Cone Drive HARMONIC SOLUTIONS®



HBC

- Space efficient, simple design
- Design conducive to machinery integration requirements
- Complete customization available
- Dimensionally interchangeable with competitive products
- Compare to 'High Torque' version from competitors'



HBCF-

- Space efficient, simple design
- Design conducive to machinery integration requirements
- Complete customization available
- Same internal components as standard HBC component gearset
- Bolt patterns to match competitors' lower torque 'F' style



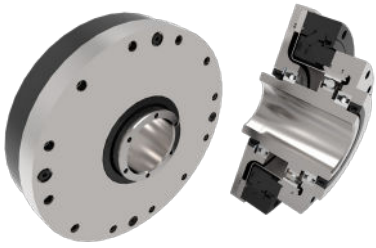
HBG

- Housed output with cross roller bearing included
- Complete customization available
- Dimensionally interchangeable with competitive products
- Compare to 'High Torque' version from competitors'



HBGT-

- Housed output with cross roller bearing included
- Large hollow shaft allows cable / equipment to pass through gearing
- Complete customization available
- Same internal components as standard HBG gearhead
- Compare to 'High Torque' version from competitors'



HBGHL

- Housed output with cross roller bearing included
- Large hollow shaft allows cable / equipment to pass through gearing
- Complete customization available
- Same internal components as standard HBG gearhead
- Fully supported and sealed gearhead

MADE IN USA

ULTIMATE PRECISION. ULTIMATE CONTROL.

Harmonic gearing is low to zero backlash by design. It provides high transmission accuracy and can support a high ratio reduction in a single stage with lower inertia. The highly accurate, torque dense design makes harmonic gears a great solution for robotic and positioning applications.







Ring Component

PRODUCT SPECIFICATIONS

Sizes: 14, 17, 20, 25, 32

Flex Spine Sizes: Single & double input bearing

Configuration: Component set only. No gearhead option

Continuous Output Torque: Up to 136 Nm (1204 in. lb)

Peak Output Torque: Up to 330 Nm (2921 in. lb)

Gear Ratios: 50:1 to 160:1

Standard Input Options: Keyed or set screws

Custom Input Options: Through bore, Dowel Pins, Tapped Holes, Piloted, Stepper/Servo Motor Ready, Special Materials and Coatings

Hat Component & Gearhead

PRODUCT SPECIFICATIONS

Sizes: 14 ,17, 20, 25, 32

Configuration: Component gearset or gearhead. Sealed, through bore, lightweight, and other options available

Continuous Output Torque: Up to 172 Nm (1522 in. lb)

Peak Output Torque: Up to 824 Nm (7293 in. lb)

Gear Ratios: 50:1 to 160:1; ratio offerings are size dependent

Standard Input Options: Keyed or set screws. Includes Oldham style coupling

Custom Input Options: Through bore, Solid Input, Dowel Pins, Tapped Holes, Piloted, Stepper/Servo Motor Ready, Special Materials and Coatings

Cup Component & Gearhead

PRODUCT SPECIFICATIONS

Sizes: 11, 14, 17, 20, 25, 32

Configurations: Component gearset or gearhead. Large bore (lightweight) and other options available

Continuous Output Torque: Up to 172 Nm (1522 in. lb)

Peak Output Torque: Up to 824 Nm (7293 Nm)

Gear Ratios: 50:1 to 160:1; ratio offerings are size dependent

Standard Input Options: Keyed or set screws. Includes Oldham style coupling

Custom Input Options: Solid Input, Dowel Pins, Tapped Holes, Piloted, Stepper/Servo Motor Ready, Special Materials and Coatings

With each revolution of the wave generator, the OD spline moves two teeth in the opposite direction. One tooth for each 180 degrees of wave generator rotation. A high gear reduction is possible because many gear teeth can be formed into the OD spline and mating ID spline.

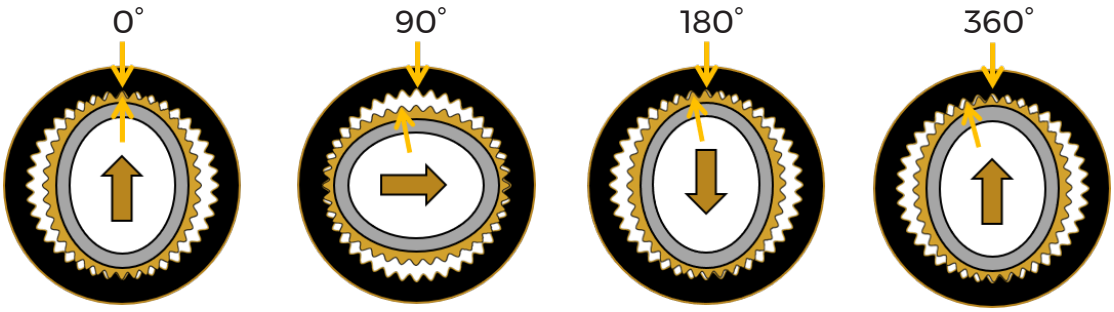


KEY

ID Spline (circular spline)
Rigid, circular ring with gear teeth on the inner diameter

OD Spline (flex spline)
Thin alloy steel designed for increased compliance in radial deflection

Wave Generator
Elliptical disc with an outer ball bearing



⚠ WARNING: ***Failure to observe the following warnings could lead to a risk of death or serious bodily harm.***

Do not exceed catalog ratings and follow all catalog guidelines and precautions.

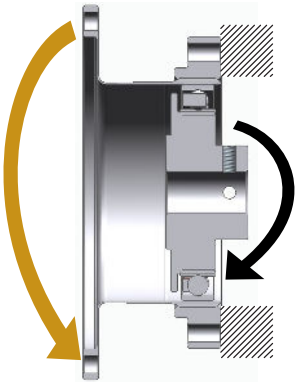
Do not use standard catalog products in explosive or corrosive environments.

Improper handling, installation, misuse and not adhering to the guidelines, procedures and lubrication applications outlined hereafter may result in damage to the product, cause physical injury or harm, and void the product warranty.

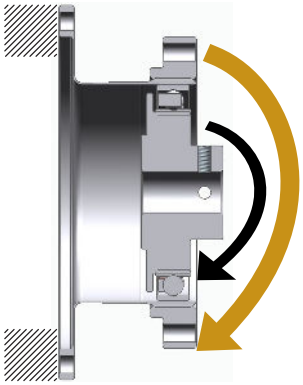
Please contact Cone Drive at ae@conedrive.com for applications involving human transport or contact, medical equipment, nuclear equipment, aircraft equipment, space or vacuum equipment, or other safety related applications

Reduction Ratio: Hat Style (HBC/HBG)

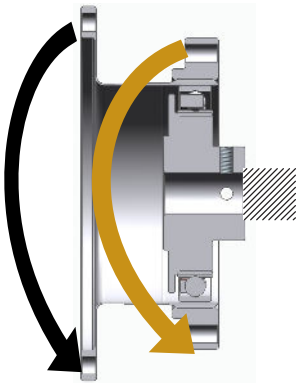
i = -1 / R



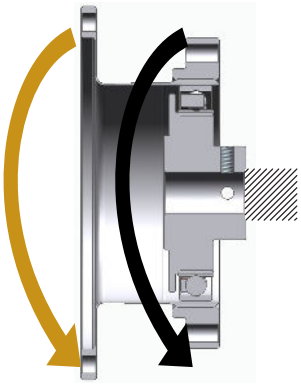
i = 1 / (R+1)



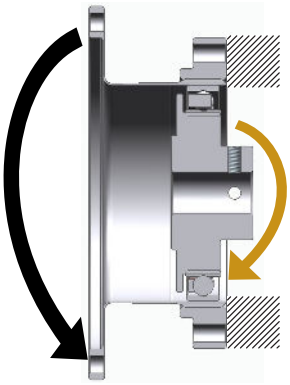
i = R / (R+1)



