Laifual Drive

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Laifual Drive

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Laifual Drive

ZHEJIANG LAIFUAL DRIVE CO.,LTD

Product photos

LSS SERIES

LSS/LSN/LSG

LSS-Ⅰ-M

LFS-Ⅰ

LSD

LHT SERIES

LHT/LHG-Ⅰ

LHT/LHG-Ⅱ

LHT/LHN/LHG-Ⅲ

LHT/LHN/LHG-Ⅳ

LHT/LHG-Ⅴ

LHD-Ⅰ

LHD-Ⅲ

CONTENTS

Principle of harmonic gear reducer

I. Composition of harmonic gear reducer

Harmonic gear reducer has three basic components:a wave generator,a flexspline and a circular spline.
Wave generator: it is made up of a ball bearing and an elliptical cam.The wave generator is usually attached to the input end,the inner ring of the bearing is fixed around the cam causing the outer ring of the bearing deforms to an elliptical shape.
Fexspline: it is an elastic thin-walled component with gear teeth on outer surface.It is usually fitted to output end.
Circular spline:it is a rigid steel ring with internal teeth. It usually has two more teeth than the flexspline,and generally mounted onto a housing.

II. Principle of harmonic gear reducer

As a reducer, the harmonic gear reducer is often in a status as:the wave generator drives,the circular spline is fixed, the flexspline is output end.
When the wave generator is put inside of the flexspline,the flexspline is forced into an elliptical shape causing the flexspline teeth to engage with the tooth profile of the circular spline along the major axis of the ellipse,with the teeth completely disengaged across the minor axis of the ellipse.
The rotation of the wave generator makes the flexspline deform continuously, the teeth change operating state in the process of engagement and disengagement,thus the motion transmission between wave generator and flexspline is realized.

III .Characteristics of harmonic gear reducer

1. High accuracy: a good percentage of its teeth are meshed at all times, and are engaged at two zones 180 degrees apart. This means influences of tooth pitch errors and accumulated pitch errors on rotational accuracy are neutralized, which assures high positional and rotational accuracy.
2. High speed reduction ratio: a harmonic gear reducer has high single-stage reduction ratios of 1/30-1/500. Three basic components along same axle without complex structures can provide high reduction ratios.
3. High torque capacity:each tooth is subjected to a negligible amount of force yet provides a high torque capacity because of the way the teeth come into contact with each other and because a good percentage of the teeth in the flexspline are engaged at all times.
4. Small-sized and light weight: while being less the size of conventional gearing mechanisms and less the weight, the harmonic gear reducer provides the same levels of torque and speed reduction ratios as its conventional counterparts enabling machinery and equipment to be made smaller and lighter.
5. Superior efficiency and long life time.
6. Quiet and minimal vibration operation.

| 0° | 90° | 180° | 360° |

Circular spline
Wave generator
Flexspline
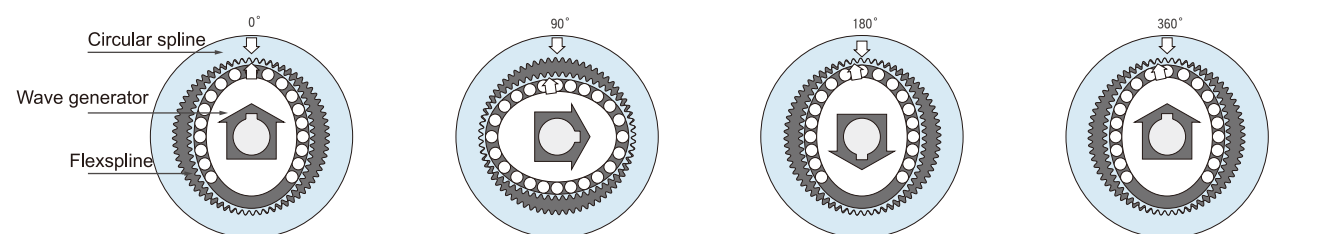
The flexspline is forced into an elliptical shape by the wave generator causing the flexspline teeth to engage with the tooth profile of the circular spline along the major axis of the ellipse, with the teeth completely disengaged across the minor axis of the ellipse

As the wave generator rotates clockwise with the circular spline fixed, the flexspline is subjected to elastic deformation and its tooth engagement position moves turning relative to the circular spline.

As the wave generator rotates 180 degrees clockwise, the flexspline moves counterclockwise by one tooth relative to the circular spline.

For every one full rotation clockwise (360 degrees) of the wave generator, the flexspline moves counterclockwise by two teeth relative to the circular spline because the flexspline has two fewer teeth than there are on the circular spline. In general, this movement is treated as output performing.

Laifual Drive

Company presentation

Zhejiang Laifual Drive Co., Ltd is a national high-tech enterprise, mainly engaged in research and manufacture of high-precision harmonic reducers and planetary gear reducers. Total factory is 30,000 square meters. About 300 employees, including around 30 R&D Personnel, with more than 10 years experience in research and development.

Laifual uses the world's first class production and inspection equipment. Pay attention to every production details, we have very strict quality control from raw materials to the finished products, to make sure the excellent quality of all products. All products are completely developed by ourselves, Laifual's R&D center is recognized as "High-tech enterprise R&D center in Zhejiang province".

After years of hard working, Laifual has obtained 30 patents in the field of drive area. Including 1 major scientific and technological patent and 29 independent intellectual property rights patents. Laifual was recognized as a national high-tech enterprise, medium-sized enterprise in Zhejiang province, and successfully passed the ISO9001 quality management system certification.

Thanks to years of research and development experience, Laifual has made breakthroughs in many special performance. Our high precision harmonic reducer have the characteristics of low temperature rise, low starting torque, high reliability, big torque, long life time, big speed ratio, small size, etc. Which can be widely used in industrial robots, service robots, medical equipment, high precision automation equipment, etc. And we sincerely provide satisfactory and diversified custom design services for all our valued customers.

Taking professionalization, internationalization as standard, to build Laifual into the most respectable harmonic reducer brand.

Technical Information

■ Tooth profile

● Gear toothing capacity increased by 15%

● Reduce gear fatigue pitting contact area

● Temperature rise decreased by 8-10 degrees

● Service time over 15000 hours

About LS tooth profile

We have made some upgrades based on the traditional theoretical double arc profile. The tooth profile formed by the original two-curve continuous arc curve is optimized as a continuous arc curve with multiple segments of curvature. To ensure that the gears of reducer are properly meshed, while protecting the risk of grease failure after grease is squeezed by reducing relative sliding friction. Based on the δ tooth shape, the load capacity is increased by 15%, the temperature rise is reduced by 8-10 degrees, the gear fatigue pitting contact area is reduced by more than 30%, continuous running and service life is over 15000 hours, which improves the overall performance of the harmonic reducer.
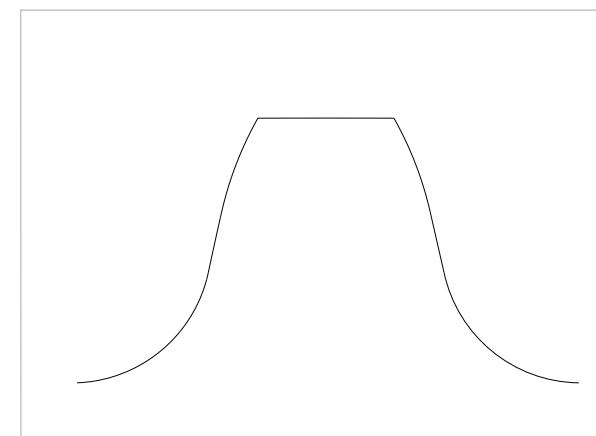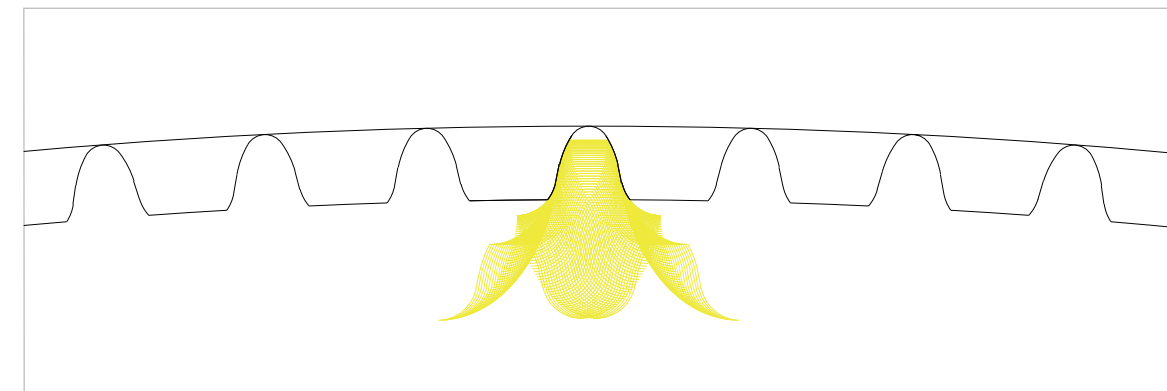
During development, the formation of the soft tooth profile can be determined by the radial displacement of the generator. Different gear reduction ratios can be fitted with various tooth profiles. And the mesh backlash can be conveniently adjusted according to actual conditions. Keep the reducer in the best working condition.

About grease

Special grease developed for laifual drive

Laifual's LF-I grease

Compare with the common greases on the market, Laifual's grease has high efficiency and durable.

Laifual's LF-II grease

Excellent lubrication when the wave generator is rotated by extruding additives to liquefy.

