

# Terminology and Definition

## 1. Rated Torque

This indicates the permissible continuous load when the input rotational speed is 2000 r/min.

## 2. Permissible Peak Torque for Start/Stop

Load torque is larger than the steady torque which applied to reducer by the load inertia moment for start and stop. Values from the ratings show the acceptable value at peak torque .

## 3. Permissible maximum momentary torque

Unexpected impact torque may be applied from the exterior except regular-load torque and load torque for emergency stop.

The maximum value of the impact torque must not exceed the maximum momentary torque, if not , it can damage the reducer.

## 4. Ratcheting Torque

When excess impact torque is applied during operation, the engagement of the teeth between the circular spline and the flexspline may be put momentarily out of alignment instead of damaging the flexspline. This phenomenon is called“ratcheting, and the torque is called“ratcheting torque”(see values on the corresponding page of each series).Operating the drive without fixing ratcheting will cause earlier teeth abrasion and shorter life of the wave generator bearing due to the effect of the grinding powder generated by ratcheting.

Please pay attention for below two points:

- ① When ratcheting is occur, the teeth may not be engaged correctly (out of alignment ) , Operating without fix it will cause vibration and damage the flexspline.
- ② Once ratcheting is occur, the tips of the teeth are worn and the torque value generated by ratcheting will be lowered.

## 5. Buckling Torque

When excess torque is applied to the flexspline(output) with the wave generator fixed,the flexspline causes elastic deformation, buckles on the body before long and will be destroyed.The torque at the time is called buckling torque.

### Starting Torque(N·cm)

| Model                  | 14  |     |     | 17   |     |     | 20  |      |     |      | 25   |      |      |     | 32   |      |      |     | 40  |     |     |     |
|------------------------|-----|-----|-----|------|-----|-----|-----|------|-----|------|------|------|------|-----|------|------|------|-----|-----|-----|-----|-----|
| Reduction Ratio        | 50  | 80  | 100 | 50   | 80  | 100 | 50  | 80   | 100 | 120  | 50   | 80   | 100  | 120 | 50   | 80   | 100  | 120 | 50  | 80  | 100 | 120 |
| HMCG-I                 | 3.6 | 2.6 | 2.3 | 5.6  | 3.6 | 3.2 | 7.3 | 4.5  | 4.1 | 3.6  | 13   | 8.5  | 7.6  | 6.9 | 29   | 18   | 17   | 14  | 51  | 32  | 29  | 26  |
| HMCG-II<br>HMHG-II/III | 4.5 | 3.1 | 2.8 | 6.7  | 4.4 | 3.7 | 8.6 | 5.4  | 4.7 | 4.2  | 17   | 10   | 8.8  | 8   | 34   | 21   | 20   | 17  | 61  | 39  | 34  | 31  |
| HMHG-I                 | 8.8 | 7.5 | 6.9 | 27   | 25  | 24  | 36  | 33   | 32  | 31   | 56   | 50   | 49   | 48  | 85   | 74   | 72   | 68  | 136 | 117 | 112 | 110 |
| HMHG-IV                | 5.7 | 4.4 | 3.7 | 9.7  | 7.2 | 6.5 | 14  | 11   | 9.9 | 9.3  | 22   | 15   | 14   | 13  | 41   | 29   | 27   | 24  | 72  | 52  | 47  | 44  |
| HMHG-V                 | 7.9 | 6.4 | 6   | 11.9 | 9.4 | 8.6 | 16  | 12.7 | 12  | 11.4 | 30.2 | 23.3 | 21.8 | 21  | 61.2 | 46.8 | 45.6 | 42  | -   | -   | -   | -   |

| Model           | 14  |     |     | 17  |     |     | 20  |     |     |     | 25 |    |     |     | 32 |    |     |     |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|-----|-----|----|----|-----|-----|
| Reduction Ratio | 50  | 80  | 100 | 50  | 80  | 100 | 50  | 80  | 100 | 120 | 50 | 80 | 100 | 120 | 50 | 80 | 100 | 120 |
| HMCD            | 4.4 | 3.5 | 2.8 | 6.7 | 4.5 | 3.8 | 8.9 | 5.5 | 5.1 | -   | 16 | 10 | 9.1 | -   | 32 | 20 | 20  | -   |
| HMHD            | 6.2 | 5.2 | 4.8 | 10  | 9   | 9   | 13  | 12  | 11  | -   | 20 | 18 | 17  | -   | 30 | 28 | 25  | -   |