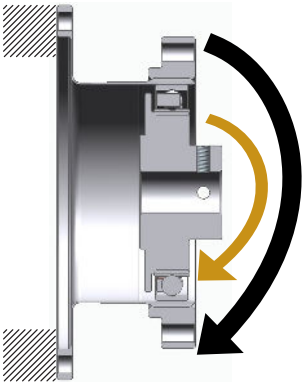
i = (R+1) / R

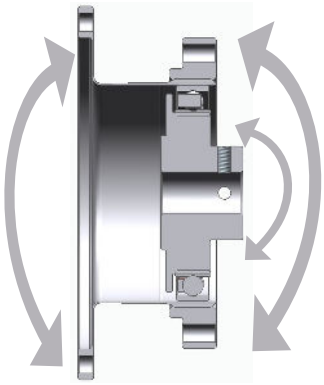


i = -R



i = R + 1





VARIABLE RATIO:

A combination of final drive ratios available with all components in motion

i = Final Drive Ratio
R = Reducer Catalog Ratio

Stationary

Input **Output**

Harmonic Unit Designation

1	2	3	4	5	6	7	8	9	10	11
C	B	C	1	4	1	0	8	0	-	-

1 OD SPLINE STYLE

C	Cup
R	Ring
H	Hat

2 ID SPLINE STYLE

B	Big
L	Little

3 TYPE

C	Component Set
G	Gearhead, Non-Sealed

4 - 5 SIZE

1	1
1	4
1	7
2	0
2	5
3	2

6 REVISION LEVEL

0
1
2
3

**Contact ae@conedrive.com for support on determining individual revision level.*

7-9 RATIO

0	5	0
0	8	0
1	0	0
1	2	0
1	6	0

10 EXTENDED TYPE*

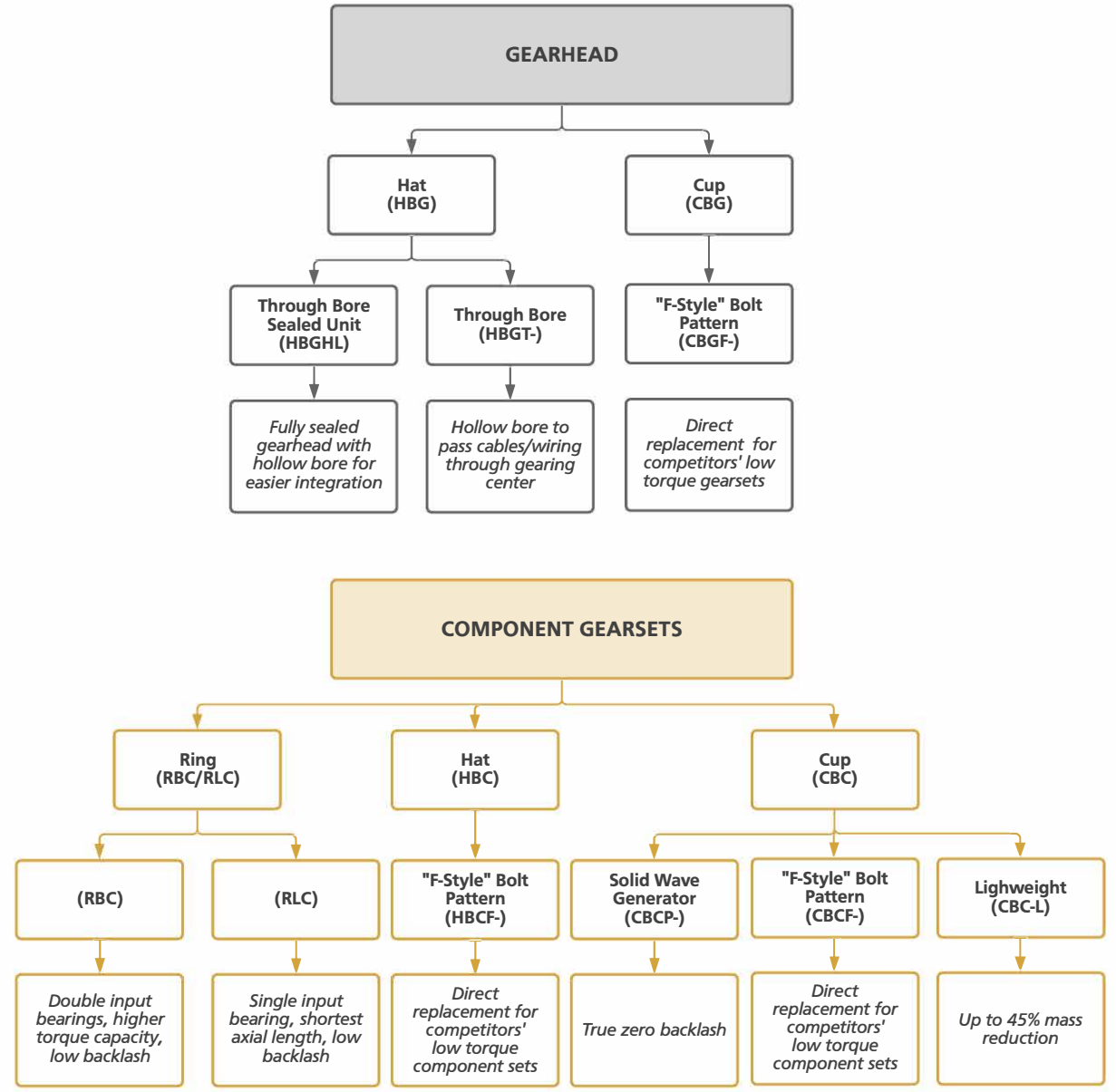
-	Standard (Oldham coupling standard; see page 46)
H	Sealed Gearhead, Hollow Input
S	Sealed Gearhead, Solid Input
T	Non-Sealed Gearhead, Thru-Bore/Hollow Input
P	One-Piece Input (Replacement for Mulit-Piece Oldham Input)
F	Equivalent Interface to Competitor Low Torque Option

**For custom options, contact ae@conedrive.com*

11 EXTENDED TYPE

-	Standard
L	Lightweight

We reserve the right to improve or change product design and specifications without notice.