Grease characteristics

Model	Color	Operating temperature	Working ambient temperature	Durability	Grease leakage
LF-I	YELLOW	0℃~+40℃	-20℃~+100℃	○	◎
LF-II	GREEN	0℃~+40℃	-20℃~+100℃	○	◎

○ Applicable   ◎ Superior

A suitable grease for different models

Greases for reduction ratio more than 50

Model / Reduction ratio	Reduction ratio	11	14	17	20	25	32	40
Grease	LF-I	—	—	—	○	○	○	○
	LF-II	○	○	○	□	□	□	□

○ Standard grease   □ Quasi-standard grease

Seal size description

Series	Model	Circular spline		Flexspline	
		Seal size	Slot size	Seal size	Slot size
LHT-I	14	37 ＊ 1	Φ37 $_{-0.1}^{0}$＊φ39.6$_{-0.1}^{+0.1}$＊0.75$_{0}^{+0.1}$	53 ＊ 1.5	φ53 $_{-0.1}^{0}$＊ φ56.8 $_{0}^{+0.1}$＊1.15$_{0}^{+0.1}$
	17	46.5 ＊ 1	φ46.5$_{-0.1}^{0}$＊φ49.1$_{-0.1}^{+0.1}$＊0.75$_{0}^{+0.1}$	64 ＊ 1	φ64 $_{-0.1}^{0}$＊ φ66.6 $_{0}^{+0.1}$＊0.75$_{0}^{+0.1}$
LHT-II	20	55 ＊ 1	φ55 $_{-0.1}^{0}$＊φ57.6$_{-0.1}^{+0.1}$＊0.75$_{0}^{+0.1}$	73 ＊ 1.5	φ73 $_{-0.1}^{0}$＊ φ76.8 $_{0}^{+0.1}$＊1.15$_{0}^{+0.1}$
	25	68 ＊ 1	φ68 $_{-0.1}^{0}$＊φ70.6$_{-0.1}^{+0.1}$＊0.75$_{0}^{+0.1}$	90 ＊ 1.5	φ90 $_{-0.1}^{0}$＊ φ94.2 $_{0}^{+0.1}$＊1.15$_{0}^{+0.1}$
	32	88 ＊1.5	φ88 $_{-0.1}^{0}$＊ φ92 $_{0}^{+0.1}$＊ 1.15$_{0}^{+0.1}$	119＊1.5	φ119$_{-0.1}^{0}$＊φ123.1$_{0}^{+0.1}$＊ 1.15$_{0}^{+0.1}$

Terms and definitions

Starting torque

It is the minimum torque value applied to the input end at which the harmonic reducer first starts to rotate with no load.

Backlash

The clearance between flexspline tooth profile and circular spline tooth profile.

Rated torque

It indicates allowable continuous output torque at rated input speed.

Permissible peak torque at start and stop

It's the maximum torque as a result of the moment of inertia of the output load during acceleration and deceleration.

Permissible maximum value for average load torque

It's the maximum torque when the harmonic reducer keeps continuous operation.

Permissible maximum momentary torque

It is the momentary peak torque the harmonic reducer may be subjected to the event of a collision or emergency stop.

Permissible maximum input rotational speed

Don't exceed the permissible rating.

## Permissible average input rotational speed

It's the average value of input speed.

Wave generator

The wave generator includes a structure of a European-style coupling with a self-aligning structure and an integrated type without an automatic self-aligning structure, and varies depending on the series. For details, please refer to the outline drawing of each series.

• Basic structure and shape of wave generator shown as below:

■ Cross sliding block type   ■ Unibody
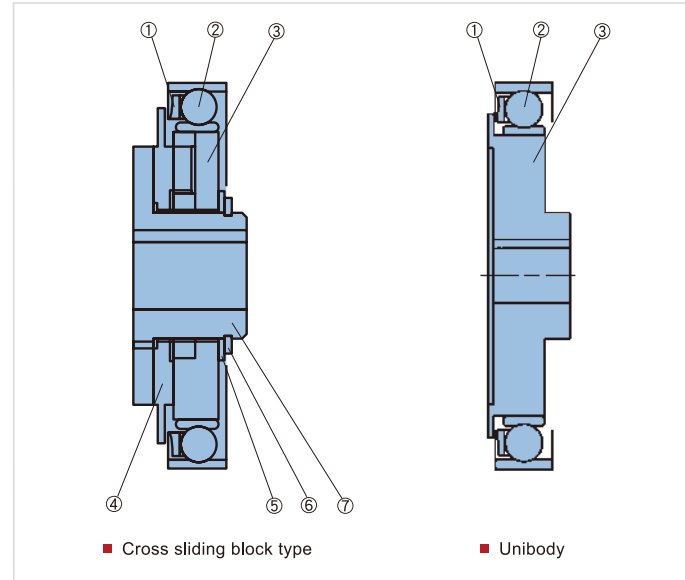
• Structure of cross sliding block type-Using European coupling structure
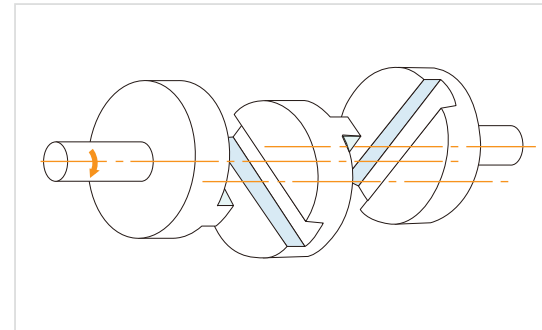

❶ Holder of flexible bearing
❷ Flexible baring
❸ Wave generator
❹ Cross sliding block
❺ Gasket
❻ Ring-shield
❼ Power input shaft

Axial force and axial fixation of wave generator

The axial force on wave generator begins to work due to elastic deformation of flexspline.
When used as a reducer, the axial force moves towards to the inside of the flexspline.
When used as a speed increaser, the axial force's movement is opposite to the direction of the deceleration.
The design of prevent axial force of wave generator shall be adopted under any conditions of usage.
*Please make sure to consult with the authorized distributor when setting the stop screw and fixing it to the input axial on the wave generator.

• Axial force direction of the wave generator

Axial force direction during decelerating

Axial force direction during accelerating
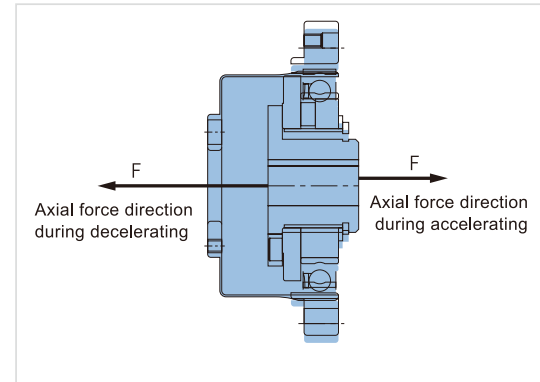
Maximum aperture size of the unibody wave generator

The standard aperture of the wave generator has shown in the outline-drawing, the alteration can be made within maximum size range shown in the table.
We suggest to use GB standard for keyway size. The key's effective length dimension should be designed to fully withstand the value of the transmitted torque.

• Wave generator aperture
unit: mm

Model	11	14	17	20	25	32	40
Standard size (H7)	6	6	8	8	14	14	14
Minimum size	3	3	4	5	6	6	10
Maximum size	8	17	20	23	28	36	42

The aperture of the wave generator can be customized according to customer requirements.
Please contact with the authorized distributor in case of any changes in the table.
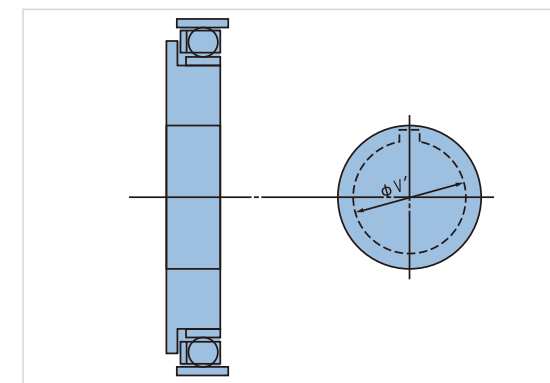
Installation procedure

Installation of LSS series

Install the reducer as the arrow shows

Seal between the input fixed end and circular spline

Output terminal

Fill grease here

$L1 > 0.3mm$
$L2 \geq 1mm$
$D \geq 1mm$
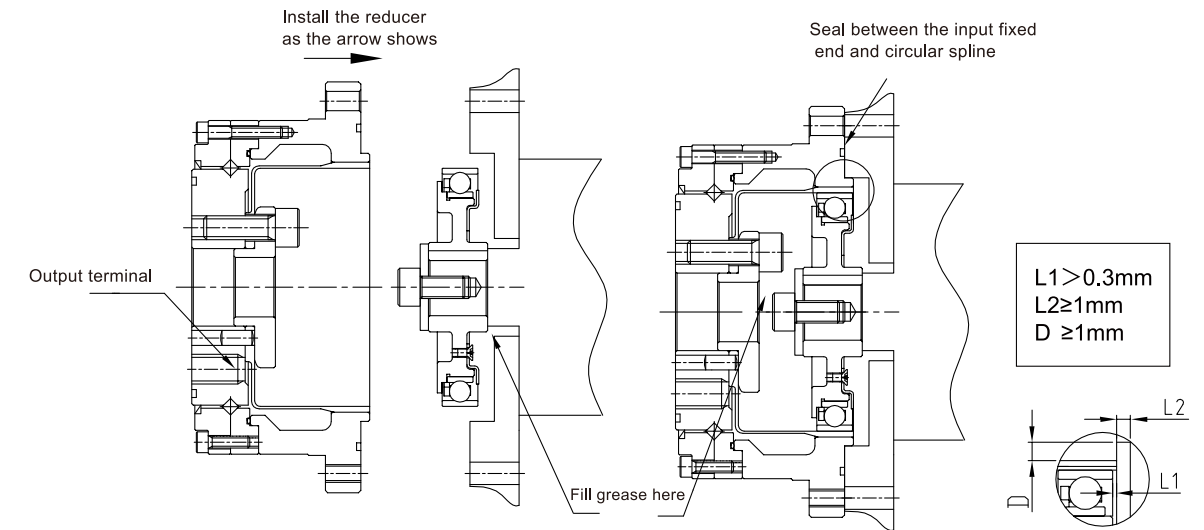
The first method of installation for LHT-I/II Series

Install wave generator as arrow shows

Seal between the output end and circular spline.

