HarmonicDrive®

Ultra Lightweight, Flat
CSF-ULW Series

Sizes 8, 11

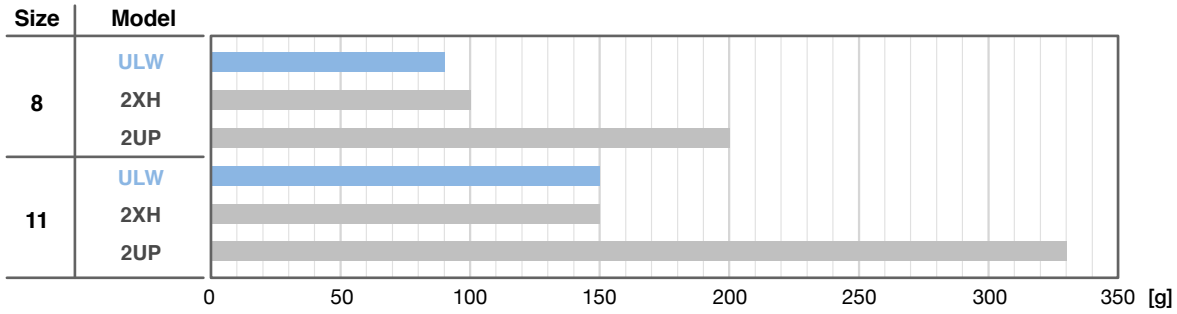
New gear units from Harmonic Drive achieve unprecedented low weight in an ultra-flat housing.

Introducing CSF-ULW ultra-light weight gearhead. This series features a newly engineered lightweight structure with an ultra-compact shape. The ULW line maintains the same performance standards as the CSF-2UH series. Ideal for use on end of arm axes for small industrial and collaborative robots, the CSF-ULW is also well suited for general industrial machinery where weight is a critical factor.

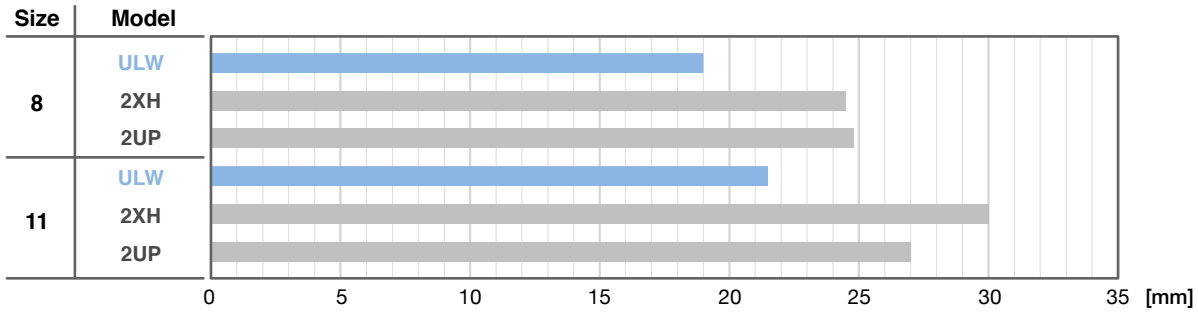
Features

- Size 8 and 11 are the first sizes available and are ready to order now. Additional sizes to follow.