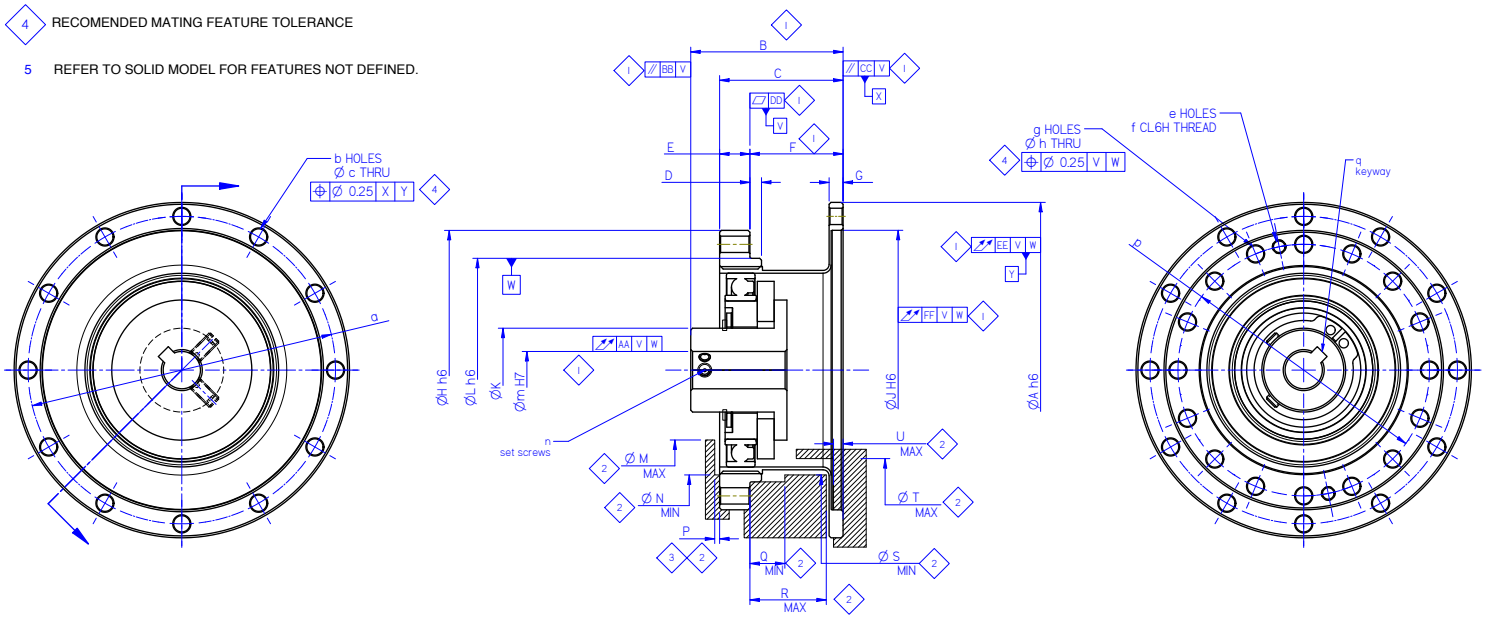


Style	Available Sizes	Through Bore	Backlash	Torsional Stiffness	Torque Capacity	Lifetime (L_{10})
			arcmin			hrs
CBC	11 - 32	Available (small)	Ultra Low to Zero	Highest		10,000
HBC	14 - 32	Available (large)	Ultra Low to Zero	Highest		10,000
RLC	14 - 32	Available (large)	< 3	Lowest		3,000
RBC	14 - 32	Available (large)	< 3	Medium		3,000
CBG	11 - 32	Available (small)	Ultra Low to Zero	Highest		10,000
HBG	14 - 32	Available (large)	Ultra Low to Zero	Highest		10,000

Harmonic Hat - Component Set Dimensional Drawings

NOTES

1. RECOMMENDED ASSEMBLY TOLERANCE FOR PROPER OPERATION
2. RECOMMENDED HOUSING / CASE DIMENSIONS FOR PROPER CLEARANCE AND LUBRICANT RETENTION.
3. IF THE APPLICATION REQUIRES OPERATION SUCH THAT THE WAVE GENERATOR IS MOUNTED VERTICAL FACING UPWARD FOR EXTENDED PERIODS, INCREASE THE NOTED DIMENSION TO 2 x THE CURRENT VALUE.
4. RECOMENDED MATING FEATURE TOLERANCE
5. REFER TO SOLID MODEL FOR FEATURES NOT DEFINED.



*Solid model available on configurator

Cross hatched pattern indicates housing and is the responsibility of the customer

Size	ØA	B	C	D	E	R	G	ØH	ØJ	ØK	Øa	b	c	e	f	g	Øh
	(all units in mm unless otherwise noted)																
14	60	28.6 - 29.0	23.5	2	6	17.5 - 17.9	2.4	50	48	6	54	8	3.5	2	M3 x 0.5	8	3.5
17	72	32.5 - 32.9	26.5	2.5	6.5	20.0 - 20.5	3	60	60	8	66	12	3.5	2	M3 x 0.5	16	3.5
20	82	33.5 - 33.9	29.3	3	7.5	21.5 - 22.1	3	70	70	9	76	12	3.5	2	M3 x 0.5	16	3.5
25	104	37.0 - 37.5	34.3	3	10	24.0 - 24.6	3.3	85	88	11	96	12	4.5	2	M4 x 0.7	16	4.5
32	134	44.0 - 44.6	42.3	3	14	28.0 - 28.6	3.6	110	114	14	124	12	5.5	2	M5 x 0.8	16	5.5

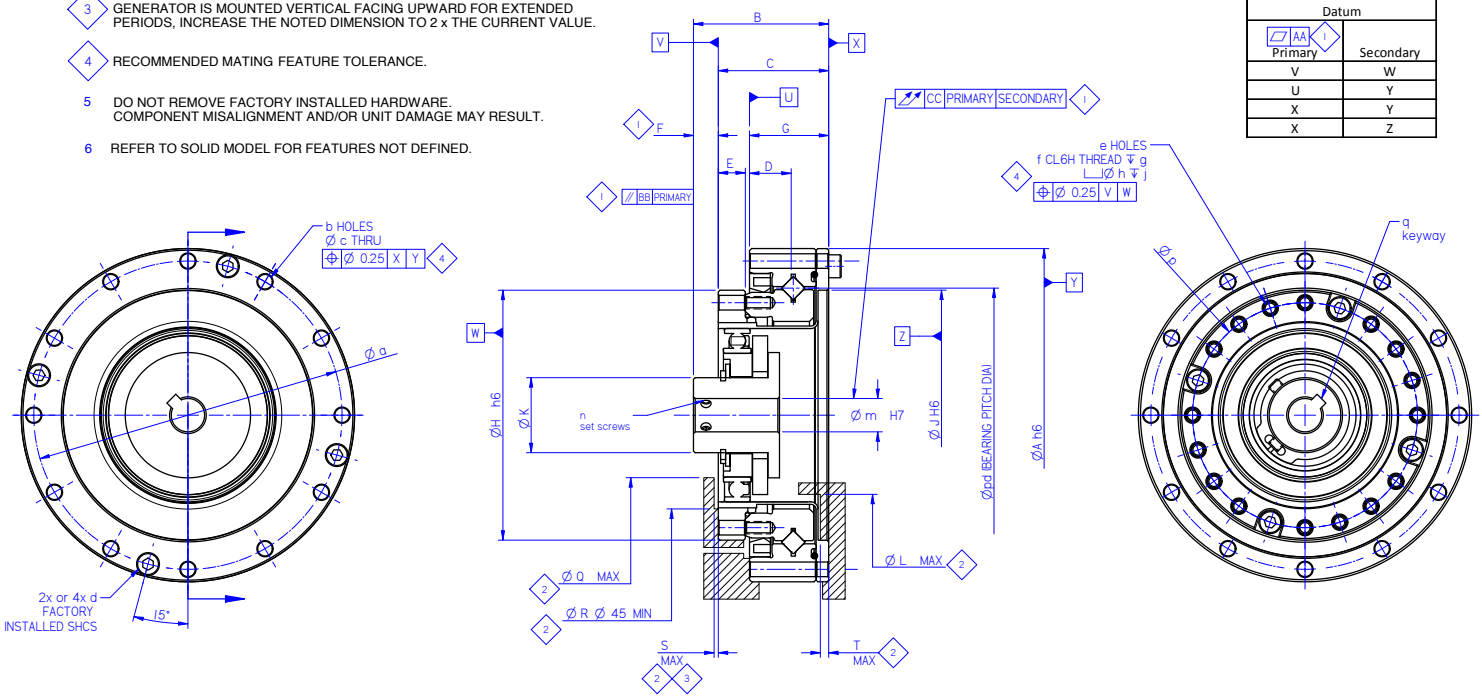
Size	Øm	n	p	q	ØM	ØN	P	Q	R	ØS	ØT	U	AA	BB	CC	DD	EE	FF
	(all units in mm unless otherwise noted)																	
14	6	2 x M3 x 0.5 x 4	44	-	25	38	1	-	14.6	38	31	1.6	0.03	0.04	0.02	0.02	0.015	0.015
17	8	2 x M3 x 0.5 x 6	54	-	30	45	1	7.5	16.4	45	38	2	0.035	0.05	0.025	0.025	0.02	0.02
20	9	-	62	3 x 1.4+0.1	36	53	1.5	8	17.8	53	45	2	0.045	0.055	0.025	0.025	0.02	0.02
25	11	-	75	4 x 1.8+0.1	48	66	1.5	8	19.8	66	56	2	0.045	0.07	0.03	0.03	0.02	0.02
32	14	-	100	5 x 2.3+0.1	60	86	1.5	8	23.2	86	73	2	0.05	0.075	0.04	0.04	0.02	0.02

NOTES

1. RECOMMENDED ASSEMBLY TOLERANCE FOR PROPER OPERATION (SEE TABLE 1 FOR DEFINITION OF THE PRIMARY AND SECONDARY DATUMS REFERENCED IN REQUIREMENTS)
2. RECOMMENDED HOUSING / CASE DIMENSIONS FOR PROPER CLEARANCE AND LUBRICANT RETENTION.
3. IF THE APPLICATION REQUIRES OPERATION SUCH THAT THE WAVE GENERATOR IS MOUNTED VERTICAL FACING UPWARD FOR EXTENDED PERIODS, INCREASE THE NOTED DIMENSION TO 2 x THE CURRENT VALUE.
4. RECOMMENDED MATING FEATURE TOLERANCE.
5. DO NOT REMOVE FACTORY INSTALLED HARDWARE. COMPONENT MISALIGNMENT AND/OR UNIT DAMAGE MAY RESULT.
6. REFER TO SOLID MODEL FOR FEATURES NOT DEFINED.