## Performance Parameter

### HMCG、HMHG Series

| Model | Reduction Ratio | Rated torque at input 2000r/min | Permissible peak torque at start / stop | Permissible max. value of ave. load torque | Instantaneous permissible max. torque | Permissible max. input rotational speed | Permissible ave. input rotational speed | Backlash (arc sec) | Transmission accuracy (arc sec) |
|-------|-----------------|---------------------------------|---|--|---------------------------------------|---|---|--------------------|---------------------------------|
|       |                 | Nm                              | Nm                                      | Nm   | Nm                                    | r/min                                   | r/min                                   | ≤                  | ≤                               |
| 14    | 50              | 7                               | 23                                      | 9  | 46                                    | 8000                                    | 3500                                    | 20                 | 90                              |
|       | 80              | 10                              | 30                                      | 14   | 51                                    |   |   | 20                 | 90                              |
|       | 100             | 10                              | 36                                      | 14   | 70                                    |   |   | 10                 | 90                              |
| 17    | 50              | 21                              | 44                                      | 34   | 91                                    | 7000                                    | 3500                                    | 20                 | 90                              |
|       | 80              | 29                              | 56                                      | 35   | 113                                   |   |   | 20                 | 90                              |
|       | 100             | 31                              | 70                                      | 51   | 143                                   |   |   | 10                 | 90                              |
|       | 120             | 31                              | 70                                      | 51   | 112                                   |   |   | 10                 | 90                              |
| 20    | 50              | 33                              | 73                                      | 44   | 127                                   | 6000                                    | 3500                                    | 20                 | 60                              |
|       | 80              | 44                              | 96                                      | 61   | 165                                   |   |   | 20                 | 60                              |
|       | 100             | 52                              | 107                                     | 64   | 191                                   |   |   | 10                 | 60                              |
|       | 120             | 52                              | 113                                     | 64   | 191                                   |   |   | 10                 | 60                              |
|       | 160             | 52                              | 120                                     | 64   | 191                                   |   |   | 10                 | 60                              |
| 25    | 50              | 51                              | 127                                     | 72   | 242                                   | 5500                                    | 3500                                    | 20                 | 60                              |
|       | 80              | 82                              | 178                                     | 113  | 332                                   |   |   | 20                 | 60                              |
|       | 100             | 87                              | 204                                     | 140  | 369                                   |   |   | 10                 | 60                              |
|       | 120             | 87                              | 217                                     | 140  | 395                                   |   |   | 10                 | 60                              |
|       | 160             | 87                              | 229                                     | 140  | 408                                   |   |   | 10                 | 60                              |
| 32    | 50              | 99                              | 281                                     | 140  | 497                                   | 4500                                    | 3500                                    | 20                 | 60                              |
|       | 80              | 153                             | 395                                     | 217  | 738                                   |   |   | 10                 | 60                              |
|       | 100             | 178                             | 433                                     | 281  | 841                                   |   |   | 10                 | 60                              |
|       | 120             | 178                             | 459                                     | 281  | 892                                   |   |   | 10                 | 60                              |
|       | 160             | 178                             | 484                                     | 281  | 892                                   |   |   | 10                 | 60                              |
| 40    | 50              | 178                             | 523                                     | 255  | 892                                   | 4000                                    | 3000                                    | 10                 | 60                              |
|       | 80              | 268                             | 675                                     | 369  | 1270                                  |   |   | 10                 | 60                              |
|       | 100             | 345                             | 738                                     | 484  | 1400                                  |   |   | 10                 | 60                              |
|       | 120             | 382                             | 802                                     | 586  | 1530                                  |   |   | 10                 | 60                              |
|       | 160             | 382                             | 841                                     | 586  | 1530                                  |   |   | 10                 | 60                              |

### HMCG Series Ratcheting Torque(Nm)

| Reduction Ratio \ Model | 14  | 17  | 20  | 25  | 32   | 40   |
|-------------------------|-----|-----|-----|-----|------|------|
| 50                      | 110 | 190 | 280 | 580 | 1200 | 2300 |
| 80                      | 140 | 260 | 450 | 880 | 1800 | 3600 |
| 100                     | 100 | 200 | 330 | 650 | 1300 | 2700 |
| 120                     | -   | 150 | 310 | 610 | 1200 | 2400 |
| 160                     | -   | -   | 280 | 580 | 1200 | 2300 |

### HMCG Series Buckling Torque (Nm)

| Model      | 14  | 17  | 20  | 25   | 32   | 40   |
|------------|-----|-----|-----|------|------|------|
| All Ratios | 260 | 500 | 800 | 1700 | 3500 | 6700 |

### HMHG Series Ratcheting Torque(Nm)

| Reduction Ratio \ Model | 14  | 17  | 20  | 25  | 32   | 40   |
|-------------------------|-----|-----|-----|-----|------|------|
| 50                      | 110 | 190 | 280 | 580 | 1200 | 2300 |
| 80                      | 140 | 260 | 450 | 880 | 1800 | 3600 |
| 100                     | 100 | 200 | 330 | 650 | 1300 | 2700 |
| 120                     | -   | 150 | 310 | 610 | 1200 | 2400 |
| 160                     | -   | -   | 280 | 580 | 1200 | 2300 |

### HMHG Series Buckling Torque(Nm)

| Model      | 14  | 17  | 20  | 25   | 32   | 40   |
|------------|-----|-----|-----|------|------|------|
| All Ratios | 210 | 420 | 700 | 1300 | 2800 | 5200 |