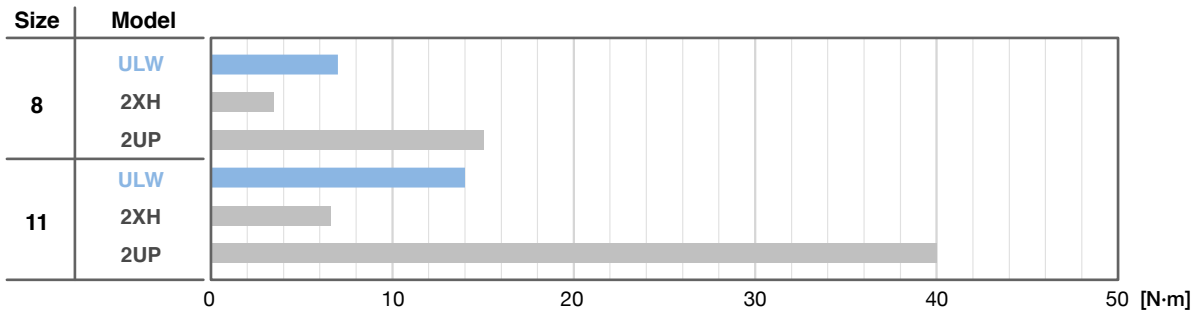
Mass Comparison



Length Comparison



Allowable Moment Load Comparison



Ordering Code

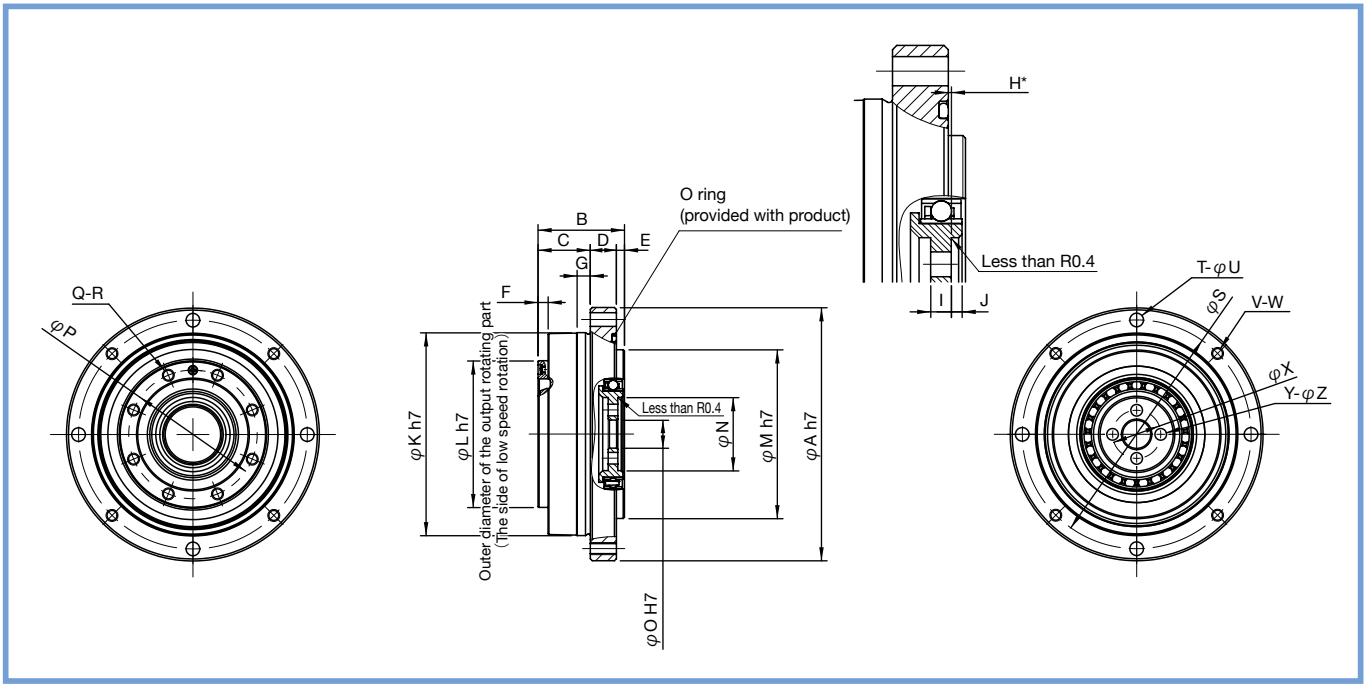
CSF - 8 - 50 - 2UH - ULW - Specifications

Series	Size	Reduction Ratio			Model	Specification 1	Special Specifications
CSF Series	8	30	50	100	2UH: Unit	ULW: Ultra-lightweight	Blank = Standard product SP = Special specification code
	11	30	50	100			

Rating Table

Size	Reduction Ratio	Rated torque at input speed 2000 rpm		Limit for repeated peak torque		Limit for average torque		Limit for momentary peak torque		Maximum input speed	Limit for average input speed	Moment of inertia ($1/4GD^2$)
		N·m	kgf·m	N·m	kgf·m	N·m	kgf·m	N·m	kgf·m	rpm	rpm	kg·m²
8	30	0.9	0.09	1.8	0.18	1.4	0.14	3.3	0.34	8500	3500	1.7×10^{-7}
	50	1.8	0.18	3.3	0.34	2.3	0.24	6.6	0.67			
	100	2.4	0.25	4.8	0.49	3.3	0.34	9.0	0.92			
11	30	2.2	0.22	4.5	0.46	3.4	0.35	8.5	0.87			8.6×10^{-7}
	50	3.5	0.36	8.3	0.85	5.5	0.56	17	1.7			
	100	5.0	0.51	11	1.1	8.9	0.91	25	2.6			

