load torque max allowable value	Instant max allowed	Instant max input speed (lubricating oil)	Allow average input speed (grease)	Backlash	Weight	Service life
		Nm	Nm	Nm	Nm	r/min	r/min			
14	30	3.7	8.5	6.2	15	7000	3500	≤20	0.55	12000
	50	5.2	16	6.5	33					
	80	7.5	22	10	45					
	100	7.5	26	10	52					
17	30	8.5	15	11	28	6000	3500	≤20	0.69	12000
	50	15	32	24	68					
	80	21	41	25	84					
	100	23	52	37	105					
20	30	14	25	18	47	5200	3500	≤20	0.99	12000
	50	24	52	32	95					
	80	32	71	45	123					
	100	38	77	47	142					
25	120	38	82	47	142	4500	3500	≤10	1.55	15000
	160	38	88	47	142					
	30	25	47	36	92					
	50	37	94	52	181					
32	80	61	130	84	245	4500	3500	≤20	3.2	12000
	100	65	148	105	275					
	120	65	160	105	298					
	160	65	171	105	305					
40	50	73	210	106	367	4000	3000	≤10	5	12000
	80	115	292	162	552					
	100	133	325	212	625					
	120	133	342	212	662					
45	160	133	358	212	662	4000	3000	≤20	5.75	15000
	50	132	385	186	664					
	80	198	502	272	962					
	100	252	554	360	1062					
	120	286	602	443	1162	4000	3000	≤10	5	15000
	160	286	634	443	1162					
	50	169	482	252	934					
	80	304	690	378	1250					
	100	344	740	482	1550	4000	3000	≤10	5.75	15000
	120	395	810	610	1750					
	160	395	862	620	1890					



### BHS-III series



### BHS-III series size

Code	No.	14	17	20	25	32	40	45
ØA h7		74	84	95	115	147	175	195
ØB h7		20	25	30	38	45	59	64
ØC h7		14	19	21	29	36	46	52
ØD		36	45	50	60	85	100	120
ØE h7		54	64	75	90	115	140	160
ØF h7		70	80	90	110	142	170	190
G		52.5	56.5	51.5	55.5	65.5	79	85
H		12	12	5	6	7	8	8
I		20.5	23	25	26	32	38	42
J		20	21.5	21.5	23.5	26.5	33	35
K		9	10	10.5	10.5	12	14	15
L		8	8.5	9	8.5	9.5	13	12
M		7.5	8.5	7	6	5	7	7
N		10	10	10	10	10	/	14.5
O		20	22	22	23	25	/	34.5
ØP		64	74	84	102	132	158	180
Q		8	12	12	12	12	12	18
ØR		3.5	3.5	3.5	4.5	5.5	6.6	6.6
S		2.5	2.5	25.5	33.5	40.5	52	58
T		3	3	6	6	6	6	6
U		M3	M3	M3	M3	M3	M4	M4
ØV		44	54	62	77	100	122	140
W		8	16	16	16	16	16	12
X		3.5(M3)	3.5(M3)	3.5(M3)	4.5(M4)	5.5(M5)	6.6(M6)	9.0(M8)

### BHS-IV series

#### BHS-IV series

Hat shape combination (shaft type)  
BHS-IV type harmonic reducer connection mode series, the flexible wheel is a standard hollow hat structure. The characteristic is that the wave generator is the shaft input type, motor can be connected with drive by the coupling, or inis installed timing pulley on the shaft for transmission. Installation and application methods are generally: Shaft wave generator input, flexspline end face fixed, circular spline output.