Table 1: Mounting Datum Options
(Select tolerance control datums based on static mounting surface)

Datum	
AA (1) Primary	Secondary
V	W
U	Y
X	Y
X	Z



*Solid model available on configurator

Cross hatched pattern indicates housing and is the responsibility of the customer

Size	ØA	B	C	D	E	F	G	ØH	ØJ	ØK	Øa	b	c	d	e	f
	(all units in mm unless otherwise noted)															
14	70	28.59	23.49	9.2	6	4.9 - 5.3	16.5	50	48	14	64	8	3.5	2x M3	8	M3 x 0.5
17	80	32.45	26.5	10	6.5	5.75 - 6.15	19	60	60	18	74	12	3.5	4x M3	16	M3 x 0.5
20	90	33.4	29	10.8	7.5	4.2 - 4.6	20.5	70	70	21	84	12	3.5	4x M3	16	M3 x 0.5
25	110	36.95	34	11.3	10	2.7 - 3.2	22	85	88	26	102	12	4.5	4x M3	16	M4 x 0.7
32	142	44	42	14.2	14	1.7 - 2.3	27	110	114	26	132	12	5.5	4x M4	16	M5 x 0.8

Size	g	Øh	j	Øm	n	p	q	Øpd	ØQ	ØR	S	T	ØL	AA	BB	CC
	(all units in mm unless otherwise noted)															
14	12	3.5	6	6	2 x M3 x 0.5 x 4	44	-	51	25	38	1	1.6	31	0.02	0.04	0.03
17	12.5	3.5	6.5	8	2 x M3 x 0.5 x 6	54	-	61	30	45	1	2	38	0.02	0.05	0.035
20	13.5	3.5	7.5	9	-	62	4 x 1.8+0.1	70	36	53	1.5	2	45	0.025	0.055	0.045
25	17	4.5	10	11	-	77	5 x 2.3+0.1	88	48	66	1.5	2	56	0.03	0.07	0.045
32	22	5.5	14	14	-	100	5 x 2.3+0.1	114	60	86	1.5	2	73	0.04	0.075	0.05

CONTINUOUS TORQUE

Torque at which the unit can operate continuously for L10 life. Rating is at 2,000RPM input speed.

START - STOP TORQUE

Max torque at which the unit can operate in a start - stop (acceleration – deceleration) application.

MAX AVERAGE TORQUE

For applications where the unit runs at different torque loads over its life. This is the max average torque over its life. All torques must be less than peak torque rating.

PEAK TORQUE

Torque at which the unit can operate for 5,000 input revolutions. This is the highest load the unit should see expecting it to still be operational. An E-stop condition is a good example.

EFFICIENCY

The efficiency of a harmonic unit is dependent on the reduction ratio, input speed, load torque, and lubricant type and quantity. The lubricant type and quantity may impact the gearbox efficiency in respect to temperature. Published efficiency is at the following operating conditions:

INPUT SPEED	2000 RPM
AMBIENT TEMPERATURE	20˚C (68˚F)
LUBRICANT	Cone Drive Harmonic Solutions® High Performance L1 Grease
LUBRICANT QUANTITY	Standard Quantity

NO LOAD INPUT TORQUE

No load running torque is the torque required to spin the high speed input shaft when the low speed output is unloaded. The no load running torque can be affected by reduction ratio, input speed, and lubricant type and quantity. Published no load input torque is at the following operating conditions:

INPUT SPEED	2000 RPM
AMBIENT TEMPERATURE	20˚C (68˚F)
LUBRICANT	Cone Drive Harmonic Solutions® High Performance L1 Grease
LUBRICANT QUANTITY	Standard Quantity

STARTING TORQUE

Torque required to start motion of the input with no load applied at the output. Standard grease lubrication at standard temperature 20˚C.

BACKDRIVE STARTING TORQUE

Torque required to turn output with a freely rotating input. (no load attached to input side). Standard grease lubrication at standard temperature 20˚C.

DRIVETRAIN INERTIA AT INPUT

The tendency of a drivetrain to resist change in rotation velocity. All components in motion add to this resistance of change. In standard configurations these rotating components include: Input, OD Spline, bearings, assembly bolts, other minor components.

MAX BACKLASH

Backlash occurs in a harmonic unit that utilizes an Oldham input and is due to the internal clearance of the Oldham coupling. This is in addition to the Hysteresis loss and is dependent on the size and ratio of the unit. This parameter does not apply to solid wave generator inputs.

HYSTERESIS LOSS

Hysteresis loss is the lost motion that occurs due to internal friction of all harmonic gearboxes. When a harmonic unit is loaded to a torque and the load is returned to zero load or the load is reversed, the output position of the harmonic reducer will not return zero. The published hysteresis loss is that which occurs when the unit is operated at the Continuous Rated Torque and may be reduced at torque levels below rated torque.

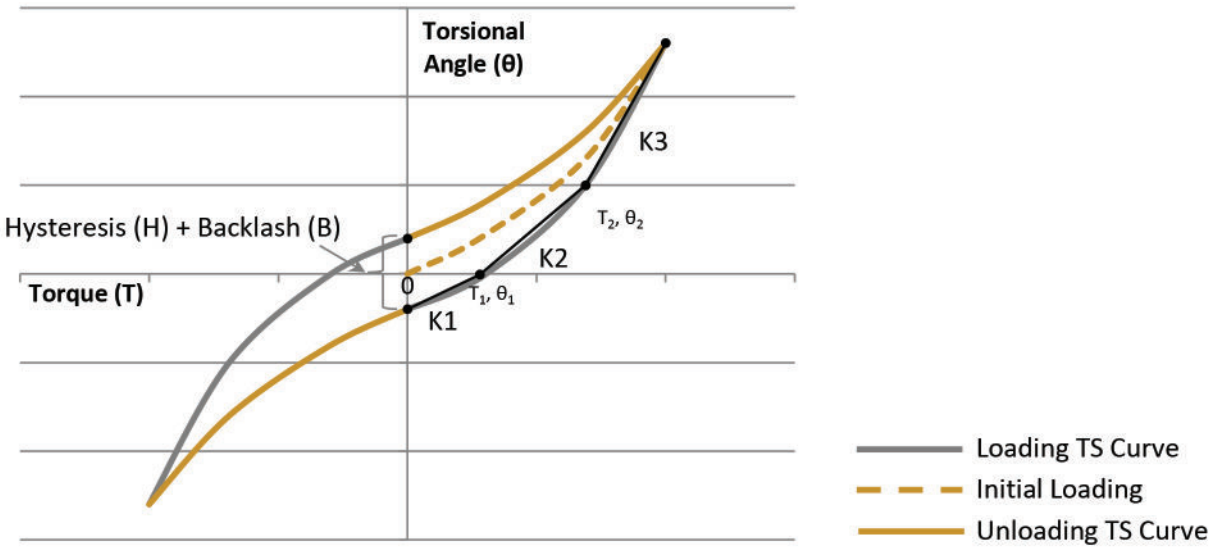
TORSIONAL STIFFNESS (K1, K2, K3)

The torsional stiffness of a harmonic unit is an important parameter that impacts that stiffness of a complete motion control system. The torsional stiffness is defined as the displacement of the low speed output shaft when the high speed input shaft is locked and a torque is applied to the output shaft. The torsional stiffness curve is represented with three best fit slopes, hysteresis loss and backlash (if applicable).