Outline Drawing



Dimension Table

[Unit: mm]

Size \ Symbol	ϕA h7	B	C	D	E	F	G	H*	I	J	ϕK h7	ϕL h7	ϕM h7	ϕN
8	54	19.0	12.3	5.0	1.7	2.5	2.5	$0.65\ ^{0}_{-0.3}$	2.0	0.65	41.5	28.5	34	12.5
11	63	21.5	13.0	6.5	2.0	2.5	3.3	$0.35\ ^{0}_{-0.7}$	2.4	1.25	50.5	36.5	42	18.2

Size \ Symbol	ϕO H7	ϕP	Q	R	ϕS	T	U	V	W	X	Y	Z	Weight (g)
8	3	24.5	6	M3	48	4	3.4	4	M3	7.5	4	2.4	90
11	7	32.0	8	M3	57	4	3.4	4	M3	12	4	2.9	150

* Dimension H is the mounting position in the shaft direction and tolerance of the three parts (wave generator, flexspline, circular spline). Strictly observe these dimensions as they affect the performance and strength.

* For details of terms, refer to the “Engineering Data” in the HarmonicDrive® Reducer Catalog.

Positioning Accuracy

Ratio \ Size		8	11
30	×10⁻⁴rad	5.8	5.8
	arc-min	2.0	2.0
50 or more	×10⁻⁴rad	5.8	4.4
	arc-min	2.0	1.5

Hysteresis Loss

Ratio \ Size		8	11
30	×10⁻⁴rad	8.7	8.7
	arc-min	3.0	3.0
50	×10⁻⁴rad	5.8	5.8
	arc-min	2.0	2.0
100	×10⁻⁴rad	5.8	5.8
	arc-min	2.0	2.0

Torsional Stiffness

Symbol \ Size			8	11
T1		N·m	0.29	0.80
		kgf·m	0.030	0.082
T2		N·m	0.75	2.00
		kgf·m	0.077	0.200
Reduction ratio 30	K1	×10⁴N·m/rad	0.034	0.084
		kgf·m/arc-min	0.010	0.025
	K2	×10⁴N·m/rad	0.044	0.130
		kgf·m/arc-min	0.013	0.037
	K3	×10⁴N·m/rad	0.054	0.160
		kgf·m/arc-min	0.016	0.047
	θ1	×10⁻⁴rad	8.5	9.5
		arc-min	3.0	3.3
	θ2	×10⁻⁴rad	19	19
		arc-min	6.6	6.5
Reduction ratio 50	K1	×10⁴N·m/rad	0.044	0.220
		kgf·m/arc-min	0.013	0.066
	K2	×10⁴N·m/rad	0.067	0.300
		kgf·m/arc-min	0.020	0.090
	K3	×10⁴N·m/rad	0.084	0.320
		kgf·m/arc-min	0.025	0.096
	θ1	×10⁻⁴rad	6.6	3.6
		arc-min	2.3	1.2
	θ2	×10⁻⁴rad	13	8.0
		arc-min	4.7	2.6
Reduction ratio 100	K1	×10⁴N·m/rad	0.091	0.270
		kgf·m/arc-min	0.027	0.080
	K2	×10⁴N·m/rad	0.100	0.340
		kgf·m/arc-min	0.031	0.100
	K3	×10⁴N·m/rad	0.120	0.440
		kgf·m/arc-min	0.036	0.130
	θ1	×10⁻⁴rad	3.2	3.0
		arc-min	1.1	1.0
	θ2	×10⁻⁴rad	8.0	6.0
		arc-min	2.6	2.2

* This table shows the reference values. The lower limit value is approximately 80% of the displayed value.

* For details of terms, refer to the “Engineering Data” in the HarmonicDrive® Reducer Catalog.