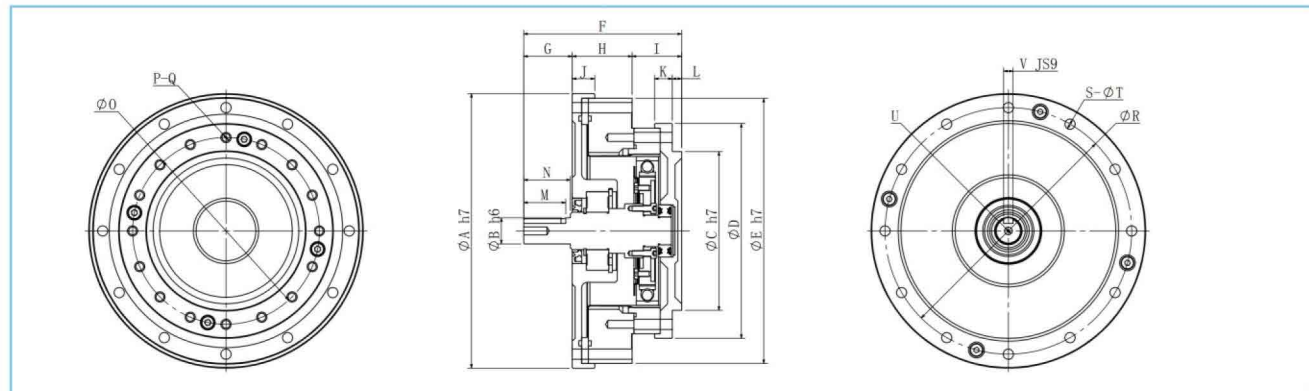


#### BHS-IV series data sheet

No.	Ratio	Rated torque	Star/stop	Average	Instant	Instant	Allow average	Backlash	Weight	Service life
		(2000r/min)	max torque	load torque	max allowed	max input speed (lubricating oil)	input speed (grease)			
		Nm	Nm	Nm	Nm	r/min	r/min	Arc Sec	kg	hour
14	30	3.8	8.5	6.5	16.5	7000	3500	≤20	0.52	12000
	50	5.1	16	6.7	34					
	80	7.3	22	10	46					
17	100	7.3	27	10	53	6000	3500	≤10	0.67	15000
	30	8.6	15	11	28					
	50	15.6	32	25	68					
20	80	21.5	42	26	84	5200	3500	≤10	0.95	15000
	100	23	50	37	105					
	120	23	50	37	82					
25	30	14	25	19	47	4500	3500	≤20	1.5	12000
	50	24	53	32	95					
	80	61	132	84	245					
32	100	65	148	105	275	4500	3500	≤10	3.16	15000
	120	65	160	105	298					
	160	65	171	105	305					
40	50	73	210	106	367	4000	3000	≤20	4.96	12000
	80	115	292	162	552					
	100	133	325	212	625					
45	120	133	342	212	662	4000	3000	≤10	5.55	15000
	160	133	358	212	662					
	50	132	385	192	664					
45	80	198	502	278	962	4000	3000	≤20	5.55	12000
	100	252	554	364	1062					
	120	282	602	442	1162					
45	160	282	634	442	1162	4000	3000	≤20	5.55	12000
	50	166	482	256	934					
	80	301	690	378	1250					
45	100	341	740	482	1550	4000	3000	≤10	5.55	15000
	120	392	810	610	1750					
	160	392	865	620	1890					



### BHS-IV series



### BHS-IV series size

Code	No.	14	17	20	25	32	40	45
ØA h7		74	84	95	115	147	175	195
ØB h6		6	8	10	14	14	16	19
ØC h7		36	45	50	60	85	100	120
ØD		54	64	75	90	115	140	160
ØE h7		70	80	90	110	142	170	190
F		50.5	56	63.5	72.5	84.5	100	108
G		15	17	21	26	26	31	31
H		20.5	23	25	26	32	38	42
I		15	16	17.5	26.5	26.5	31	35
J		9	10	10.5	10.5	12	14	15
K		8	8.5	9	8.5	9.5	13	12
L		2.5	3	3	3	5	5	7
M		11	12	16.5	22.5	22.5	27.5	27.5
N		14	16	20	25	25	30	30
ØO		44	54	62	77	100	122	140
P		8	16	16	16	16	16	12
Q		3.4(M3)	3.5(M3)	3.5(M3)	4.5(M4)	5.5(M5)	6.6(M6)	9.0(M8)
ØR		64	74	84	102	132	158	180
S		8	12	12	12	12	12	18
ØT		3.5	3.5	3.5	4.5	5.5	6.6	6.6
U		/	/	3	5	5	5	6
V		/	/	M3	M5	M5	M5	M6

### BHD-I series

#### BHD-I series

Short cup combination type (ultra-thin hollow type) BHD-1 harmonic reducer series is the pursuit of flat limit type. The flexspline is a short hat structure. The circular spline and the cross bearing are integrated. The input is directly connected with the wave generator shaft hole. The installation method is:

Wave generator input, the end face of the circular spline is fixed, and the end face of the bearing connected by the flex-spline is output.