TRANSMISSION ERROR

The deviation of the expected output position and the actual output position when rotating the input.

TORSIONAL STIFFNESS CURVE



TORSIONAL STIFFNESS FORMULAS

$$T \le T_1: \qquad \theta = \frac{T}{K_1} - \frac{(H^* + B)}{2}$$

$$T_1 < T \le T_2: \theta = \frac{T_1}{K_1} + \frac{(T - T_1)}{K_2} - \frac{(H^* + B)}{2}$$

$$T > T_2: \qquad \theta = \frac{T_1}{K_1} + \frac{(T_2 - T_1)}{K_2} + \frac{(T - T_2)}{K_3} - \frac{(H^* + B)}{2}$$

* At loads less than Continuous Rated Torque, the lost motion due to hysteresis loss may be less than specified.

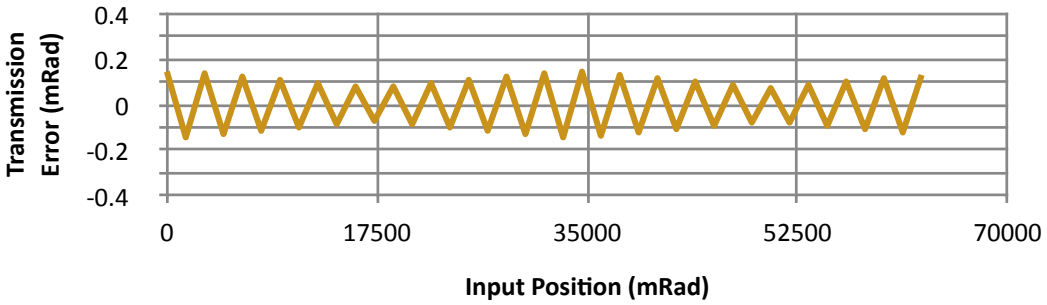
POSITIONAL ACCURACY & VIBRATION

Positional accuracy is defined as the difference between the actual output angular position and the theoretical output angular position based upon the input angular position and ratio. This error is termed the transmission error (θ_{TE}) of the gearbox and is measured in milliradians (mRad) or arcseconds.

$$\theta_{TE} = \theta_{Output} - \frac{\theta_{Input}}{Ratio}$$

θ_{TE}	Angular Transmission Error
θ_{Input}	Input Angular Position
θ_{Output}	Output Angular Position
$Ratio$	Reduction Ratio of Gearbox (1:Ratio)

1 mRad = 206.27 arcsecond



The primary frequency of the transmission error is twice that of the input speed (i.e. period is twice per input revolution). This characteristic along with the natural frequency of the system can be used to determine the input speed at which a system may resonate; a source of system vibration.

Equations for the natural frequency of a harmonic system and approximate speed at which a resonance may occur can be found from the following equations:

$$f_n = \frac{1}{2\pi}\sqrt{\frac{K*1000}{I}}$$

$$N_{Resonant} = \frac{60 f_n}{2}$$

f_n	Natural Frequency (Hz)
K	Torsional Stiffness at Load Point (Nm/mRad)
I	Output Inertia (kgm^2)
$N_{Resonant}$	Resonant Input speed (RPM)

Size	Ratio	Continuous Torque Rating (2000 rpm)	Start/Stop Torque Rating	Max Average Torque Rating	Peak Torque Rating	Efficiency (2000 rpm, 20°C, Continuous Rated Load)	No Load Input Torque (2000 rpm at 20°C)	Starting Torque (20°C)	Backdrive Starting Torque (20°C)	Transmission Error	Hysteresis	Max Backlash
		Nm	Nm	Nm	Nm	%	Nm	Nm	Nm	mRad	mRad	mRad
HAT COMPONENT SET (HBC)												
14	50	7.6	24.4	8.8	44	71	0.036	0.037	2.2	0.44	0.58	0.18
14	80	10.3	30	13.9	58	71	0.032	0.028	2.7	0.44	0.29	0.11
14	100	10.2	32	13.3	63	68	0.031	0.024	2.8	0.44	0.29	0.087
17	50	21.5	43	34	88	78	0.069	0.058	3.4	0.44	0.58	0.097
17	80	28.6	53	34	107	77	0.062	0.038	3.7	0.44	0.29	0.063
17	100	29.8	64	51	133	77	0.060	0.033	4.0	0.44	0.29	0.048
17	120	29.2	65	51	113	74	0.059	0.031	4.5	0.44	0.29	0.039
20	50	32	72	43	127	78	0.11	0.073	4.4	0.29	0.58	0.082
20	80	42	94	61	156	77	0.098	0.048	4.6	0.29	0.29	0.053
20	100	51	100	62	185	77	0.095	0.043	5.2	0.29	0.29	0.044
20	120	50	105	62	184	74	0.094	0.039	5.6	0.29	0.29	0.039
20	160	50	114	62	182	70	0.091	0.034	6.6	0.29	0.29	0.029
25	50	49	124	70	230	78	0.21	0.14	8.2	0.29	0.58	0.082
25	80	74	177	112	307	77	0.19	0.089	8.6	0.29	0.29	0.053
25	100	82	185	137	346	77	0.18	0.079	9.5	0.29	0.29	0.044
25	120	83	191	136	346	74	0.18	0.073	10.0	0.29	0.29	0.039
25	160	80	202	131	356	70	0.17	0.064	12.1	0.29	0.29	0.029
32	50	99	274	139	480	78	0.43	0.28	17.0	0.29	0.58	0.068
32	80	153	341	212	726	77	0.39	0.19	18.0	0.29	0.29	0.044
32	100	170	403	278	824	77	0.38	0.18	21.0	0.29	0.29	0.034
32	120	171	430	275	823	74	0.38	0.15	21.0	0.29	0.29	0.029
32	160	172	460	275	751	70	0.37	0.14	26.0	0.29	0.29	0.024
HAT GEARHEAD (HBG)												
14	50	7.6	24.4	8.8	44	64	0.057	0.052	3.1	0.44	0.58	0.18
14	80	10.3	30	13.9	58	65	0.050	0.040	3.8	0.44	0.29	0.11
14	100	10.2	32	13.3	63	61	0.048	0.034	4.1	0.44	0.29	0.087
17	50	21.5	43	34	88	67	0.12	0.087	5.2	0.44	0.58	0.097
17	80	28.6	53	34	107	66	0.11	0.063	6.1	0.44	0.29	0.063
17	100	29.8	64	51	133	65	0.11	0.057	6.8	0.44	0.29	0.048
17	120	29.2	65	51	113	62	0.10	0.054	7.8	0.44	0.29	0.039
20	50	32	72	43	127	68	0.18	0.12	7.4	0.29	0.58	0.082
20	80	42	94	61	156	69	0.16	0.095	8.7	0.29	0.29	0.053
20	100	51	100	62	185	65	0.16	0.085	10.3	0.29	0.29	0.044
20	120	50	105	62	184	64	0.15	0.080	11.2	0.29	0.29	0.039
20	160	50	114	62	182	58	0.15	0.073	14.2	0.29	0.29	0.029
25	50	49	124	70	230	69	0.29	0.20	11.9	0.29	0.58	0.082
25	80	74	177	112	307	71	0.26	0.14	13.4	0.29	0.29	0.053
25	100	82	185	137	346	66	0.25	0.13	15.1	0.29	0.29	0.044
25	120	83	191	136	346	66	0.25	0.12	16.6	0.29	0.29	0.039
25	160	80	202	131	356	59	0.24	0.11	20.6	0.29	0.29	0.029
32	50	99	274	139	480	70	0.55	0.38	23.0	0.29	0.58	0.068
32	80	153	341	212	726	70	0.50	0.26	25.5	0.29	0.29	0.044
32	100	170	403	278	824	69	0.48	0.25	30	0.29	0.29	0.034
32	120	171	430	275	823	68	0.47	0.22	31	0.29	0.29	0.029
32	160	172	460	275	751	62	0.46	0.21	39	0.29	0.29	0.024