Starting Torque

(Unit: Ncm)

Ratio \ Size	8	11
30	1.50	3.4
50	0.92	2.0
100	0.65	1.5

Backdriving Torque

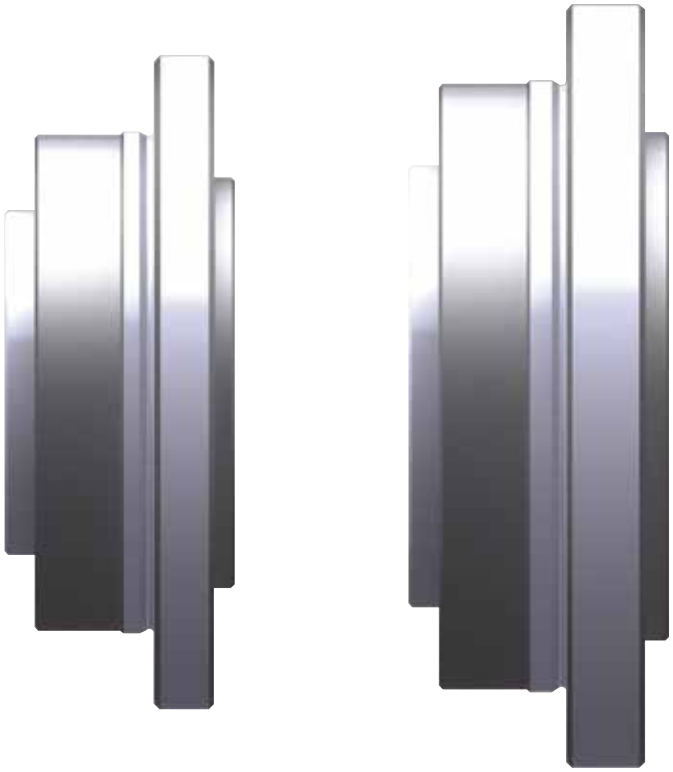
(Unit: Nm)

Ratio \ Size	8	11
30	0.70	1.7
50	0.55	1.2
100	0.75	1.5

Buckling Torque

(Unit: Nm)

Ratio \ Size	8	11
All ratios	35	90



No-Load Running Torque

No-load running torque is the input torque (high-speed shaft side) required to rotate a HarmonicDrive® gear under a no-load condition.

* Contact us for details.

Measurement Condition

Lubrication	Speed reducer	Main bearing
	HarmonicGrease® SK-2	Multemp HL-D*
The torque value is measured after two or more hours run-in at 2000 rpm input speed.		

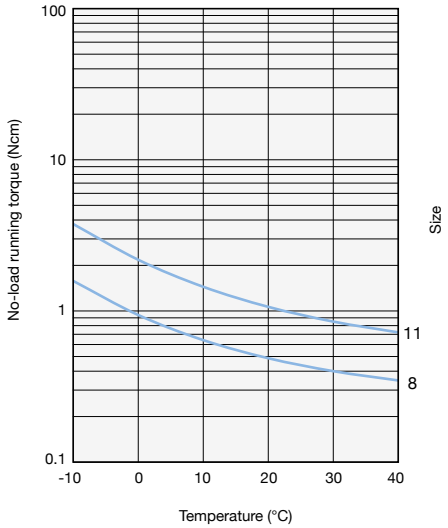
* “Multemp” is a registered trademark of Kyodo Yushi Co., Ltd.

Compensation Value

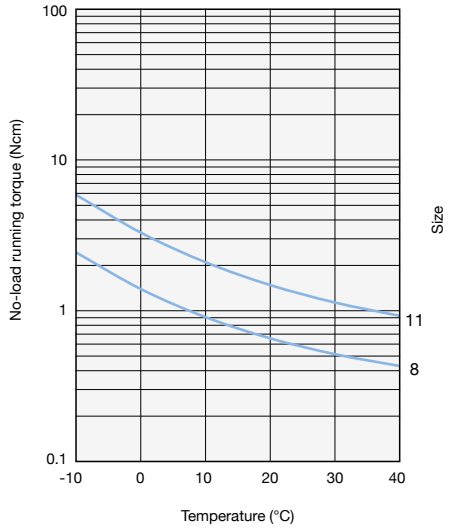
Ratio \ Size	8	11
30	0.54	1.05
50	0.23	0.43

No-Load Running Torque (Ratio100:1)