## HMCD、HMHD Series

| Model | Reduction Ratio | Rated torque at input 2000r/min | Permissible peak torque at start / stop | Permissible max. value of ave. load torque | Instantaneous permissible max. torque | Permissible max. input rotational speed | Permissible ave. input rotational speed | Backlash (arc sec) | Transmission accuracy (arc sec) |
|-------|-----------------|---------------------------------|---|--|---------------------------------------|---|---|--------------------|---------------------------------|
|       |                 | Nm                              | Nm                                      | Nm   | Nm                                    | r/min                                   | r/min                                   | ≤                  | ≤                               |
| 14    | 50              | 3.5                             | 11.4                                    | 4.6  | 23                                    | 8000                                    | 3500                                    | 20                 | 90                              |
|       | 80              | 5.1                             | 15                                      | 6.2  | 29                                    |   |   | 20                 | 90                              |
|       | 100             | 5.1                             | 18                                      | 7  | 33                                    |   |   | 20                 | 90                              |
| 17    | 50              | 10.5                            | 22                                      | 17   | 46                                    | 7000                                    | 3500                                    | 20                 | 90                              |
|       | 80              | 14                              | 29                                      | 21   | 54                                    |   |   | 20                 | 90                              |
|       | 100             | 15                              | 35                                      | 26   | 67                                    |   |   | 20                 | 90                              |
| 20    | 50              | 16                              | 37                                      | 23   | 66                                    | 6000                                    | 3500                                    | 20                 | 90                              |
|       | 80              | 23                              | 49                                      | 28   | 78                                    |   |   | 10                 | 90                              |
|       | 100             | 27                              | 54                                      | 32   | 90                                    |   |   | 10                 | 90                              |
| 25    | 50              | 26                              | 66                                      | 36   | 121                                   | 5500                                    | 3500                                    | 20                 | 60                              |
|       | 80              | 42                              | 91                                      | 62   | 157                                   |   |   | 10                 | 60                              |
|       | 100             | 45                              | 105                                     | 71   | 175                                   |   |   | 10                 | 60                              |
| 32    | 50              | 50                              | 143                                     | 71   | 255                                   | 4500                                    | 3500                                    | 20                 | 60                              |
|       | 80              | 79                              | 202                                     | 126  | 350                                   |   |   | 10                 | 60                              |
|       | 100             | 91                              | 221                                     | 143  | 399                                   |   |   | 10                 | 60                              |

### HMCD Series Ratcheting Torque(Nm)

| Reduction Ratio | Model | 14 | 17  | 20  | 25  | 32   |
|-----------------|-------|----|-----|-----|-----|------|
| 50              |       | 88 | 150 | 220 | 450 | 980  |
| 80              |       | 90 | 170 | 280 | 550 | 1050 |
| 100             |       | 84 | 160 | 260 | 500 | 1000 |

### HMCD Series Buckling Torque(Nm)

| Model      | 14  | 17  | 20  | 25   | 32   |
|------------|-----|-----|-----|------|------|
| All Ratios | 190 | 330 | 560 | 1000 | 2200 |

### HMHD Series Ratcheting Torque(Nm)

| Reduction Ratio | Model | 14 | 17  | 20  | 25  | 32   |
|-----------------|-------|----|-----|-----|-----|------|
| 50              |       | 88 | 150 | 220 | 450 | 980  |
| 80              |       | 90 | 170 | 280 | 550 | 1050 |
| 100             |       | 84 | 160 | 260 | 500 | 1000 |

### HMHD Series Buckling Torque(Nm)

| Model      | 14  | 17  | 20  | 25  | 32   |
|------------|-----|-----|-----|-----|------|
| All Ratios | 130 | 260 | 470 | 850 | 1800 |

## Performance Parameter

| HMCG HMHG Series Hysteresis Loss and Rigidity |                 |     |     |                           |                                    |       |       |                             |     |
|---|-----------------|-----|-----|---------------------------|------------------------------------|-------|-------|-----------------------------|-----|
| Model   | Reduction Ratio | T1  | T2  | Hysteresis Loss<br>arcmin | Torsional Stiffness (10000 Nm/rad) |       |       | Torsional Quantity (arcmin) |     |
|   |                 | Nm  | Nm  |                           | K1                                 | K2    | K3    | θ1                          | θ2  |
| 14  | 50              | 2   | 6.9 | 2                         | 0.41                               | 0.47  | 0.57  | 1.7                         | 5.6 |
|   | >80             |     |     | 1                         | 0.56                               | 0.61  | 0.71  | 1.2                         | 4.2 |
| 17  | 50              | 3.9 | 12  | 2                         | 0.97                               | 1.00  | 1.30  | 1.4                         | 4.2 |
|   | >80             |     |     | 1                         | 1.20                               | 1.40  | 1.60  | 1.1                         | 3.3 |
| 20  | 50              | 7   | 25  | 2                         | 1.56                               | 1.80  | 2.30  | 1.6                         | 5.3 |
|   | >80             |     |     | 1                         | 1.92                               | 2.50  | 2.90  | 1.3                         | 3.9 |
| 25  | 50              | 14  | 48  | 2                         | 3.00                               | 3.40  | 4.40  | 1.6                         | 5.4 |
|   | >80             |     |     | 1                         | 3.72                               | 5.00  | 5.70  | 1.3                         | 3.8 |
| 32  | 50              | 29  | 108 | 2                         | 6.48                               | 7.80  | 9.80  | 1.6                         | 5.4 |
|   | >80             |     |     | 1                         | 8.00                               | 11.00 | 12.00 | 1.2                         | 4.0 |
| 40  | 50              | 54  | 198 | 2                         | 12.00                              | 14.00 | 18.00 | 1.6                         | 5.3 |
|   | >80             |     |     | 1                         | 15.60                              | 20.00 | 23.00 | 1.2                         | 3.8 |