Seal between the input fixed end and flexspine

Fill grease in the flexspline cavity

Fill grease here

$L1 > 0.5mm$
$L2 \geq 1mm$
$D \geq 1mm$
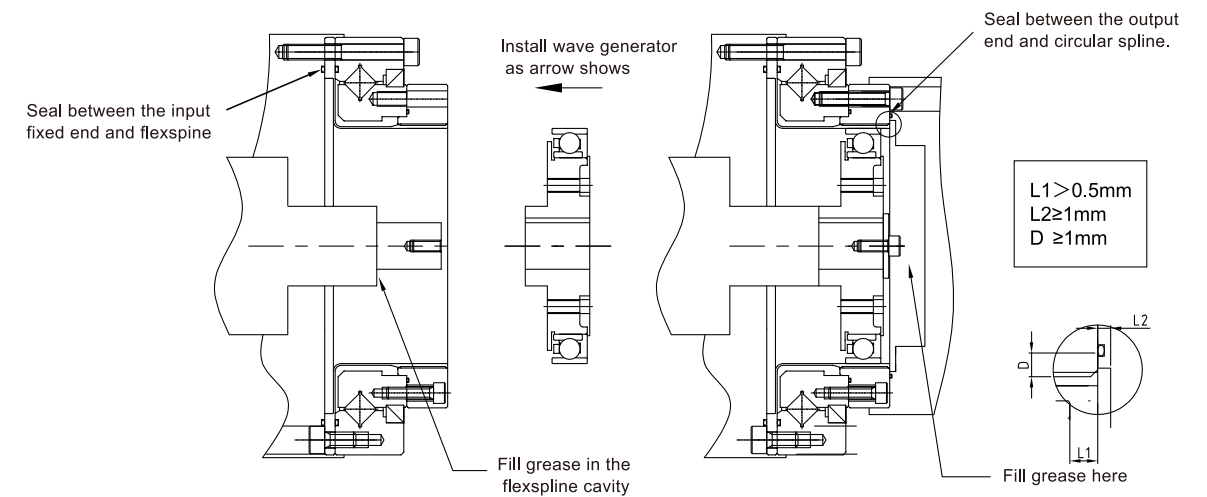
The second method of installation for LHT-I/II series

Install the reducer as the arrow shows

Seal between the output end and flexspline

Seal between the input fixed end and circular spline.

Fill grease here

Fill grease in the flexspline cavity

$L1 > 0.5mm$
$L2 \geq 1mm$
$D \geq 1mm$
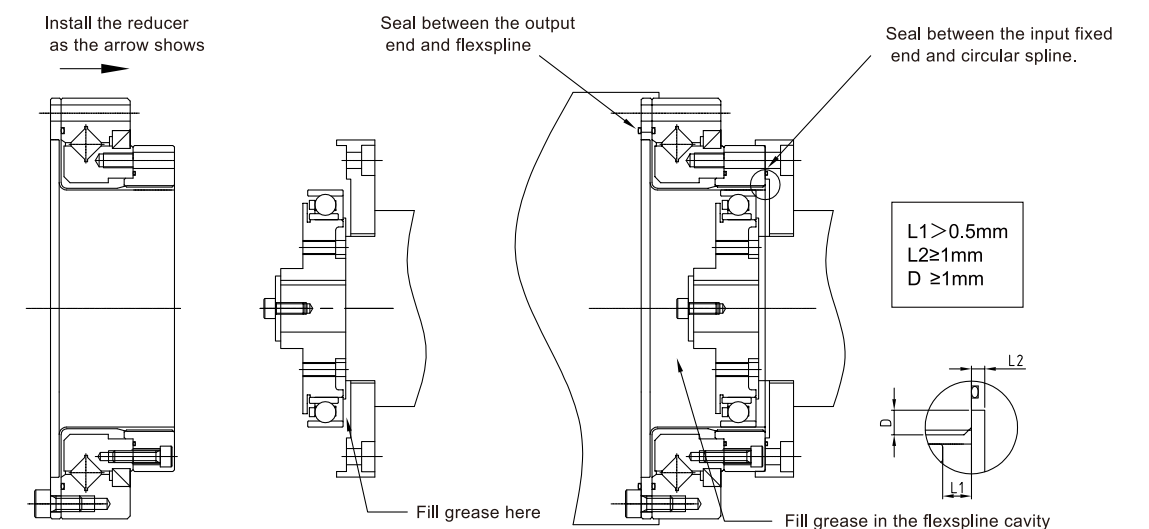
■ Installation procedure

The connecting and fixing method of wave generator

1.Input shaft has a shaft shoulder, it can be connected with wave generator directly. As shown in the figure.

Key
Flat gasket
Screw
Wave generator
Input shaft
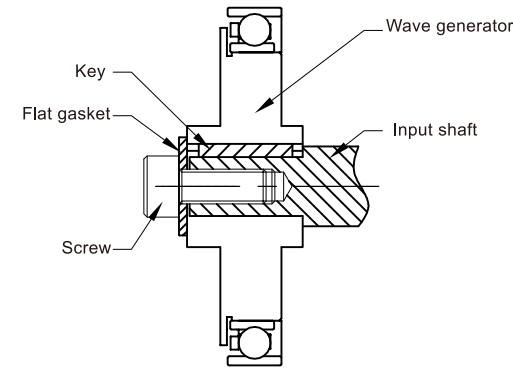
2.Input shaft has a shaft shoulder, but it's too long. You can add a space ring on the shaft(the parallelism of space ring should be within 0.01mm), then connect and fix with the wave generator. As shown in the figure.

Key
Flat gasket
Screw
Wave generator
Space ring
Input shaft
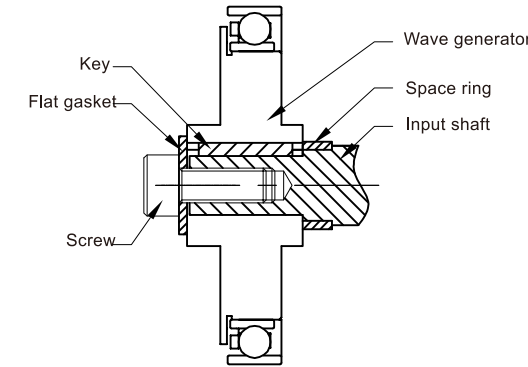
3.Input shaft has no shaft shoulder. Fix a connection gasket on the wave generator, then connect and fix with the input shaft. As shown in the figure.

Connection screw
Key
Screw
Connection gasket
Wave generator
Input shaft

4.This fixing method is suitable for small models, optical axis input. Input shaft inserted into the wave generator, then connect and fix it through the thimble screw on wave generator. As shown in the figure.

Wave generator
Thimble screw
Input shaft

■ Assembly considerations

Assembly procedure

Install the circular spline and flexspline on the device, and then install the wave generator.
Otherwise it may cause stuffing damage to the gear teeth or improper eccentric gear mesh. Please pay close attention to it.

• Correct assembly steps

Flexspline/CRB outer ring   Circular spline/CRB inner ring

Wave generator   Wave generator

Precautions on installation

The improper assembly may cause vibration and noise during operation.
Please assembly base on the following precautions.