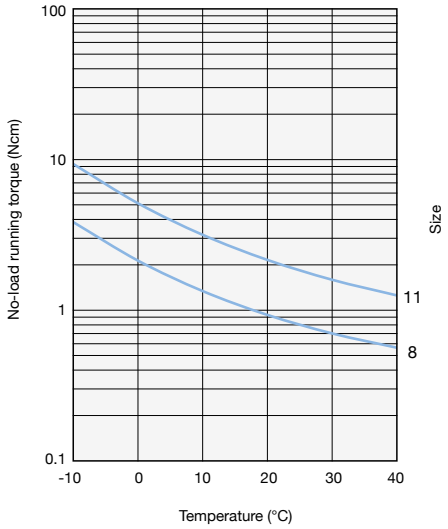
Input rotational speed 500rpm



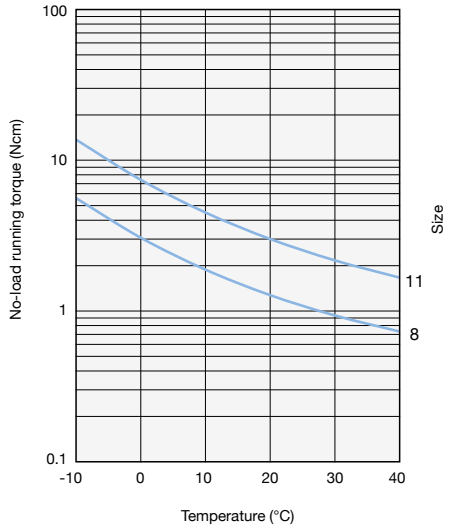
Input rotational speed 1000rpm



Input rotational speed 2000rpm



Input rotational speed 3500rpm



* The graphs show the average value X.

Efficiency

The efficiency varies depending on the load torque. Calculate the compensation coefficient Ke from the graph, and check the value through the following formula.

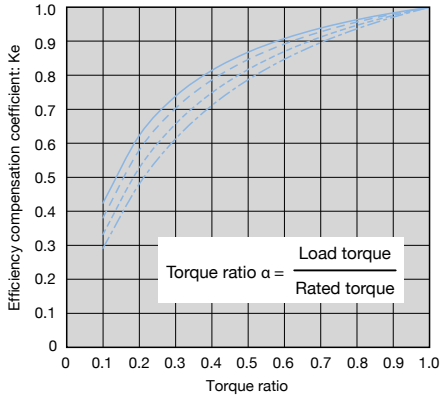
*1 The efficiency compensation coefficient is the average value when the grease temperature is approximately 30°C.
*2 When load torque is larger than rated torque, efficiency compensation coefficient Ke = 1.