\*The values of Rigidity in this table are for reference, the lower-limit value is about 80% of the value listed above..

| HMCD HMHDSeries Hysteresis Loss and Rigidity |                 |     |     |                           |                                    |      |      |                             |     |
|--|-----------------|-----|-----|---------------------------|------------------------------------|------|------|-----------------------------|-----|
| Model  | Reduction Ratio | T1  | T2  | Hysteresis Loss<br>arcmin | Torsional Stiffness (10000 Nm/rad) |      |      | Torsional Quantity (arcmin) |     |
|  |                 | Nm  | Nm  |                           | K1                                 | K2   | K3   | θ1                          | θ2  |
| 14   | 50              | 2   | 6.9 | 2.5                       | 0.29                               | 0.37 | 0.47 | 2.4                         | 6.4 |
|  | >80             |     |     | 2                         | 0.4                                | 0.44 | 0.61 | 1.7                         | 5.4 |
| 17   | 50              | 3.9 | 12  | 2                         | 0.67                               | 0.88 | 1.20 | 2.0                         | 4.6 |
|  | >80             |     |     | 1                         | 0.84                               | 0.94 | 1.30 | 1.6                         | 4.3 |
| 20   | 50              | 7   | 25  | 2                         | 1.1                                | 1.3  | 2    | 2.2                         | 6.6 |
|  | >80             |     |     | 1                         | 1.3                                | 1.7  | 2.5  | 1.8                         | 5.0 |
| 25   | 50              | 14  | 48  | 2                         | 2                                  | 2.7  | 3.7  | 2.4                         | 6.1 |
|  | >80             |     |     | 1                         | 2.7                                | 3.7  | 4.7  | 1.8                         | 4.5 |
| 32   | 50              | 29  | 108 | 2                         | 4.7                                | 6.1  | 8.4  | 2.1                         | 6.1 |
|  | >80             |     |     | 1                         | 6.1                                | 7.8  | 11   | 1.7                         | 4.8 |

\*The values of Rigidity in this table are for reference, the lower-limit value is about 80% of the value listed above..

### Rigidity

Fixing the input side (wave generator), the torsional angle and torsional stiffness when applying torque to the output side (flexspline) generates torsion almost proportional to the torque on the output side.

Torsional Stiffness = Torque T / Torsional Angle θ

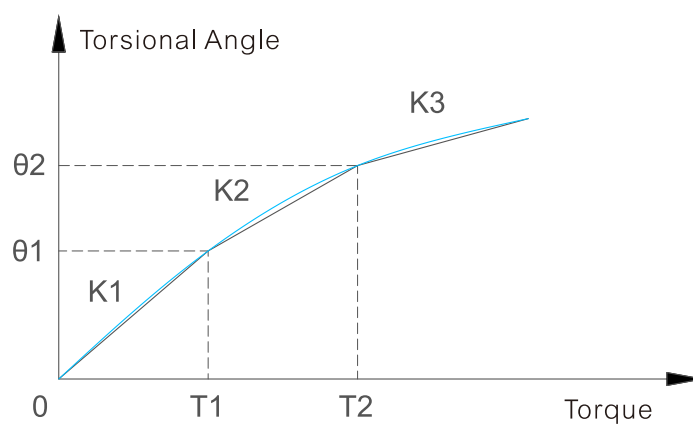
K1...The torsional stiffness of the torque from 0 to T1

K2...The torsional stiffness of the torque from T1 to T2

K3...The torsional stiffness of the torque from T3 to T4

### Hysteresis Loss

Fixing the input side (wave generator), after the torque is applied up to the rated torque value, the torque is brought back to zero, the torsional angle will not become absolutely zero and a small amount remains, this calls hysteresis loss.



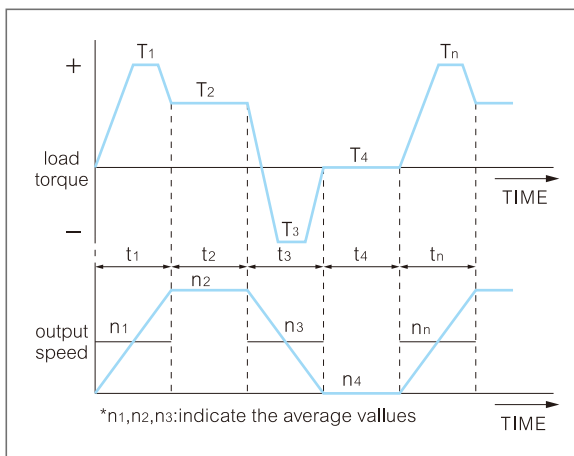
# Selection process

Please select the model according to the following flow chart. Whenever a value exceeds the rating table, reconsider a larger model or consider to reduce the load torque and other conditions.