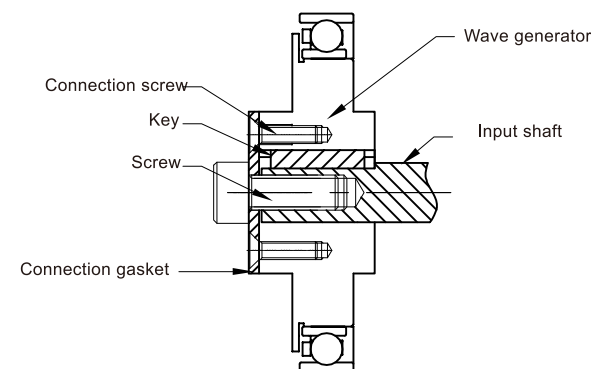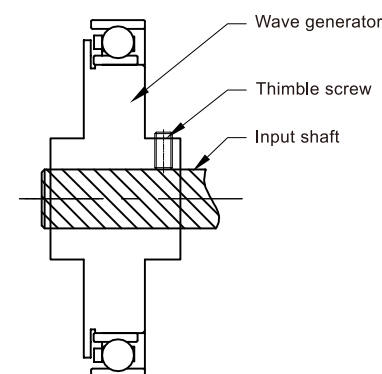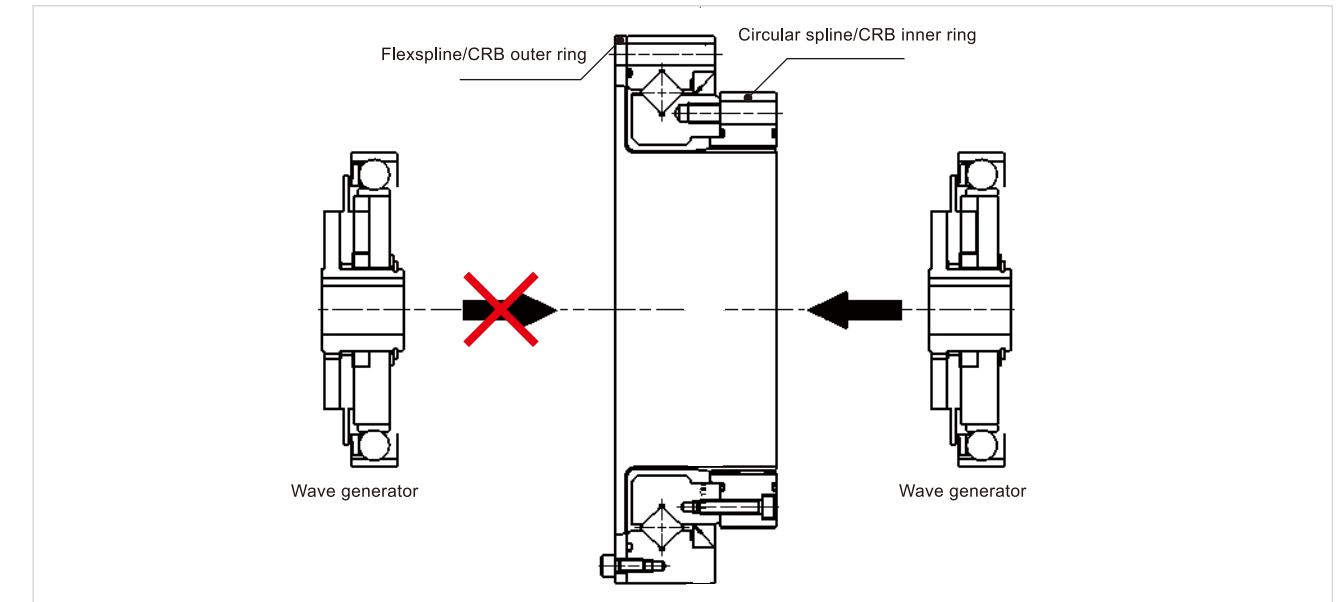• Precautions on wave generator

1.Please avoid applying undue force to the bearing on wave generator during assembly. We suggest to rotate the wave generator while inserting, it will ease the process.
2. If the wave generator does not have an oldham coupling, extra care must be given to ensure that concentricity and inclination are within the specified limits.

• Precautions on circular spline

1.Mounting surfaces need to have adequate flatness, smoothness, and no distortion.
2.Especially in the area of the screw holes, burrs or foreign matter should not be present.
3.Please make sure the chamfering and avoidance machining are performed on the housing assembly, to avoid the interference with the circular spline.
4.The circular spline should be rotatable within the housing. Be sure there is no interference and it does not catch on anything.
5.When mounting the bolt, make sure the bolt hole is correct and aligned. Bolts should rotate freely when tightening and should not have any irregularity due to the bolt hole being misaligned or oblique.
6.Don't tighten the bolts with the specified torque all at once. Tighten the bolts temporarily with about half the specified torque, and then tighten them with the specified torque. Tighten them in an even, crisscross pattern.
7.Avoid pinning the circular spline if possible as it can reduce the rotational precision and smoothness of operation.

• Precautions on flexspline

1.Mounting surfaces need to have adequate flatness, smoothness, and no distortion.
2.Especially in the area of the screw holes, burrs or foreign matter should not be present.
3.Please make sure the chamfering and avoidance machining are performed on the housing assembly, to avoid the interference with the circular spline.
4.When mounting the bolt, make sure the bolt hole is correct and aligned. Bolts should rotate freely when tightening and should not have any irregularity due to the bolt hole being misaligned or oblique.
5.Don't tighten the bolts with the specified torque all at once. Tighten the bolts temporarily with about half the specified torque, and then tighten them with the specified torque. Tighten them in an even, crisscross pattern.
6.Avoid unilateral meshing and deviation when assembling with circular spline.

• Rust prevention

The complete assembly unit has no rust prevention on surface.
Please daub anti-rust if needed.
Besides, if an anti-rust product is needed, please contact with the authorized distributor.

■ Precautions on installation

Assembly accuracy of LSS series

To make sure LSS series play its excellent performance when assemble, please make sure to use the following accuracy.
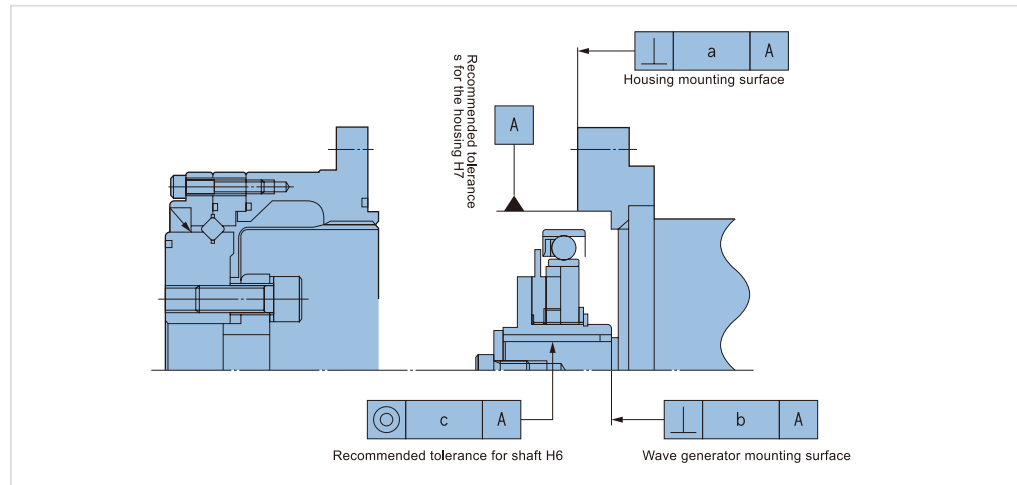
• Recommended accuracy of the assembled housing

unit：mm

Symbol / Model	14	17	20	25	32
a	0.011	0.015	0.017	0.024	0.026
b	0.017 (0.008)	0.020 (0.010)	0.020 (0.010)	0.024 (0.012)	0.024 (0.012)
c	0.030 (0.016)	0.034 (0.018)	0.044 (0.019)	0.047 (0.022)	0.050 (0.022)

*b,c is the value of the unibody generator (I series) and the cross slider generator (II series).
The value in () is the value of the unibody generator (I series).

Assembly accuracy of LHT series

To make sure LHT-I/II series play its excellent performance when assemble, please make sure to use the following accuracy.
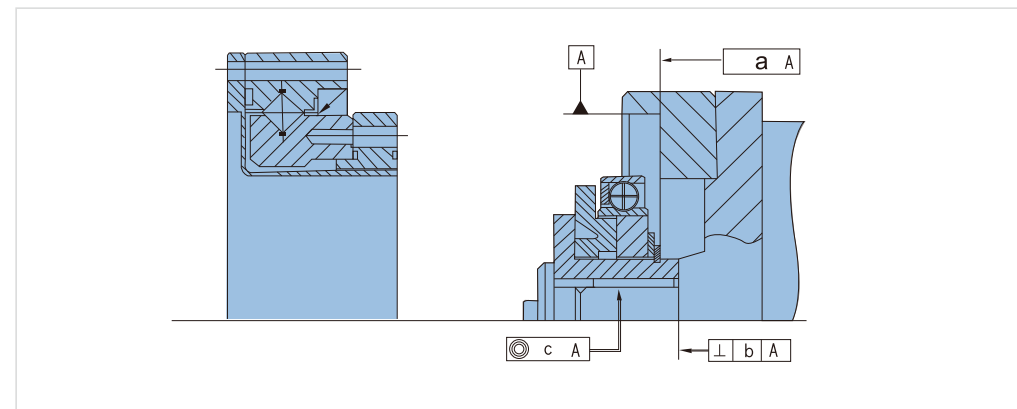

• Recommended accuracy of the assembled housing

unit：mm

Symbol / Model	14	17	20	25	32	40
a	0.011	0.015	0.017	0.024	0.026	0.026
b	0.017 (0.008)	0.020 (0.010)	0.020 (0.010)	0.024 (0.012)	0.024 (0.012)	0.032 (0.012)
c	0.030 (0.016)	0.034 (0.018)	0.044 (0.019)	0.047 (0.022)	0.047 (0.022)	0.050 (0.024)

*b,c is the value of the unibody generator (I series) and the cross slider generator (II series).
The value in () is the value of the unibody generator (I series).

■ Specification of main bearing

Each product is assembled with precise cross roller bearing for supporting external loading(Output flange).

Specification of LSS series

Type	Basic rated load				Allowable static moment Mc		Weight
	Basic rated dynamic load Cr		Basic rated static load Cr				
	KN	kgf	KN	kgf	Nm	kgfm	kg
14	4.7	480	6.07	620	41	4.2	0.22
17	5.2	540	7.55	770	64	6.5	0.3
20	5.8	590	9.0	920	91	9.3	0.38
25	9.6	980	15.1	1540	156	16	0.6
32	15	1530	25.1	2550	313	32	1.1

■ Basic rated dynamic load refers to static radial load that makes dynamic rated life of bearing reach up to 1 million rotations.
■ Basic rated static load refers to static load that exerts a certain level of contact stress(4KN/mm) on the central location between rotor of bearing maximum load and contact part of pathway.
■ Allowable static moment refers to the value of the maximum torque exerting on output bearing, within the scope of which, it's workable and the basic performance is possible.