Efficiency compensation coefficient: Ke

Efficiency at rated torque: η_R

Efficiency depending on the load torque: η

$\eta = Ke \times \eta_R$



Input rotational speed
- 500rpm
- 1000rpm
- 2000rpm
- 3500rpm

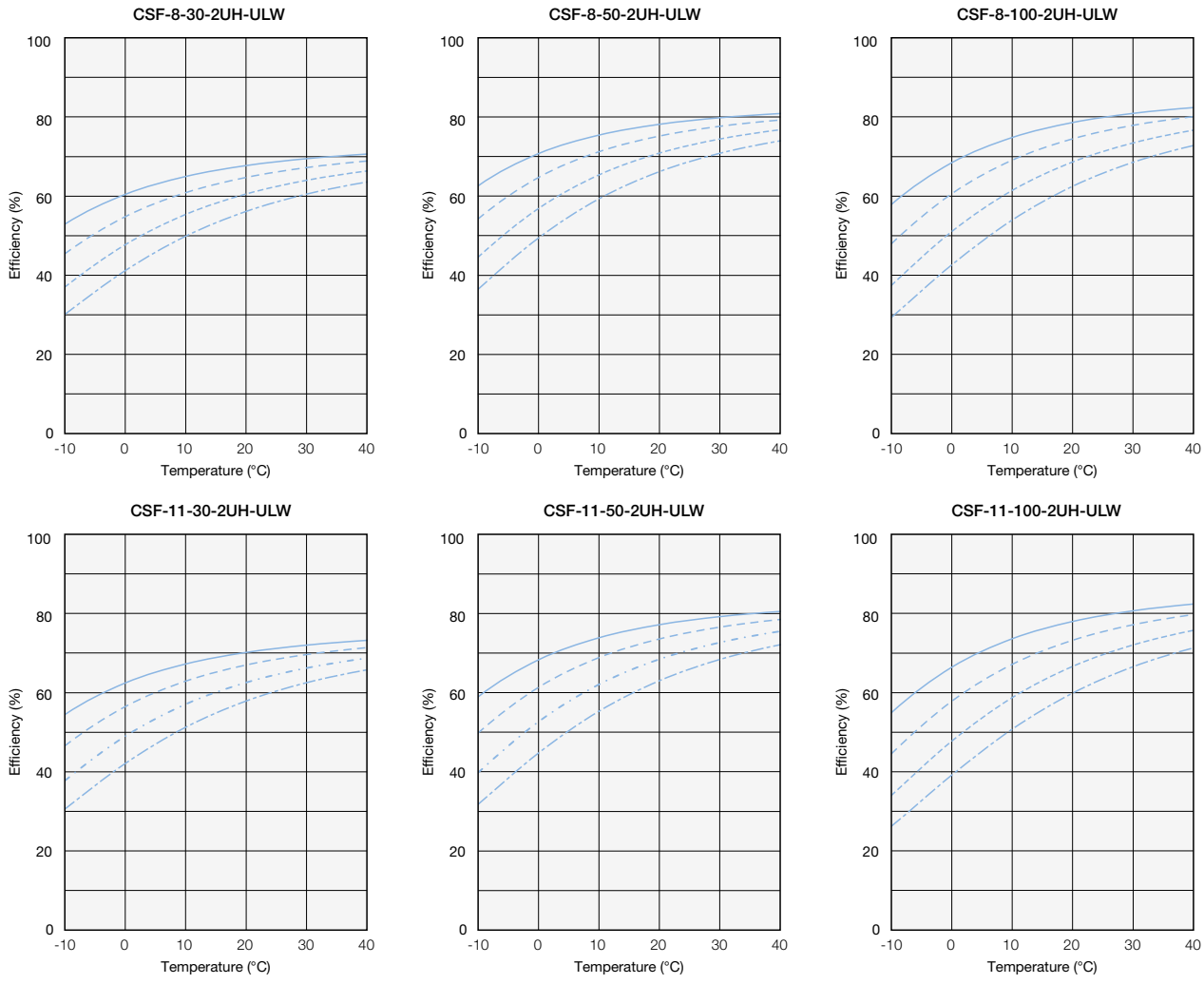
Measurement Condition

Lubrication	Speed reducer	Main bearing
	HarmonicGrease® SK-2	Multemp HL-D*

The torque value is measured after two or more hours run-in at 2000 rpm input speed.

* "Multemp" is a registered trademark of Kyodo Yushi Co., Ltd.

Efficiency at rated torque



* The graphs show the average values.

Specifications of the Main Bearing

The CSF-ULW series incorporates a small 4-point contact ball bearing to directly support the external load (output flange). Please check the maximum moment load, the life of the small 4-point contact ball bearing and the static safety factor to

Checking Procedure

For details of the checking procedure, refer to the “Checking Main Roller Bearing” in the “Engineering Data” in the HarmonicDrive® Reducer Catalog.

(1) Checking the maximum moment load (M*max*)

Calculate the maximum moment load (M*max*) → **Maximum moment load (M*max*) ≤ Allowable moment (Mc)**

(2) Checking the life

Calculate the average radial load (Fr*av*) and average axial load (Fa*av*) → **Calculate the radial load coefficient (X) and axial load coefficient (Y)** → **Calculating lifetime**

(3) Checking the static safety coefficient

Calculate the static equivalent radial load coefficient (Po) → **Check the static safety coefficient (fs)**