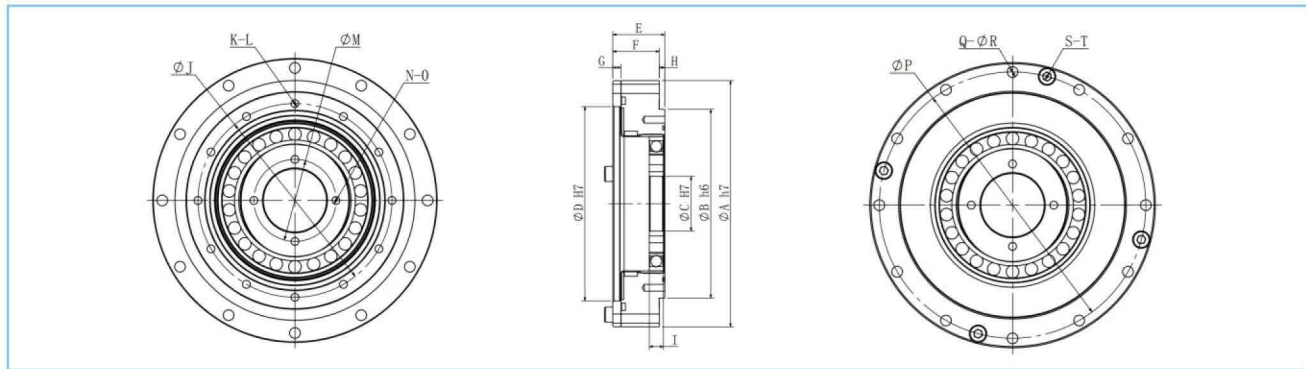


### BHD-I series data sheet

No.	Ratio	Rated torque	Star/stop max torque	Average load torque max allowable value	Instant max allowed	Instant max input speed (lubricating oil)	Allow average input speed (grease)	Backlash	Weight	Service life
		Nm	Nm	Nm	Nm	r/min	r/min			
14	50	3.6	11.7	4.7	23			≤20		12000
	80	5.1	15	6.2	29	8500	3500	≤10	0.34	15000
	100	5.4	19	7.4	34					
17	50	10.6	23	18	47			≤20		12000
	80	14	29	21	54	7300	3500	≤10	0.43	15000
	100	16	36	27	69					
20	50	16	37	23	66			≤20		12000
	100	26	57	34	90	6500	3500	≤10	0.53	15000
	160	26	62	34	90					
25	50	25	63	36	122			≤20		12000
	100	45	105	71	178	5600	3500	≤10	0.92	15000
	160	45	118	71	198					
32	50	51	146	73	262			≤20		12000
	100	94	242	149	412	4800	3500	≤10	1.9	15000
	160	94	276	149	436					



### BHD-I series



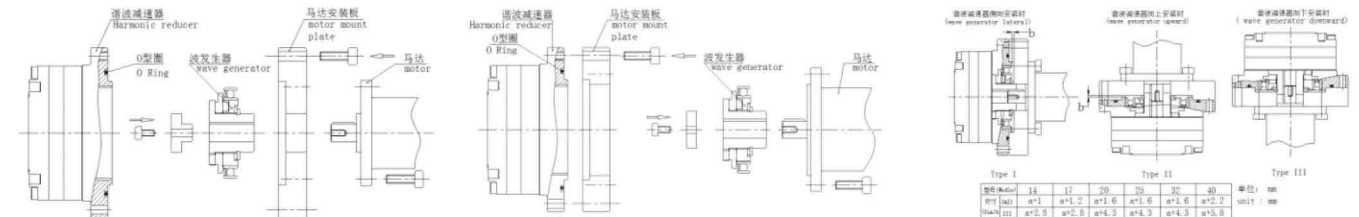
### BHD-I series size

Code	No.	14	17	20	25	32
ØA h7		70	80	90	110	142
ØB h6		49	59	69	84	110
ØC H7		11	15	20	24	32
ØD H7		50	61	71	88	114
E		17.5	18.5	19	22	27.9
F		15.5	16.5	17	20	23.6
G		2.4	3	3	3.3	3.6
H		2	2	2	2	4.3
I		5.4	6.5	5.2	6.4	8.6
ØJ		43	52	61.5	76	99
K		8	12	12	12	16
L		M3	M3	M3	M4	M5
ØM		17	21	26	30	40
N		4	4	4	4	4
O		M3	M3	M3	M3	M4
ØP		64	74	84	102	132
Q		8	12	12	12	12
ØR		3.4	3.4	3.4	4.5	5.5
S		2	2	4	4	4
T		M3	M3	M3	M3	M4