Starting torque of LSS series

Reduction ratio \ Type	11	14	17	20	25	32
50	2.0	4.1	6.1	7.8	15	31
80	1.8	2.8	4	4.9	9.2	19
100	1.5	2.5	3.4	4.3	8	18
120	-	2.3	3.1	3.8	7.3	15
160	-	-	-	3.8	-	-

Specification of LHT series

Type	Basic rated load				Allowable static moment Mc		Weight
	Basic rated dynamic load Cr		Basic rated static load Cr				
	KN	kgf	KN	kgf	Nm	kgfm	kg
14	5.8	590	8.6	880	74	7.6	0.39
17	10.4	1060	16.3	1670	124	12.6	0.56
20	14.6	1490	22	2250	187	19.1	0.73
25	21.8	2230	35.8	3660	258	26.3	1.23
32	38.2	3900	65.4	6680	580	59.1	2.54
40	43.3	4410	81.6	8330	849	86.6	7.2

■ Basic rated dynamic load refers to static radial load that makes dynamic rated life of bearing reach up to 1 million rotations.
■ Basic rated static load refers to static load that exerts a certain level of contact stress(4KN/mm) on the central location between rotor of bearing maximum load and contact part of pathway.
■ Allowable static moment refers to the value of the maximum torque exerting on output bearing, within the scope of which, it's workable and the basic performance is possible.

Starting torque of hollow type(LHT-III)

unit：cNm

Reduction ratio \ Type	14	17	20	25	32	40
50	8.8	27	36	56	85	136
80	7.5	25	33	50	74	117
100	6.9	24	32	49	72	112
120	6.9	24	31	48	68	110
160	–	–	31	–	–	–

Starting torque of input axial type(LHT-IV)

unit：cNm

Reduction ratio \ Type	14	17	20	25	32	40
50	5.7	9.7	14	22	41	72
80	4.4	7.2	11	15	29	52
100	3.7	6.5	9.9	14	27	47
120	3.4	6.2	9.3	13	24	44
160	–	–	8.6	–	–	–

Axial input (LHT-IV) timing belt tension torque recommended value

unit：Nm

Generator load torque	Model	14	17	20	25	32
Maximum	LHT-IV	13	19	25	25	52

Moment load table

Moment load table of LSS(LSG) series

Model	Value	Permissible value at start and stop	Instant permissible value
LSS(LSG)-14	M b di 20Nm	M b peak 40Nm	M b max 80Nm
	F t di 180N	F t peak 320N	F t max 560N
	F a di 180N	F a peak 320N	F a max 560N
LSS(LSG)-17	M b di 30Nm	M b peak 60Nm	M b max 120Nm
	F t di 230N	F t peak 400N	F t max 700N
	F a di 230N	F a peak 400N	F a max 700N
LSS(LSG)-20	M b di 42Nm	M b peak 80Nm	M b max 168Nm
	F t di 270N	F t peak 480N	F t max 830N
	F a di 270N	F a peak 480N	F a max 830N
LSS(LSG)-25	M b di 80Nm	M b peak 160Nm	M b max 313Nm
	F t di 440N	F t peak 770N	F t max 1320N
	F a di 440N	F a peak 770N	F a max 1320N
LSS(LSG)-32	M b di 220Nm	M b peak 440Nm	M b max 890Nm
	F t di 900N	F t peak 1600N	F t max 2700N
	F a di 900N	F a peak 1600N	F a max 2700N

Moment load table of LHT(LHG) series

Model	Value	Permissible value at start and stop	Instant permissible value
LHT(LHG)-14	M b di 41Nm	M b peak 80Nm	M b max 160Nm
	F t di 270N	F t peak 490N	F t max 830N
	F a di 270N	F a peak 490N	F a max 830N
LHT(LHG)-17	M b di 72Nm	M b peak 140Nm	M b max 290Nm
	F t di 400N	F t peak 700N	F t max 1200N
	F a di 400N	F a peak 700N	F a max 1200N
LHT(LHG)-20	M b di 140Nm	M b peak 280Nm	M b max 560m
	F t di 650N	F t peak 1150N	F t max 1980N
	F a di 650N	F a peak 1150N	F a max 1980N
LHT(LHG)-25	M b di 243Nm	M b peak 480Nm	M b max 974Nm
	F t di 900N	F t peak 1600N	F t max 2800N
	F a di 900N	F a peak 1600N	F a max 2800N
LHT(LHG)-32	M b di 460Nm	M b peak 900Nm	M b max 1860Nm
	F t di 1350N	F t peak 2300N	F t max 4000N
	F a di 1350N	F a peak 2300N	F a max 4000N
LHT(LHG)-40	M b di 600Nm	M b peak 1200Nm	M b max 3000Nm
	F t di 2000N	F t peak 3500N	F t max 6000N
	F a di 2000N	F a peak 3500N	F a max 6000N

■ Note: Output load Mb- Bending moment, Ft-radial force, Fa-axial force

Moment load table of LSD series

Model	Value	Permissible value at start and stop	Instant permissible value
LSD-14	M b di 20Nm	M b peak 40Nm	M b max 80Nm
	F t di 180N	F t peak 320N	F t max 560N
	F a di 180N	F a peak 320N	F a max 560N
LSD-17	M b di 30Nm	M b peak 60Nm	M b max 120Nm
	F t di 230N	F t peak 400N	F t max 700N
	F a di 230N	F a peak 400N	F a max 700N
LSD-20	M b di 42Nm	M b peak 80Nm	M b max 168Nm
	F t di 270N	F t peak 480N	F t max 830N
	F a di 270N	F a peak 480N	F a max 830N
LSD-25	M b di 80Nm	M b peak 160Nm	M b max 313Nm
	F t di 440N	F t peak 770N	F t max 1320N
	F a di 440N	F a peak 770N	F a max 1320N
LSD-32	M b di 220Nm	M b peak 440Nm	M b max 890Nm
	F t di 900N	F t peak 1600N	F t max 2700N
	F a di 900N	F a peak 1600N	F a max 2700N

Moment load table of LHD series

Model	Value	Permissible value at start and stop	Instant permissible value
LHD-14	M b di 41Nm	M b peak 80Nm	M b max 160Nm
	F t di 270N	F t peak 490N	F t max 830N
	F a di 270N	F a peak 490N	F a max 830N
LHD-17	M b di 59Nm	M b peak 140Nm	M b max 239Nm
	F t di 330N	F t peak 570N	F t max 990N
	F a di 330N	F a peak 570N	F a max 990N
LHD-20	M b di 117Nm	M b peak 230Nm	M b max 468Nm
	F t di 550N	F t peak 975N	F t max 1680N
	F a di 550N	F a peak 975N	F a max 1680N
LHD-25	M b di 213Nm	M b peak 420Nm	M b max 855Nm
	F t di 790N	F t peak 1400N	F t max 2450N
	F a di 790N	F a peak 1400N	F a max 2450N
LHD-32	M b di 400Nm	M b peak 800Nm	M b max 1600Nm
	F t di 1240N	F t peak 2100N	F t max 3680N
	F a di 1240N	F a peak 2100N	F a max 3680N
LHD-40	M b di 600Nm	M b peak 1200Nm	M b max 2520Nm
	F t di 1530N	F t peak 2670N	F t max 4600N
	F a di 1530N	F a peak 2670N	F a max 4600N

■ Note: Output load Mb- Bending moment, Ft-radial force, Fa-axial force

LSS – 14 – 100 – U/C – I

Series	Type	Reduction ratio(Note 1)						Structure code	Style
LSS	11	50	80	100	-	-	-		
	14	50	80	100	-	-	-		
LSN	17	50	80	100	-	-	-	U: Completely unit	I: Simple Standard Type
LSG	20	50	80	100	120	160	-	C: Component	II: Simple Cross Slider type
LSD	25	50	80	100	120	-	-		
LFS	32	50	80	100	120	-	-		

■ Note1: Reduction ratio indicates of wave generator as inputting, fixing circular spline, and flexspline as outputting.

LSS series

LSS series

A combination product which is easy to operate.
Each model has a cross-roller bearing that with high rigidity to support external loads.

LSN series

A light weight product. Compare with standard product that with the same performance, LSN series is 30% lighter.

LSG series

High torque. Compare with standard products, LSG series' torque capacity is 30% higher. And the service life is increased by 43%, with high load capacity and high reliability.