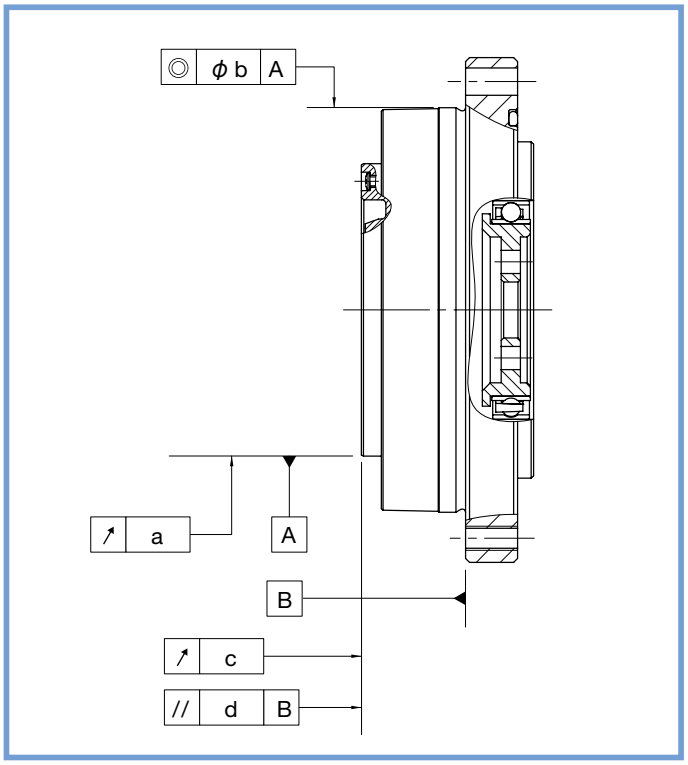
Main bearing specifications

Size	Pitch Circle	Offset	Basic rated load		Allowable moment load Mc	Moment stiffness Km
	dp	R	Basic dynamic rated load C	Basic static rated load C0		
	mm	mm	N	N	N·m	N·m/rad
8	29.0	7.90	1.8×10^3	2.2×10^3	7.9	10.0×10^3
11	37.1	8.15	2.8×10^3	3.5×10^3	17	17.5×10^3

* The basic dynamic load rating is a constant static radial load that provides a basic dynamic rating life of bearings to reach 1 million rotations.
* The basic static load rating is the static load that produces a contact stress of (4.2kN/mm^2) at the center of the contact area between the rolling element receiving the maximum load.
* The moment stiffness value is an average.
* Allowable moment load is the maximum moment load that may be applied to the output shaft. Please adhere to these values for optimum performance. Moment stiffness is a reference value. The minimum value is approximately 80% of the displayed value.

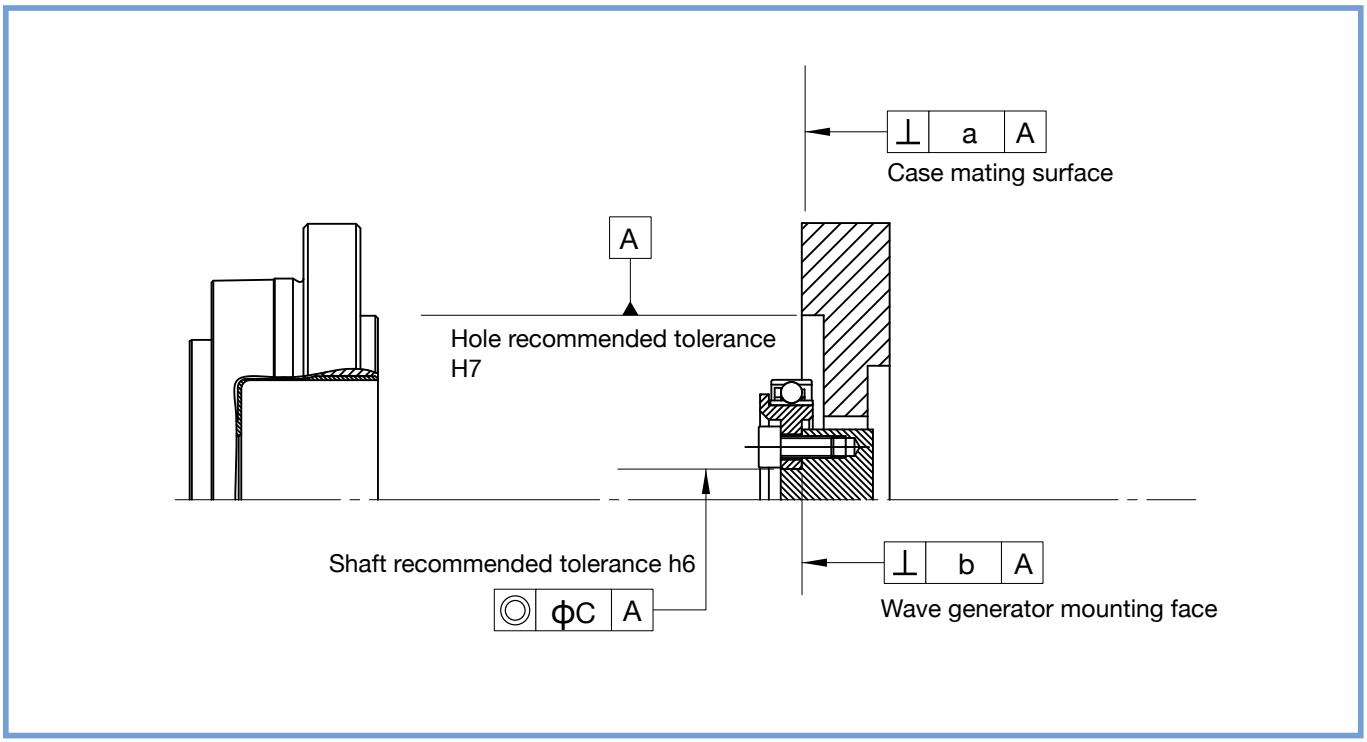
Mechanical Accuracy

Symbol	Feature	Size	
		8	11
a	Output shaft runout	0.010	0.010
b	Mounting pilot concentricity	0.050	0.050
c	Output flange surface runout	0.010	0.010
d	Parallelism between the mounting surface and the output flange surface	0.025	0.025