### Precautions

#### BCS series installation methods

1. CS series installation A. 2. CS series installation B. 3. Recommended installation method



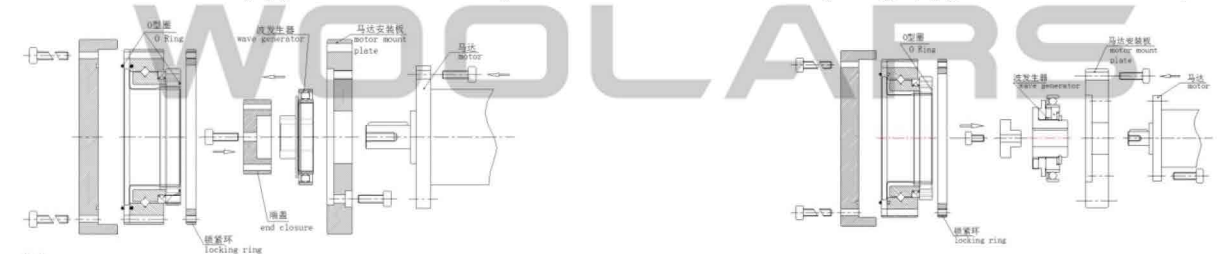
#### Installation Precautions

Improper installation may cause the harmonic reducer to vibrate during operation, abnormal noise, or even damage. Please observe the following installation items:

1. Before installation, please confirm whether the flatness of the mounting plate is good, and confirm whether there are any protrusions or foreign objects around the screw holes.
2. When assembling, avoid applying excessive external force to the bearing part of the wave generator. You can use the wave generator to rotate and smoothly insert into the flex-spline.
3. When using the coupling structure of the cross slider, pay special attention to the positional accuracy of the control installation position (recommended within 0.01-0.05mm).
4. When the wave generator is facing up or down, fill the gap between the wave generator and the flange mounting position with grease.

#### BHS series installation methods

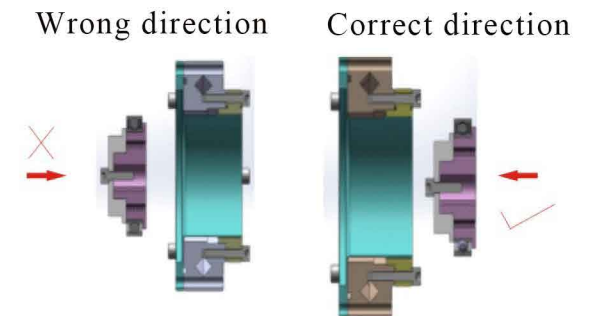
1. Wave generator is directly connected to the motor (type I connection)
2. Motor connect with cross slide coupling (type II connection)



#### Installation Precautions

Improper installation may cause the harmonic reducer to vibrate during operation, abnormal noise, or even damage. Please observe the following installation items:

1. Before installation, please confirm whether the flatness of the mounting plate is good, and confirm whether there are any protrusions or foreign objects around the screw holes.
2. When assembling, avoid applying excessive external force to the bearing part of the wave generator. You can use the wave generator to rotate and smoothly insert into the flex-spline.
3. When using the coupling structure of the cross slider, pay special attention to the positional accuracy of the control installation position (recommended within 0.01-0.05mm).
4. When the wave generator is facing up or down, fill the gap between the wave generator and the flange mounting position with grease.