Application

Industrial robot	Service Robots	Metal Machine Tools	Medical Devices
Analysis, Test Equipment	Energy Related equipment	Papermaking Equipment	

• Combinative structure of LSS series

Standard Type (LSS-I/II)

Circular spline
Cross roller bearing
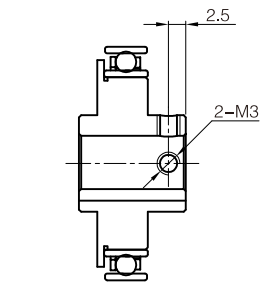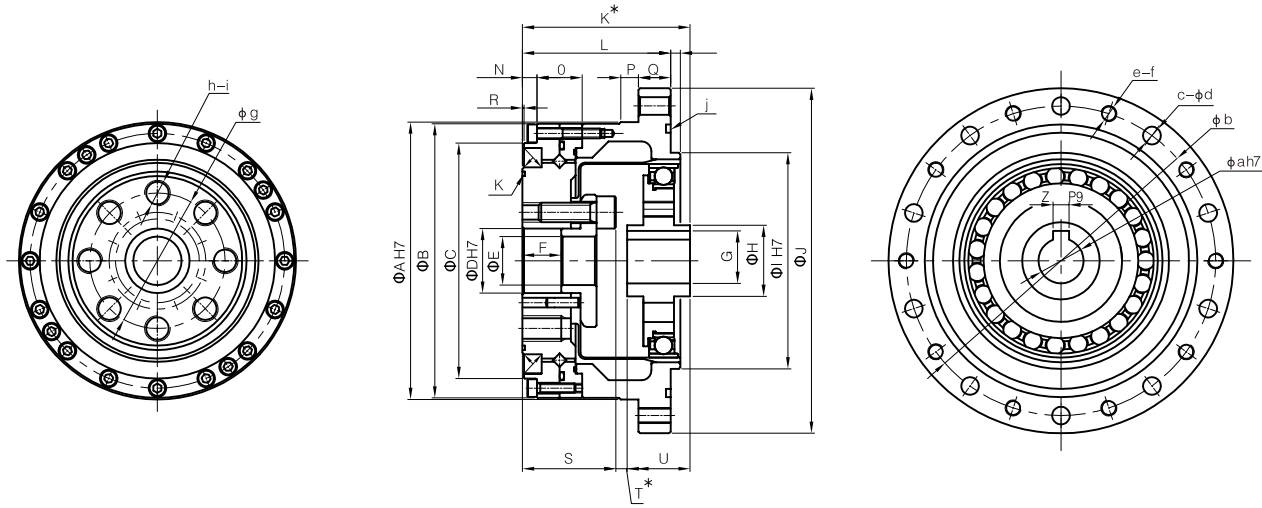Output flange
Wave generator
Flexspline
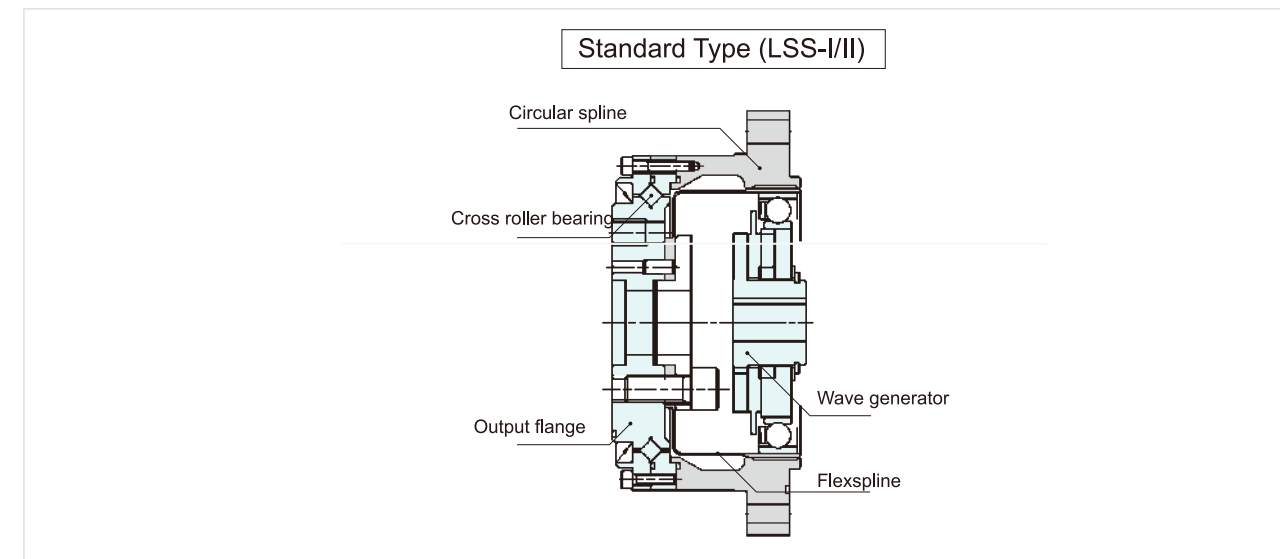
Rated parameter table of LSS/LSN series

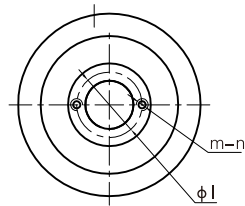| Model	Reduction ratio	Rated torque at 2000r/min input	Permissible peak torque at start and stop	Permissible maximum value for average load torque	Permissible maximum momentary torque	Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Grease)	Moment of inertia
		Nm	Nm	Nm	Nm	r/min	r/min	kgcm²
11	50	3.5	8.3	5.5	17.0	8500	3500	1.4×10^{-2} 1.2×10^{-2}
	80	4.5	9.9	8.0	22.5			
	100	5.0	11	8.9	25.0			

Model	Reduction ratio	Rated torque at 2000r/min input		Permissible peak torque at start and stop		Permissible maximum value for average load torque		Permissible maximum momentary torque		Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Grease)	backlash	Design life
		Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	r/min	r/min	Arc Sec	Hour
14	50	5.4	0.55	18	1.8	6.9	0.70	35	3.6	8500	3500	≤20	10000
	80	7.8	0.80	23	2.4	11	1.1	47	4.8				15000
	100	7.8	0.80	28	2.9	11	1.1	54	5.5				15000
	120	7.8	0.80	28	2.9	11	1.1	54	5.5				15000
17	50	16	1.6	34	3.5	26	2.6	70	7.1	7300	3500	≤20	10000
	80	22	2.2	43	4.4	27	2.7	87	8.9				15000
	100	24	2.4	54	5.5	39	4.0	108	11				15000
	120	24	2.4	54	5.5	39	4.0	86	8.8				15000
20	50	25	2.5	56	5.7	34	3.5	98	10	6500	3500	≤20	10000
	80	34	3.5	74	7.5	47	4.8	127	13				15000
	100	40	4.1	82	8.4	49	5.0	147	15				15000
	120	40	4.1	87	8.9	49	5.0	147	15				15000
	160	40	4.1	92	9.4	49	5.0	147	15				15000
25	50	39	4.0	98	10	55	5.6	186	19	5600	3500	≤20	10000
	80	63	6.4	137	14	87	8.9	255	26				15000
	100	67	6.8	157	16	108	11	284	29				15000
	120	67	6.8	167	17	108	11	304	31				15000
32	50	76	7.8	216	22	108	11	382	39	4800	3500	≤20	10000
	80	118	12	304	31	167	17	568	58				15000
	100	137	14	333	34	216	22	647	66				15000
	120	137	14	353	36	216	22	686	70				15000
40	50	137	14	402	41	196	20	686	70	4000	3000	≤20	10000
	80	206	21	519	53	284	29	980	100				15000
	100	265	27	568	58	372	38	1080	110				15000
	120	294	30	617	63	451	46	1180	120				15000

# Rated parameter table of LSG series

Model	Reduction ratio	Rated torque at 2000r/min input		Permissible peak torque at start and stop		Permissible maximum value for average load torque		Permissible maximum momentary torque		Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Grease)	backlash	Design life
		Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	r/min	r/min	Arc Sec	Hour
11	80	3.8	0.4	8.5	0.9	6.8	0.7	19.1	1.9	8000	3000	≤20	10000
	100	4.1	0.4	8.9	0.9	7.2	0.7	20	2				
14	50	7	0.7	23	2.3	9	0.9	46	4.7	10000	6500	≤20	15000
	80	10	1	30	3.1	14	1.4	61	6.2				
	100	10	1.0	36	3.7	14	1.4	70	7.2				
17	50	21	2.1	44	4.5	34	3.4	91	9	7500	5600	≤20	20000
	80	29	2.9	56	5.7	35	3.6	113	12				
	100	31	3.2	70	7.2	51	5.2	143	15				
20	50	33	3.3	73	7.4	44	4.5	127	13	7000	4800	≤20	20000
	80	44	4.5	96	9.8	61	6.2	165	17				
	100	52	5.3	107	10.9	64	6.5	191	20				
	120	52	5.3	113	11.5	64	6.5	191	20				
	160	52	5.3	120	12.2	64	6.5	191	20				
25	50	51	5.2	127	13	72	7.3	242	25	5600	4000	≤20	20000
	80	82	8.4	178	18	113	12	332	34				
	100	87	8.9	204	21	140	14	369	38				
	120	87	8.9	217	22	140	14	395	40				
32	50	99	10	281	29	140	14	497	51	5600	3000	≤20	20000
	80	153	16	395	40	217	22	738	75				
	100	178	18	433	44	281	29	841	86				
	120	178	18	459	47	281	29	892	91				