In general, the servo system can nearly impossible operate continuously with a certain amount of load. Input speed and load torque will change, and there will be a large torque effect when starting and stopping. In addition, there will be unexpected impact torque.

### Confirmation of load torque mode

First, the mode of load torque must be mastered, please confirm the specifications shown below.



Calculate the average load torque applied to the output side of the harmonic drive according to the load torque model:  $T_{av}$  (Nm)

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

Select the model temporarily according to the following conditions  
 $T_{av} \leq$  Maximum permissible value of average load torque (refer to the rated tables of each series)

● Calculate the average output speed:  $no_{av}$  (r/min)

$$no_{av} = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + \dots + t_n}$$

● Confirm the reduction ratio (R)  
 $ni_{max}$  Will be restricted according to the motor

$$\frac{ni_{max}}{no_{max}} \geq R$$

● Calculate the average input speed ( $ni_{av}$  (r/min)) according to the average output speed ( $no_{av}$ ) and reduction ratio (R)

$$ni_{av} = no_{av} \cdot R$$

● Calculate the maximum input speed ( $ni_{max}$  (r/min)) according to the maximum output speed ( $no_{max}$ ) and reduction ratio (R)

$$ni_{max} = no_{max} \cdot R$$

Calculate the values of each load torque mode

|                  |               |
|------------------|---------------|
| Load Torque      | $T_n$ (Nm)    |
| Time             | $t_n$ (sec)   |
| The output speed | $n_n$ (r/min) |

#### Normal mode of operation

|                         |                 |
|-------------------------|-----------------|
| Starting Time           | $T_1, t_1, n_1$ |
| Steady operation time   | $T_2, t_2, n_2$ |
| Stopping time (slowing) | $T_3, t_3, n_3$ |
| Break Time              | $T_4, t_4, n_4$ |

#### Maximum rotational speed

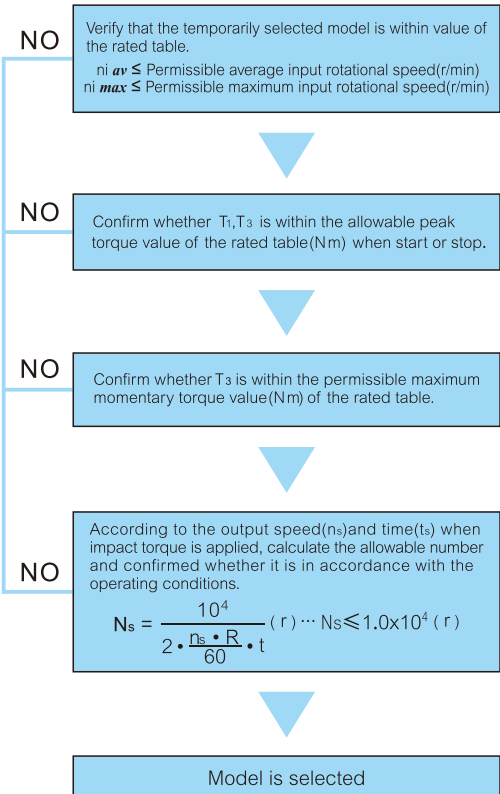
|                      |            |
|----------------------|------------|
| Maximum output speed | $no_{max}$ |
| Maximum input speed  | $ni_{max}$ |

(restricted by motor)

#### Impact torque

|                             |                 |
|-----------------------------|-----------------|
| When impact torques applied | $T_s, t_s, n_s$ |
|-----------------------------|-----------------|

Study working condition or model again



## Main roller bearings Specification

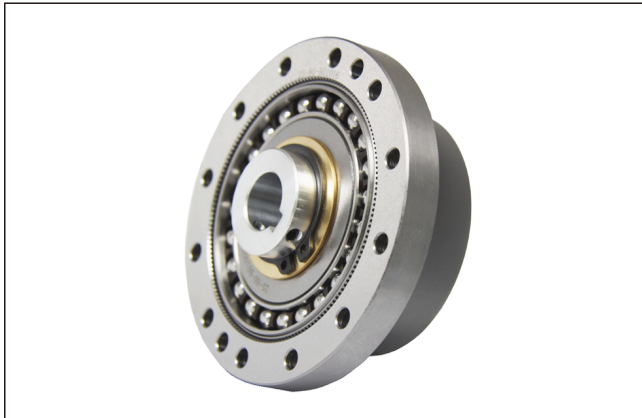
Crossed roller bearing is used in the unit type to directly support the external load.