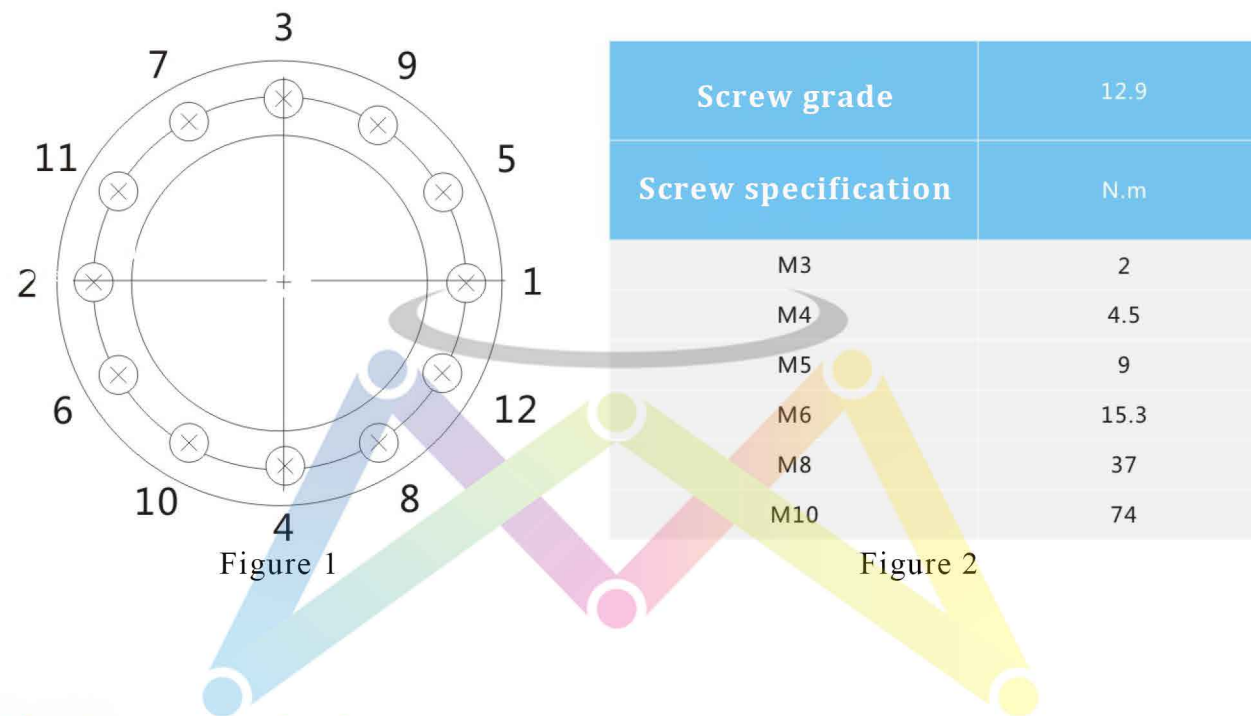




## Installation tips

### How to tighten the locking screw

Please lock the screws in turn according to the way of Figure 1, and then repeat fasten in turn again. The tightening torque is shown in Figure 2.



### Lubrication method

Recommended lubricant

Lubricant	SK-1A	SK-2	4BN0.2
Viscosity	265~295	265~295	290~320
Melting point	197°	198°	247°

1. The combined product is lubricated with grease. It has been added with grease before leaving the factory. It does not need to be refilled during assembly. The simple type is not sealed with grease when it is shipped, and it needs to be added separately during assembly.
2. Avoid mixing with other types of grease.
3. The following measures are taken to improve the lubrication life. Apply grease to each contact part at the initial stage of operation, and thoroughly remove the initial wear dust generated by each contact seal to replenish the grease for each contact.

## Instructions for use

### About warranty

1. In the normal assembly state, rated load operation and sufficient lubrication condition, the warranty period is 12 months or 3000H, whichever is the first reached.
2. Malfunction due to the following is not covered by the warranty:
  - a. Long-term exposure in the air, which affects product use due to dust, moisture, and water immersion.
  - b. The company is not responsible for any damage caused by the modification or dismantling of the product.
  - c. Malfunction due to improper use or violation of usage rules.
  - d. Malfunction caused by the quality of this product.
  - e. Malfunction caused by natural external forces that are not manpower controllable.

### Note:

1. Do not exceed the allowable torque when using
2. Please use in the following environment:  
Ambient temperature: 0 ° C ~ +40 ° C. Non-corrosive, explosive gas, no metal dust, no water splash/oil.
3. Seal the product after use to prevent dust and water from entering. Store in a cool place to prevent direct sunlight.
4. Do not hit the parts of the product with a hammer or the like. Make sure that the product does not deform or rupture due to falling or the like during installation. When the product is used in a damaged state, its performance cannot be guaranteed and also may cause damage.

### Anti-rust measures

1. The combined surface is not rust-proof.
2. Apply rust inhibitor to the surface when rust treatment is required.
3. In addition, if you need to implement surface anti-rust treatment, please consult an authorized agent.