The generator inner hole of type 14 is non-keyway

Generator's location limited mounting hole
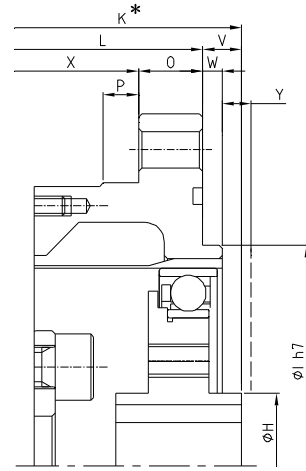
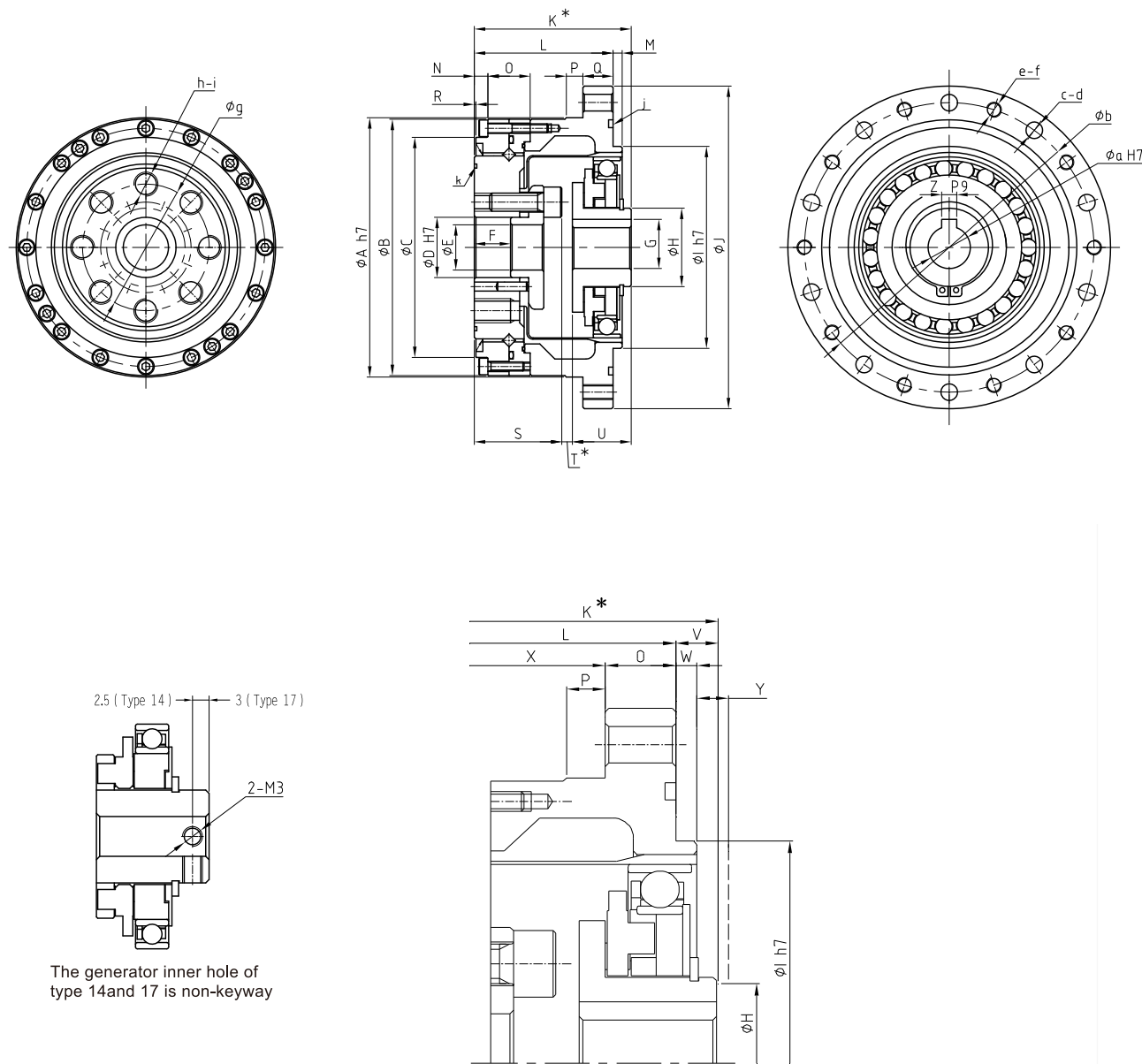Enlarged drawing of input end

Note:
- Please noted that the length of bolt mesh should be kept within the depth of internal thread. If it exceeded symbol i size, the flexspline will be damaged.
  ψE position is through-hole shape which leads to inside of the product. The size of * in figure is reference dimension of installation,please comply with requirements of such installation size.
- The output flange will be different based on each type. For details, please contact our authorized distributor.

*For detailed information of product, please confirm it with delivery specification figure.

Symbol \ Type	14	17	20	25	32
Φ A h7	56	63	72	86	113
Φ B	55	62	70	85	112
Φ C	42.5	49.5	58	73	96
Φ D H7	11	10	14	20	26
Φ E	8	7	10	15	20
Φ F	9.4	9.5	9	12	14.2
G	$9.4^{+0.1}_{0}$	$9.4^{+0.1}_{0}$	$9.4^{+0.1}_{0}$	$16.3^{+0.1}_{0}$	$21.8^{+0.1}_{0}$
Φ H	14	16	22	22	35
Φ I h7	38	48	56	67	90
Φ J	73	79	93	107	138
K	41	45	45.5	52	62
L	36	37	38	46	57
M	2	2	3	3	3
N	4.5	2.5	4	3.5	5.3
O	12	12	12.5	14	17
P	4	4	5.5	5.5	5.5
Q	7	8	10	10	12
R	0.5	0.5	0.5	0.5	1
S	21.4	23.5	23	29	36.2
T	4.1	2.5	4	3.5	5.3
U	$15.5^{0}_{-0.1}$	$19^{0}_{-0.1}$	$18.5^{0}_{-0.1}$	$19.5^{0}_{-0.1}$	$20.5^{0}_{-0.1}$
V	5	6	4.5	6	5
X	27	29	28	36	45
Y	1	1	1.5	1.5	1.5
Z P9	3	3	3	5	6
Φ a H7	8	8	8	14	19
Φ b	65	71	82	96	125
c LSS/LSG	8	8	8	10	12
c LSSF	6	6	6	8	12
Φ d	4.5	4.5	5.5	5.5	6.5
e LSS/LSG	8	8	8	10	12
e LSSF	6	6	6	10	12
f	M4	M4	M5	M5	M6
Φ g	23	27	32	42	55
h	6	6	8	8	8
i	M4	M5	M6	M8	M10
j	50x2	56x2	67x2	80x2	105x2
k	29x0.5	34.5x0.8	40.5x1.2	53x1	69x2
Φ l	/	12	18	18	26
m	/	2	2	2	2
n	/	M2.5	M2.5	M2.5	M3

- The size marked with * symbol refers to the axial connection position and tolerance of three parts, which are wave generator, flexspline, circular spline.
  The size will have an influence on performance and intensity, therefore, please strictly abide by it.
- There is also difference in tolerance owing to different manufacturing method(casting and machining) for parts and components.
  For size without giving clear indication of tolerance, please contact with our company or authorized distributor if you needed more information.
- Wave generator is individually packaged when delivering the product.

2.5 (Type 14)　3 (Type 17)

2-M3

The generator inner hole of
type 14and 17 is non-keyway

Symbol \ Type	14	17	20	25	32
Φ A h7	56	63	72	86	113
Φ B	55	62	70	85	112
Φ C	42.5	49.5	58	73	96
Φ D H7	11	10	14	20	26
Φ E	8	7	10	15	20
Φ F	9.4	9.5	9	12	14.2
G	/	/	$12.8^{+0.1}_{0}$	$16.3^{+0.1}_{0}$	$16.3^{+0.1}_{0}$
Φ H	14	18	21	26	26
Φ I h7	38	48	56	67	90
Φ J	73	79	93	107	138
K	41	45	45.5	52	62
L	34	37	38	46	57
M	2	2	3	3	3
N	4.5	4.5	4	4.5	5.5
O	7	12	12.5	14	17
P	4	4	5.5	5.5	5.5
Q	7	8	10	10	12
R	0.5	0.5	0.5	0.5	1
S	21.4	23.5	23	29	36.2
T	2	2	2.4	2.8	3.8
U	$17.6^{0}_{-0.1}$	$19.5^{0}_{-0.1}$	$20.1^{0}_{-0.1}$	$20.2^{0}_{-0.1}$	$22^{0}_{-0.1}$
V	2	8	7.5	6	5
X	27	29	28	36	45
Y	1	1	1.5	1.5	1.5
Z P9	/	/	4	5	5
Φ a H7	6	8	11	14	14
Φ b	65	71	82	96	125
c LSS/LSG	8	8	8	10	12
c LSSF	6	6	6	8	12
Φ d	4.5	4.5	5.5	5.5	6.5
e LSS/LSG	8	8	8	10	12
e LSSF	6	6	6	8	12
f	M4	M4	M5	M5	M6
Φ g	23	27	32	42	55
h	6	6	8	8	8
i	M4	M5	M6	M8	M10
j	50 x2	56 x2	67 x2	80 x2	105 x2
k	29 x0.5	34.5 x0.8	40.5 x1.2	53 x1	69 x2

Note:
■ Please noted that the length of bolt mesh should be kept within the depth of internal thread. If it exceeded symbol i size, the flexspline will be damaged.
  φE position is through-hole shape which leads to inside of the product. The size of * in figure is reference dimension of installation,please comply with requirements of such installation size.
■ The output flange will be different based on each type. For details, please contact our authorized distributor.

+For detailed information of product, please confirm it with delivery specification figure.