Size	Ratio	T1	T2	K1	K2	K3	Mass	Unit Ix Inertia about C.G.	Unit Iy=Iz Inertia about C.G.	Drive-train Inertia at input	Output Bearing Pitch Dia (dp)	Output Bearing Face Offset (w)	Basic Dynamic Output Bearing Load Rating (C)	Basic Static Output Bearing Load Rating (Co)	Max Output Bearing Moment Load	Output Bearing Moment Rigidity	Max Wave Generator Bore	Max Wave Generator Shaft
		Nm	Nm	Nm/mRad	Nm/mRad	Nm/mRad	kg	x10-6 kg-m2	x10-6 kg-m2	x10-6 kg-m2	mm	mm	kN	kN	Nm	Nm/mRad	mm	mm
HAT COMPONENT SET (HBC)																		
14	50	2.0	6.9	3.4	4.7	5.7	0.13	43	29.1	3.9	-	-	-	-	-	-	18.6	22.0
14	80	2.0	6.9	4.7	6.1	7.1	0.13	43	29.1	3.9	-	-	-	-	-	-	0.0	0.0
14	100	2.0	6.9	4.7	6.1	7.1	0.13	43	29.1	3.9	-	-	-	-	-	-	0.0	0.0
17	50	3.9	12.1	8.1	11.1	12.9	0.20	97	64	9.6	-	-	-	-	-	-	23.8	28.0
17	80	3.9	12.1	10.0	14.1	15.9	0.20	97	64	9.6	-	-	-	-	-	-	0.0	0.0
17	100	3.9	12.1	10.0	14.1	15.9	0.20	97	64	9.6	-	-	-	-	-	-	0.0	0.0
17	120	3.9	12.1	10.0	14.1	15.9	0.20	97	64	9.6	-	-	-	-	-	-	0.0	0.0
20	50	7.0	25.0	13.0	18.0	23.0	0.28	189	121	23.0	-	-	-	-	-	-	26.6	32
20	80	7.0	25.0	16.0	25.0	29.0	0.28	189	121	23.0	-	-	-	-	-	-	0.0	0.0
20	100	7.0	25.0	16.0	25.0	29.0	0.28	189	121	23.0	-	-	-	-	-	-	0.0	0.0
20	120	7.0	25.0	16.0	25.0	29.0	0.28	189	121	23.0	-	-	-	-	-	-	0.0	0.0
20	160	7.0	25.0	16.0	25.0	29.0	0.28	189	121	23.0	-	-	-	-	-	-	0.0	0.0
25	50	14.0	48	25.0	34	44	0.44	514	313	58	-	-	-	-	-	-	34	42
25	80	14.0	48	31	50	57	0.44	514	313	58	-	-	-	-	-	-	0.0	0.0
25	100	14.0	48	31	50	57	0.44	514	313	58	-	-	-	-	-	-	0.0	0.0
25	120	14.0	48	31	50	57	0.44	514	313	58	-	-	-	-	-	-	0.0	0.0
25	160	14.0	48	31	50	57	0.44	514	313	58	-	-	-	-	-	-	0.0	0.0
32	50	29.0	108	54	78	98	0.94	1832	1059	176	-	-	-	-	-	-	45	56
32	80	29.0	108	67	110	120	0.94	1832	1059	176	-	-	-	-	-	-	0.0	0.0
32	100	29.0	108	67	110	120	0.94	1832	1059	176	-	-	-	-	-	-	0.0	0.0
32	120	29.0	108	67	110	120	0.94	1832	1059	176	-	-	-	-	-	-	0.0	0.0
32	160	29.0	108	67	110	120	0.94	1832	1059	176	-	-	-	-	-	-	0.0	0.0
HAT GEARHEAD (HBG)																		
14	50	2.0	6.9	3.4	4.7	5.7	0.41	273	153	4.0	50	9.6	6.6	9.3	40	140	18.6	22.0
14	80	2.0	6.9	4.7	6.1	7.1	0.41	273	153	4.0	50	9.6	6.6	9.3	40	140	0.0	0.0
14	100	2.0	6.9	4.7	6.1	7.1	0.41	273	153	4.0	50	9.6	6.6	9.3	40	140	0.0	0.0
17	50	3.9	12.1	8.1	11.1	12.9	0.59	517	289	9.8	61	10.0	10.5	14.7	77	240	23.8	28.0
17	80	3.9	12.1	10.0	14.1	15.9	0.59	517	289	9.7	61	10.0	10.5	14.7	77	240	0.0	0.0
17	100	3.9	12.1	10.0	14.1	15.9	0.59	517	289	9.6	61	10.0	10.5	14.7	77	240	0.0	0.0
17	120	3.9	12.1	10.0	14.1	15.9	0.59	517	289	9.6	61	10.0	10.5	14.7	77	240	0.0	0.0
20	50	7.0	25.0	13.0	18.0	23.0	0.81	904	503	23.2	70	10.5	16.3	22.9	138	380	26.6	32
20	80	7.0	25.0	16.0	25.0	29.0	0.81	904	503	23.1	70	10.5	16.3	22.9	138	380	0.0	0.0
20	100	7.0	25.0	16.0	25.0	29.0	0.81	904	503	23.0	70	10.5	16.3	22.9	138	380	0.0	0.0
20	120	7.0	25.0	16.0	25.0	29.0	0.81	904	503	23.0	70	10.5	16.3	22.9	138	380	0.0	0.0
20	160	7.0	25.0	16.0	25.0	29.0	0.81	904	503	23.0	70	10.5	16.3	22.9	138	380	0.0	0.0
25	50	14.0	48	25.0	34	44	1.3	2191	1205	58	85	11.7	20.3	33	249	870	34	42
25	80	14.0	48	31	50	57	1.3	2191	1205	58	85	11.7	20.3	33	249	870	0.0	0.0
25	100	14.0	48	31	50	57	1.3	2191	1205	58	85	11.7	20.3	33	249	870	0.0	0.0
25	120	14.0	48	31	50	57	1.3	2191	1205	58	85	11.7	20.3	33	249	870	0.0	0.0
25	160	14.0	48	31	50	57	1.3	2191	1205	58	85	11.7	20.3	33	249	870	0.0	0.0
32	50	29.0	108	54	78	98	2.7	7700	4190	178	111	14.9	43	68	661	1825	45	56
32	80	29.0	108	67	110	120	2.7	7700	4190	177	111	14.9	43	68	661	1825	0.0	0.0
32	100	29.0	108	67	110	120	2.7	7700	4190	177	111	14.9	43	68	661	1825	0.0	0.0
32	120	29.0	108	67	110	120	2.7	7700	4190	176	111	14.9	43	68	661	1825	0.0	0.0
32	160	29.0	108	67	110	120	2.7	7700	4190	176	111	14.9	43	68	661	1825	0.0	0.0

Gearhead to Motor Installation (Figures 5 and 6)

- **MOTOR ADAPTER**
  - A motor adapter plate (1) must be made to center the motor shaft to the wave generator assembly (2).
  - The adapter plate should slip fit pilot to both the gearhead and the motor.
  - O-rings and shaft seals (3) should be used on each mating surface to contain assembly lubrication, and keep contaminants out.
  - To insure smooth operation, surfaces and diameters must be precision machined to maintain concentricity and alignment as specified on the assembly drawing.
  - Steel or high strength alloy aluminum would be acceptable material choices for the adapter plate. Plastic or non-precision parts will result in poor gearing performance and premature wear or damage to the gearset.