Installation Accuracy

In order to fully achieve the excellent performance of the CSF-2UH-ULW series maintain the recommended installation tolerances shown below:



Symbol	Item Precision	Size	
		8	11
a	Perpendicularity of the mounting flange	0.010	0.011
b	Perpendicularity of the Wave Generator mounting surface	0.006	0.007
c	Concentricity of the input shaft	0.006	0.007

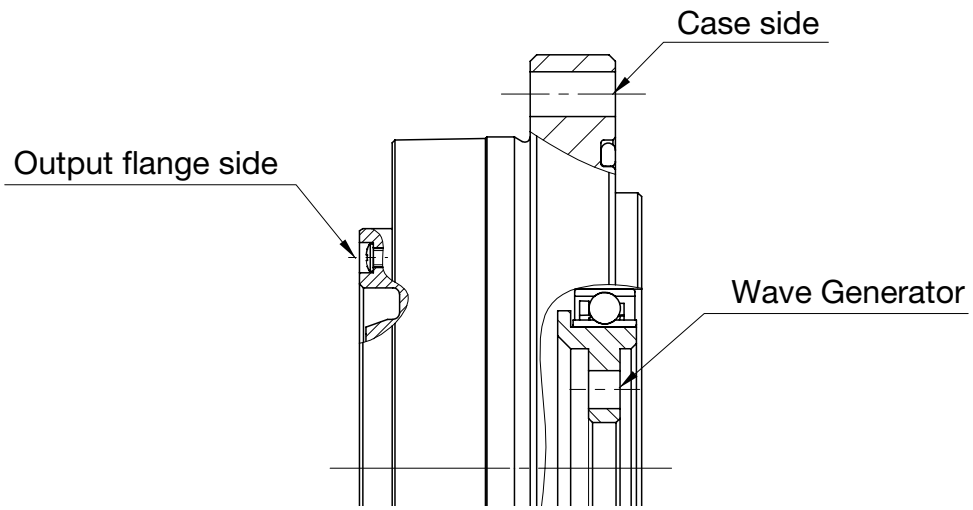
Installation and Transmission Torque

Precautions when installing the product

For peak performance of the gear, it is essential that the following tolerances be observed when assembly is complete. Pay careful attention to the following points:

- Warping and deformation on the mounting surface
- Contamination due to foreign matter
- Burrs, raised surfaces and location around the tap area of the mounting holes
- Insufficient chamfering on the mounting pilot joint
- Insufficient radii on the mounting pilot joint

Installation to the equipment



Installation and transmission torque on the side of output flange

Item	Size	8	11
Number of bolts		6	8
Bolt size		M3	M3
Mounting P.C.D.	mm	24.5	32.0
Bolt tightening torque	N·m	2.0	2.0
	kgf·m	0.20	0.20
Bolt transmission torque	N·m	30.6	53.3
	kgf·m	3.12	5.43

Installation and transmission torque on the side of case

Item	Size	8	11
Number of bolts		4	4
Bolt size		M3	M3
Mounting P.C.D.	mm	48	57
Bolt tightening torque	N·m	1.4	1.4
	kgf·m	0.14	0.14
Bolt transmission torque	N·m	28.0	33.2
	kgf·m	2.85	3.38

Installation and transmission torque on the side of Wave Generator

Item	Size	8	11
Number of bolts		4	4
Bolt size		M2	M2.5
Mounting P.C.D.	mm	7.5	12
Bolt tightening torque	N·m	0.54	1.08
	kgf·m	0.055	0.110
Bolt transmission torque	N·m	2.53	6.48
	kgf·m	0.25	0.66

Precautions for Use

Use only in a specified environment

Ensure the following environmental conditions are complied with:

- Ambient temperature 0 to 40°C
- No splashing of water or oil
- Do not expose to corrosive or explosive gas
- No dust such as metal powder

* For other precautions, refer to the “HarmonicDrive® Reducer Catalog.”

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