| Crossed Roller Bearing Specification                  |       |                       |                           |                         |                         |
|---|-------|-----------------------|---------------------------|-------------------------|-------------------------|
| Series  | Model | Rigidity              | Permissible Static Torque | Rated Dynamic load      | Rated Static Load       |
|   |       | $10^4 \text{ Nm/rad}$ | Nm                        | $\times 10^2 \text{ N}$ | $\times 10^2 \text{ N}$ |
| HMCG-II<br>HMCG-II-E                                  | 14    | 4.38                  | 41                        | 47                      | 60.7                    |
|   | 17    | 7.75                  | 64                        | 52.9                    | 75.5                    |
|   | 20    | 12.8                  | 91                        | 57.8                    | 90                      |
|   | 25    | 24.2                  | 156                       | 96                      | 151                     |
|   | 32    | 53.9                  | 313                       | 150                     | 250                     |
|   | 40    | 91                    | 450                       | 213                     | 365                     |
| HMHG-I<br>HMHG-IV<br>HMHG-II<br>HMHG-II-E<br>HMHG-III | 14    | 8.5                   | 74                        | 58                      | 86                      |
|   | 17    | 15.4                  | 124                       | 104                     | 163                     |
|   | 20    | 25.2                  | 187                       | 146                     | 220                     |
|   | 25    | 39.2                  | 258                       | 218                     | 358                     |
|   | 32    | 100                   | 580                       | 382                     | 654                     |
|   | 40    | 179                   | 849                       | 433                     | 816                     |
| HMCD-II   | 14    | 4.38                  | 41                        | 47                      | 60.7                    |
|   | 17    | 7.75                  | 64                        | 52.9                    | 75.5                    |
|   | 20    | 12.8                  | 91                        | 57.8                    | 90                      |
|   | 25    | 24.2                  | 156                       | 96                      | 151                     |
|   | 32    | 53.9                  | 313                       | 150                     | 250                     |
| HMHD-III  | 14    | 7.08                  | 37                        | 29                      | 43                      |
|   | 17    | 12.7                  | 62                        | 52                      | 81                      |
|   | 20    | 21                    | 93                        | 73                      | 110                     |
|   | 25    | 21                    | 129                       | 109                     | 179                     |
|   | 32    | 82.1                  | 290                       | 191                     | 327                     |

\*The values of Rigidity in this table are for reference, the lower-limit value is about 80% of the value listed above..

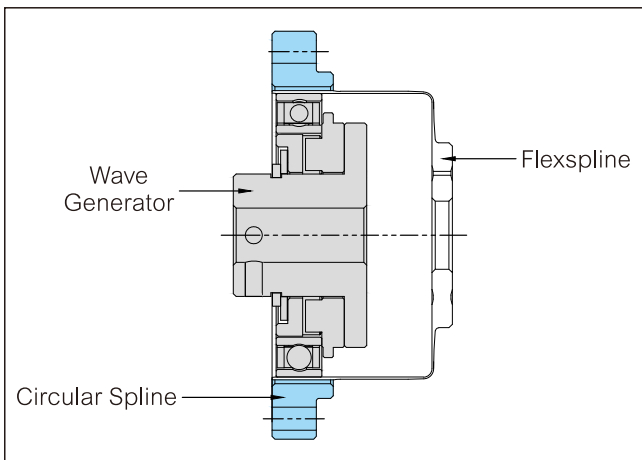
# HMCG-I series Harmonic gearbox

## HMCG-I series product details



### Component type

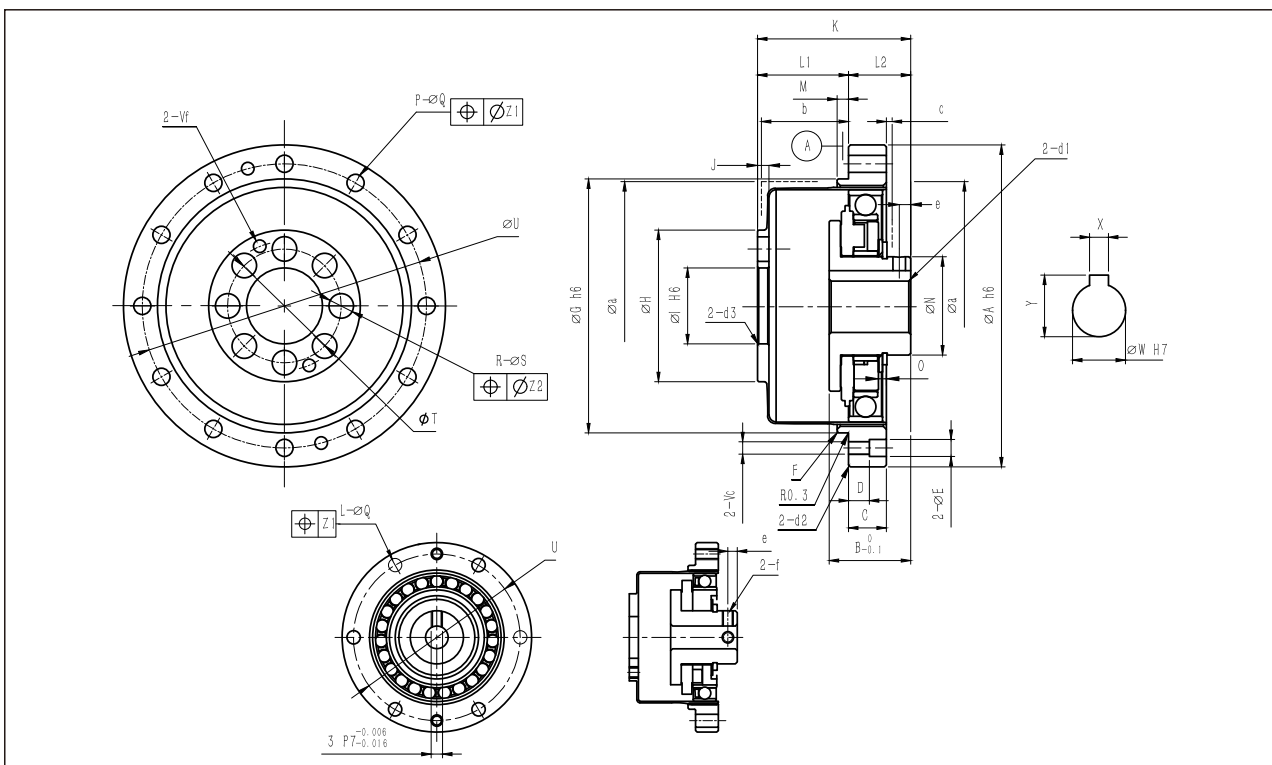
HMCG-I series consists of three basic components: flexspline, circular spline and wave generator. The flexspline is a cup-shaped standard structure, and its input shaft directly cooperates with the inner hole of wave generator and connects with it through flat key or fastening screw.