- **WAVE GENERATOR ASSEMBLY**
  - The wave generator assembly must be supported in both the radial and axial direction.
  - Axial forces are generated by the gearing. Consult with your motor manufacturer on bearing load capacity and contact Cone Drive if there are concerns of this being an issue.
  - The wave generator can be fixed axially to the motor shaft in many ways. One option is to have a tapped hole in the end of the motor shaft, and a screw and washer (4) to retain the assembly on the shaft. Fixing the wave generator in the other direction is a snap ring (5) in a groove on the motor shaft as shown in the view above. Other options are clamp rings, bushings, or even bonding of the surfaces. The goal of any of these methods is to position the wave generator as specified on the Cone Drive drawing. Standard drawings are available on our online configurator program (www.conetools.com) under each model number. For customized parts, contact Cone Drive for the drawing.

- **FINAL GEARMOTOR ASSEMBLY**
  - The most common procedure is to install the motor adapter plate to the motor, followed by the wave generator assembly to the motor. Next, this assembly is installed into the OD spline (flexspline).
  - Rotation of the wave generator assembly will aide in installation (when possible).
  - Use of excessive force when installing the wave generator may cause permanent damage to the gear teeth or wave generator bearing.
  - It may be helpful to slightly loosen the motor mounting or motor adapter bolts while rotating the complete assembly. This will allow parts to self center.
  - Concentricity of parts and alignment of components is key to smooth operation.

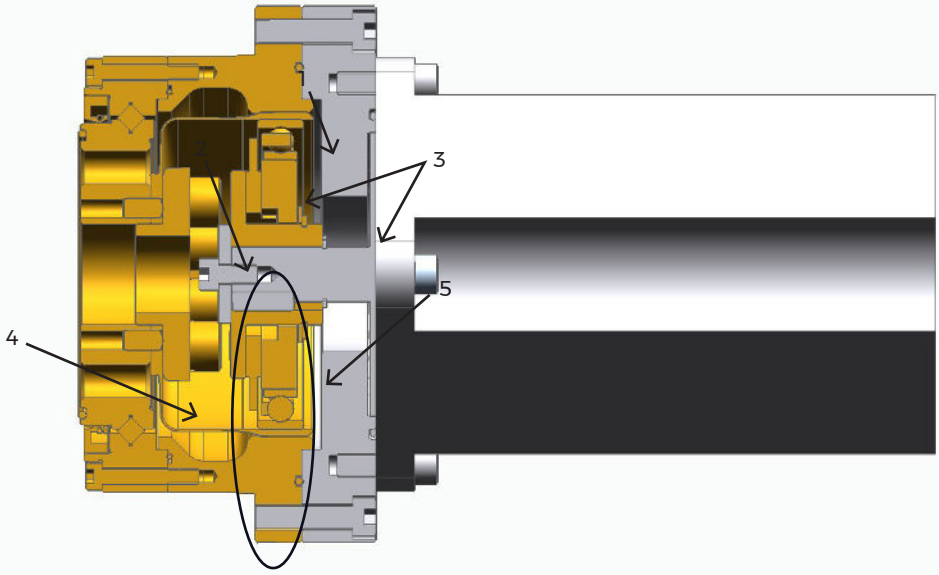


Figure 5. Gearhead to Motor Installation: Cup Style

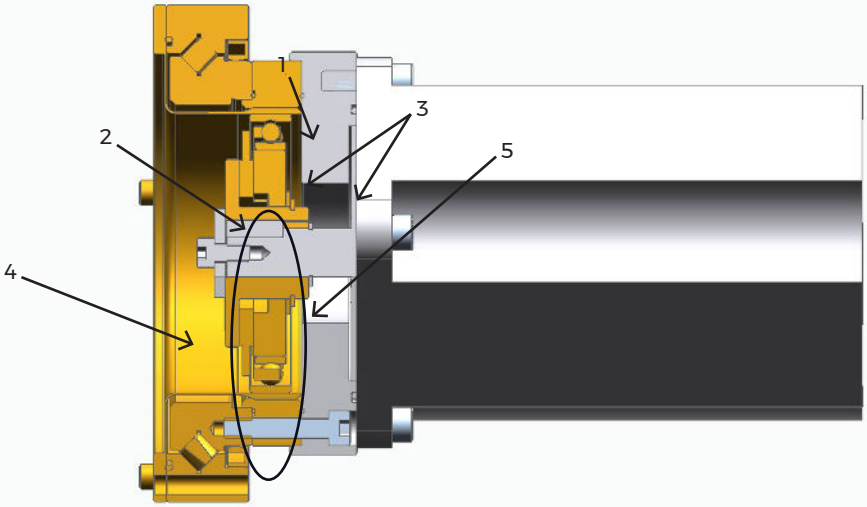


Figure 6. Gearhead to Motor Installation: Hat Style

Gold color denotes Cone Drive supplied components

Component Gearset Installation (Figures 7 and 8)

- **HOUSING**
  - A housing must be made to hold the gearset components concentric and within the specified tolerances on the assembly drawing.
  - Standard assembly drawings are available on our online configurator program under each model number. For customized parts, contact Cone Drive for the drawing.
  - All mating surfaces should use o-rings (1), shaft seals (2), or other means to contain the gearset lubrication and keep contaminants out.
  - To insure smooth operation, surfaces and diameters must be precision machined to maintain concentricity and alignment as specified on the assembly drawing.
  - Steel or high strength alloy aluminum would be acceptable material choices for the housing. Plastic or non-precision parts will result in poor gearing performance and premature wear or damage to the gearset.

- **WAVE GENERATOR ASSEMBLY**
  - The wave generator assembly must be supported in both the radial and axial direction.
  - Axial forces are generated by the gearing. Consult with your motor manufacturer on bearing load capacity and contact Cone Drive if there are concerns of this being an issue.
  - The wave generator can be fixed axially to the drive shaft in many ways. One option is to have a tapped hole and washer on the end of the drive shaft, and a snap ring on the opposite end. Another option is to use snap rings on both sides as shown in the view above. Other options are clamp rings, bushings, or even bonding of the surfaces. The goal of any of these methods is to position the wave generator as specified on the Cone Drive drawing.
  - For setscrew attachment, be sure to have an access hole (4) in the housing for tightening.

- **OD SPLINE**
  - The OD spline must be fixed in both axial and radial directions. The base of the OD spline serves as the output of the gearing.
  - Use of all dowel pin (5) and screw holes (6) is required for full torque capacity. Grade 10.9 or better fasteners must be used in all bolt holes. The OD Spline also has a piloting feature (10) for alignment. Failure to align and keep parts concentric will cause increased wear and vibration. Please consult the product drawing for these critical specifications.
  - An output plate (7) must be used to clamp the base of the OD spline to the output bearing of your choice.
  - The clamp plate must be designed without sharp edges contacting the OD spline to prevent stress concentrations.

- **ID SPLINE**
  - The ID spline can be piloted to the housing using the outer diameter (8) or the reduced diameter (9) just outside the gear teeth as noted on the assembly drawing.