### Product features

1. Three basic components
2. Compact and simple design
3. No Backlash
4. Input/output coaxial
5. Excellent positioning accuracy and rotation accuracy
6. Compared to HMCS series, torque capacity has been improved by 30%
7. Compared to HMCS series, life time has been improved by 43%

## HMCG-I series dimension drawing



# HMCG-I series Harmonic gearbox

## HMCG-I series dimension table

unit : mm

| Symbol          | Module       | 14       | 17       | 20                                | 25                                | 32                                | 40                                |
|-----------------|--------------|----------|----------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| ∅A h6           |              | 50       | 60       | 70                                | 85                                | 110                               | 135                               |
| B <sub>h6</sub> |              | 18.5     | 20.7     | 21.5                              | 21.6                              | 23.6                              | 29.7                              |
| C               |              | 6        | 6.5      | 7.5                               | 10                                | 14                                | 17                                |
| D               |              | -        | -        | 4                                 | 6                                 | 7                                 | 7                                 |
| ∅E              |              | -        | -        | 3.5                               | 4.5                               | 5.5                               | 6.6                               |
| F               |              | C0.3     | C0.4     | C0.4                              | C0.4                              | C0.4                              | C0.4                              |
| ∅G h6           |              | 38       | 48       | 54                                | 67                                | 90                                | 110                               |
| ∅H h6           |              | 23       | 27.2     | 32                                | 40                                | 52                                | 64                                |
| ∅I H6           |              | 11       | 10       | 16                                | 20                                | 26                                | 32                                |
| J               |              | 2.4      | 3        | 3                                 | 3                                 | 3.2                               | 4.1                               |
| K               |              | 28.6±0.2 | 32.2±0.2 | 33.5±0.2                          | 37.2±0.2                          | 44±0.2                            | 53±0.2                            |
| L1              |              | 17.5     | 20       | 21.5                              | 24                                | 28                                | 34                                |
| L2              |              | 11.1     | 12.2     | 12                                | 13.2                              | 16                                | 19                                |
| M               |              | 2        | 2.5      | 3                                 | 3                                 | 3                                 | 4                                 |
| ∅N              |              | 14       | 18       | 21                                | 26                                | 26                                | 32                                |
| O               |              | 0.4      | 0.3      | 0.1                               | 2.1                               | 2.5                               | 3.3                               |
| P               |              | 8        | 16       | 16                                | 16                                | 16                                | 16                                |
| ∅Q              |              | 3.5      | 3.4      | 3.5                               | 4.5                               | 5.5                               | 6.6                               |
| R               |              | 6        | 6        | 8                                 | 8                                 | 8                                 | 8                                 |
| ∅S              |              | 4.5      | 5.5      | 5.5                               | 6.6                               | 9                                 | 11                                |
| T(PCD)          |              | 17       | 19       | 24                                | 30                                | 40                                | 50                                |
| U(PCD)          |              | 44       | 54       | 62                                | 75                                | 100                               | 120                               |
| Vc              |              | M3       | M3       | M3                                | M4                                | M5                                | M6                                |
| Vf              |              | M3       | M3       | M3                                | M4                                | M5                                | M6                                |
| ∅W              | Standard(H7) | 6        | 8        | 11                                | 14                                | 14                                | 14                                |
|                 | Maximum size | 8        | 10       | 13                                | 15                                | 15                                | 15                                |
| XJS9            |              | -        | -        | 4                                 | 5                                 | 5                                 | 5                                 |
| Y               |              | -        | -        | 12.8 <sup>+0.1</sup> <sub>0</sub> | 16.3 <sup>+0.1</sup> <sub>0</sub> | 16.3 <sup>+0.1</sup> <sub>0</sub> | 16.3 <sup>+0.1</sup> <sub>0</sub> |
| ∅Z1             |              | 0.25     | 0.2      | 0.25                              | 0.25                              | 0.25                              | 0.25                              |
| ∅Z2             |              | 0.25     | 0.25     | 0.25                              | 0.3                               | 0.5                               | 0.25                              |
| ∅a              |              | 38       | 45       | 53                                | 66                                | 86                                | 106                               |
| b               |              | 17.1     | 19       | 20.5                              | 23                                | 26.8                              | 33                                |
| c               |              | 1        | 1        | 1.5                               | 1.5                               | 1.5                               | 2                                 |
| Cd1             |              | 0.4      | 0.4      | 0.4                               | 0.4                               | 0.4                               | 0.5                               |
| Cd2             |              | 0.4      | 0.4      | 0.4                               | 0.4                               | 0.4                               | 0.5                               |
| Cd3             |              | 0.5      | 0.5      | 0.5                               | 0.5                               | 0.5                               | 0.5                               |
| e               |              | 2.5      | 3        | -                                 | -                                 | -                                 | -                                 |
| f               |              | M3X4     | M3X6     | -                                 | -                                 | -                                 | -                                 |
| Weight(kg)      |              | 0.100    | 0.17     | 0.26                              | 0.43                              | 0.91                              | 1.8                               |