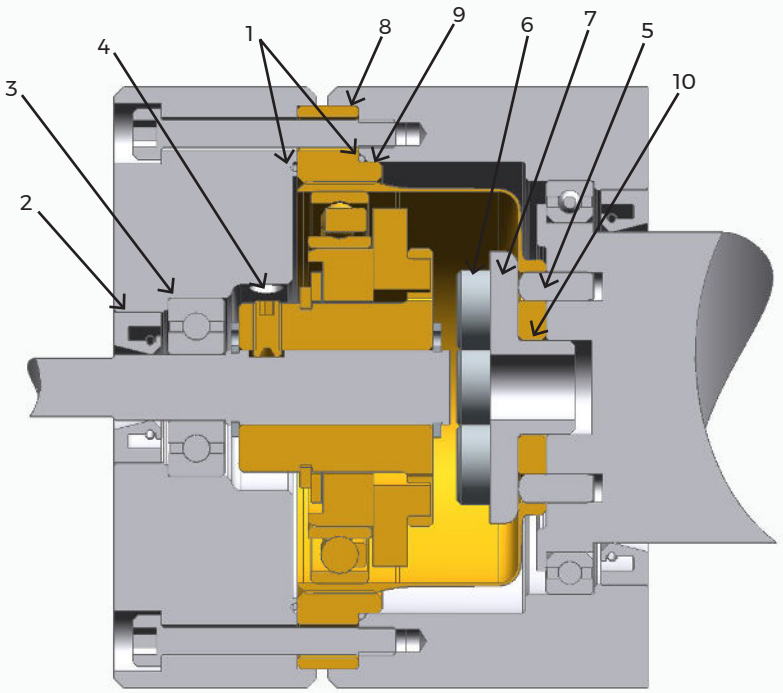


Figure 7. Component Gearseat Installation: Cup Style

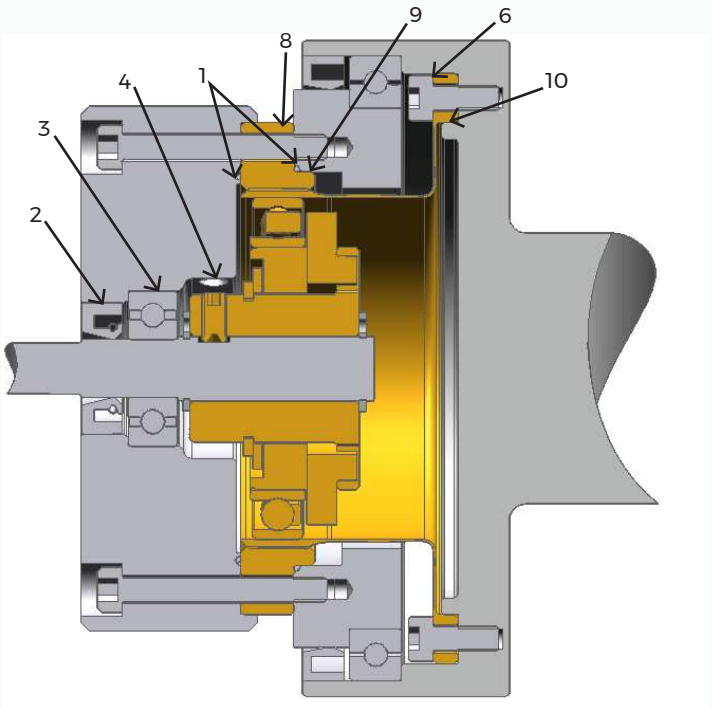
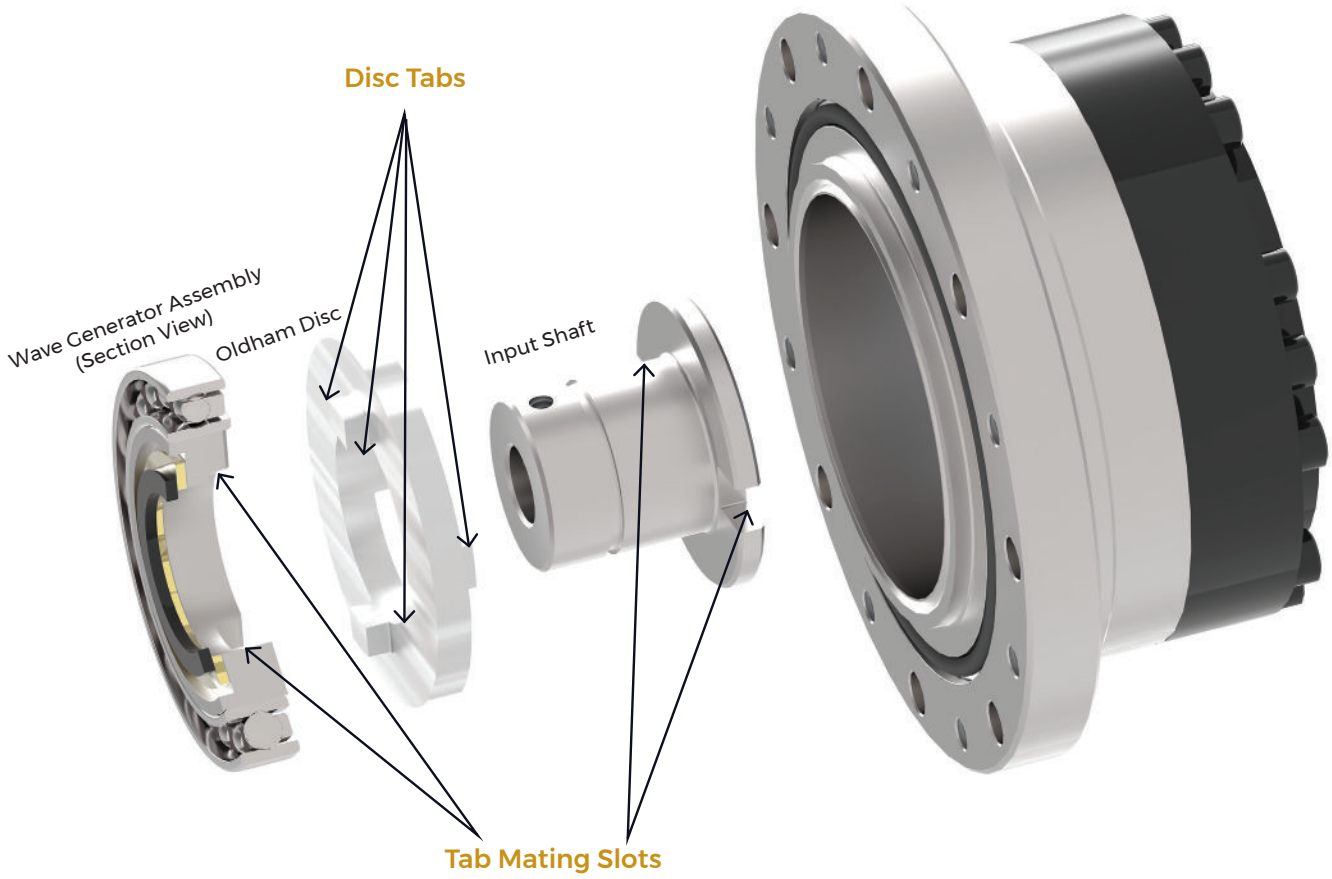


Figure 8. Component Gearset Installation: Hat Style

Gold color denotes Cone Drive supplied components

The Oldham input assembly is a two jaw-type coupling that allows movement in two radial directions. This feature provides added tolerance for drive shaft radial runout.



See page 16 for additional input options.

Cone Drive Harmonic Solutions® High Performance L1 Grease

Benefits for your application

- Low average torque in harmonic gear type drives
- Excellent low temperature performance
- Solid-free additives to enhance protection of friction points subject to high loads

Description

Cone Drive Harmonic Solutions® High Performance L1 Grease is designed for use in harmonic gear type drives such as those found in robots and machine tools.

This specially developed grease consists of synthetic hydrocarbon oil and lithium soap.

Application

Cone Drive Harmonic Solutions® High Performance L1 Grease is used for harmonic gear type drives*. Silicone is not a component of the formulation of this product.

The grease can be applied by grease gun, spatula, brush, or automatic lubricant dispenser. We recommend testing the pumpability of the grease in automatic lubrication systems.

Safety data sheets

The safety data sheet (SDS) for Cone Drive Harmonic Solutions® High Performance L1 Grease is available at www.conedrive.com/resources

Cone Drive Harmonic Solutions® High Performance L1 Grease	
Can	1 kg
Part Number	HSGREASE-01-KG
Base Oil Type	Synthetic
Thickener Type	Lithium
Lower Service Temperature (˚C/˚F)	-40/-40
Upper Service Temperature (˚C/˚F)	150/302
Base Oil Viscosity, ASTM D-7042 (40˚C)	45 - 55 mm2/s
Cone Penetration, ASTM D-217	370 - 400
NLGI Grade	0 to 00
Dropping Point, ASTM D-2265 (˚C)	180
Oil Separation, DIN 51817 (168h, 40˚C)	approx. 8%
Flow Pressure, DIN 51805 (-40˚C)	75 mbar
Minimum shelf life if the product is stored in its unopened, original container in a dry, frost-free place, approx.	24 months

**Contact ae@conedrive.com if application requires custom lubrication*