## HMCG-I series performance parameter

| Model | Reduction ratio | Rated torque at input 2000r/min | Permissible peak torque at start / stop | Permissible max. value of ave.load torque | Instantaneous permissible max. torque | Permissible max. input rotational speed | Permissible ave. input rotational speed | Backlash (arc sec) | Transmission accuracy (arc sec) | Weight |
|-------|-----------------|---------------------------------|---|---|---------------------------------------|---|---|--------------------|---------------------------------|--------|
|       |                 | Nm                              | Nm                                      | Nm  | Nm                                    | r/min                                   | r/min                                   | ≤                  | ≤                               | kg     |
| 14    | 50              | 7                               | 23                                      | 9   | 46                                    | 8000                                    | 3500                                    | 20                 | 90                              | 0.1    |
|       | 80              | 10                              | 30                                      | 14  | 51                                    |   |   | 20                 | 90                              |        |
|       | 100             | 10                              | 36                                      | 14  | 70                                    |   |   | 10                 | 90                              |        |
| 17    | 50              | 21                              | 44                                      | 34  | 91                                    | 7000                                    | 3500                                    | 20                 | 90                              | 0.17   |
|       | 80              | 29                              | 56                                      | 35  | 113                                   |   |   | 20                 | 90                              |        |
|       | 100             | 31                              | 70                                      | 51  | 143                                   |   |   | 10                 | 90                              |        |
| 20    | 50              | 33                              | 73                                      | 44  | 127                                   | 6000                                    | 3500                                    | 20                 | 60                              | 0.26   |
|       | 80              | 44                              | 96                                      | 61  | 165                                   |   |   | 20                 | 60                              |        |
|       | 100             | 52                              | 107                                     | 64  | 191                                   |   |   | 10                 | 60                              |        |
|       | 120             | 52                              | 113                                     | 64  | 191                                   |   |   | 10                 | 60                              |        |
| 25    | 50              | 51                              | 127                                     | 72  | 242                                   | 5500                                    | 3500                                    | 20                 | 60                              | 0.43   |
|       | 80              | 82                              | 178                                     | 113                                       | 332                                   |   |   | 20                 | 60                              |        |
|       | 100             | 87                              | 204                                     | 140                                       | 369                                   |   |   | 10                 | 60                              |        |
|       | 120             | 87                              | 217                                     | 140                                       | 395                                   |   |   | 10                 | 60                              |        |
| 32    | 50              | 99                              | 281                                     | 140                                       | 497                                   | 4500                                    | 3500                                    | 20                 | 60                              | 0.91   |
|       | 80              | 153                             | 395                                     | 217                                       | 738                                   |   |   | 10                 | 60                              |        |
|       | 100             | 178                             | 433                                     | 281                                       | 841                                   |   |   | 10                 | 60                              |        |
|       | 120             | 178                             | 459                                     | 281                                       | 892                                   |   |   | 10                 | 60                              |        |
| 40    | 50              | 178                             | 523                                     | 255                                       | 892                                   | 4000                                    | 3000                                    | 10                 | 60                              | 1.8    |
|       | 80              | 268                             | 675                                     | 369                                       | 1270                                  |   |   | 10                 | 60                              |        |
|       | 100             | 345                             | 738                                     | 484                                       | 1400                                  |   |   | 10                 | 60                              |        |
|       | 120             | 382                             | 802                                     | 586                                       | 1530                                  |   |   | 10                 | 60                              |        |