■ The size marked with * symbol refers to the axial connection position and tolerance of three parts, which are wave generator, flexspline, circular spline.
  The size will have an influence on performance and intensity, therefore, please strictly abide by it.
■ There is also difference in tolerance owing to different manufacturing method(casting and machining) for parts and components.
  For size without giving clear indication of tolerance, please contact with our company or authorized distributor if you needed more information.
■ Wave generator is individually packaged when delivering the product.
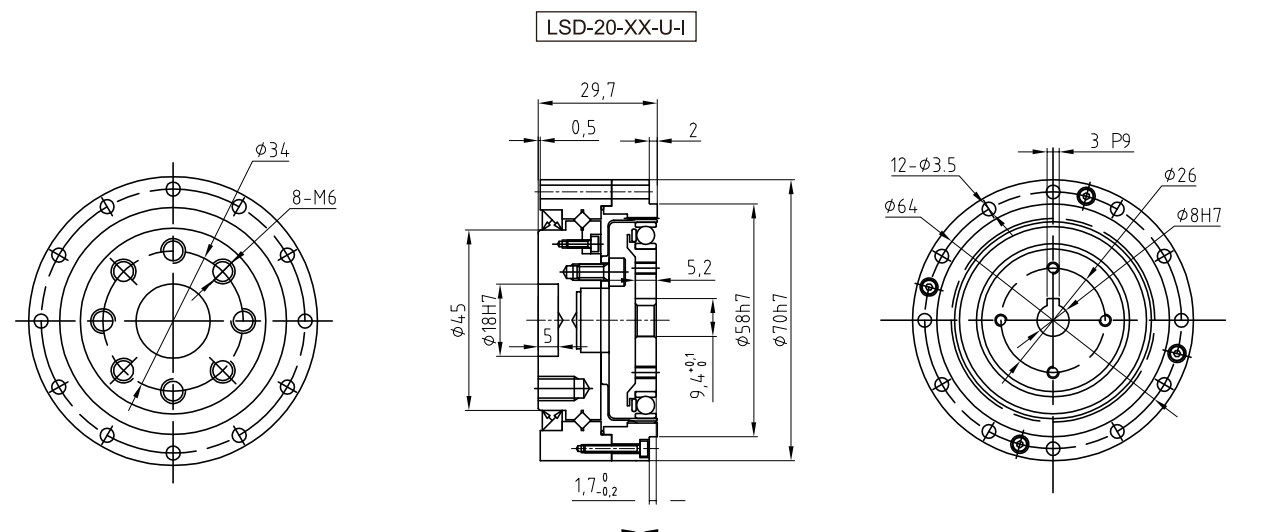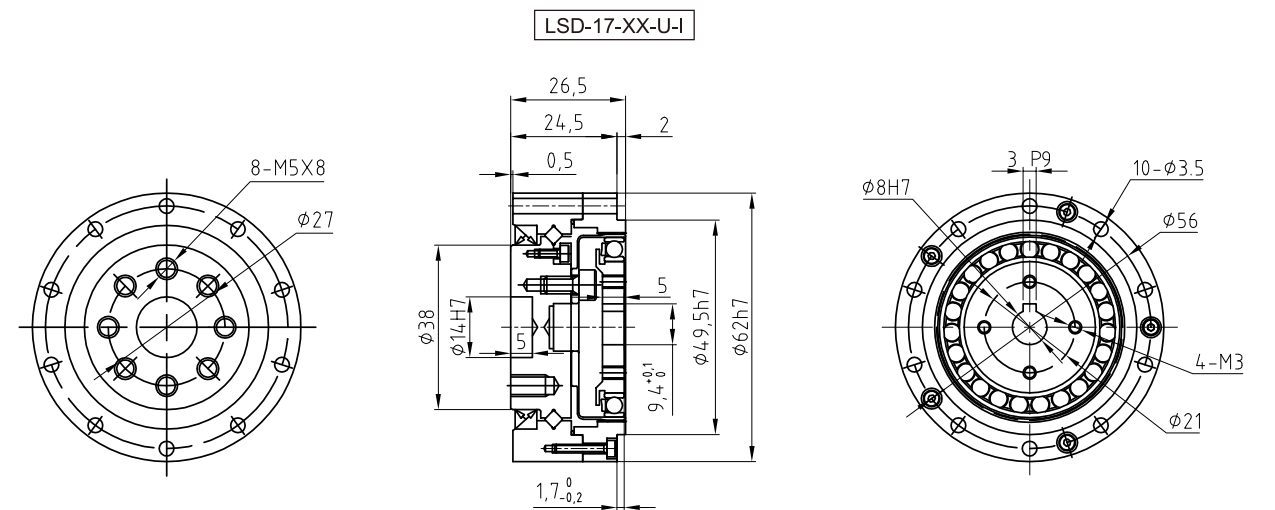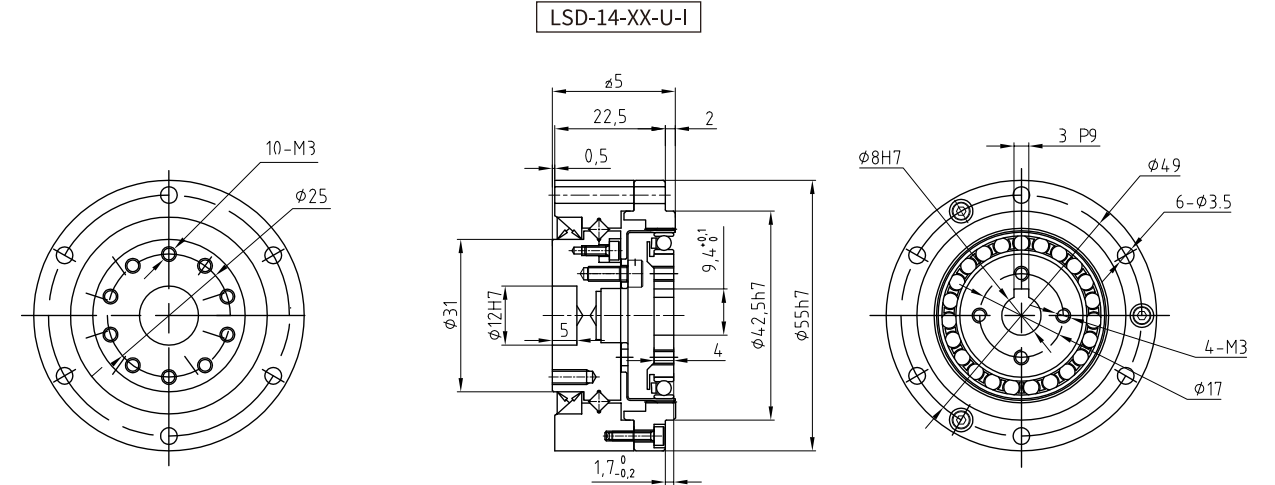
LSD Series

LSD Series

This miniaturized product was developed according to the marketing demand. Compare with LSS series that with the same torque capacity, LSD series is more compact and thin-walled, smaller size.
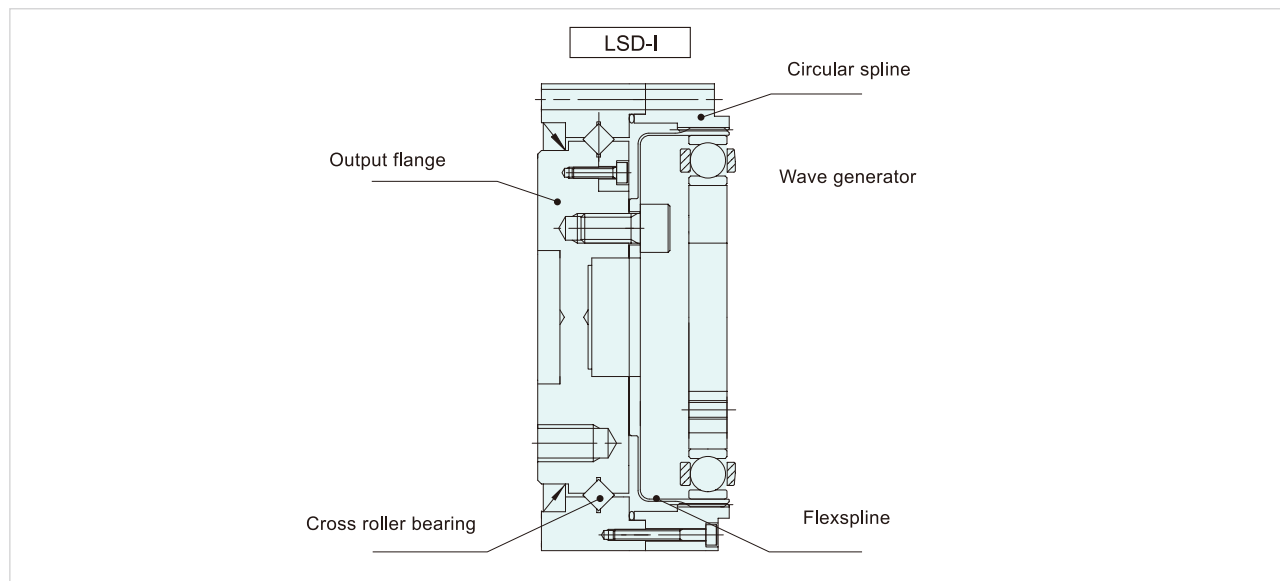
LSD-I

Application

| Industrial robot | Service Robots | Metal Machine Tools |
| Printed circuit manufacturing equipment | Wood, light metal, plastic machine tools |

Combinative structure of LSD series

LSD-I

- Circular spline
- Output flange
- Wave generator
- Cross roller bearing
- Flexspline

Rated parameter table of LSD series

Model	Reduction ratio	Rated torque at 2000r/min input		Permissible peak torque at start and stop		Permissible maximum value for average load torque		Permissible maximum momentary torque		Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Grease)	backlash	Design life
		Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	r/min	r/min	Arc Sec	Hour
14	50	3.7	0.38	12	1.2	4.8	0.49	24	2.4	8500	3500	≤20	7000
	80	4.2	0.43	16	1.6	5.9	0.6	31	3.1				
	100	5.4	0.55	19	1.9	7.7	0.79	35	3.6				
17	50	11	1.1	23	2.3	18	1.9	48	4.9	7300	3500	≤20	10000
	80	14	1.4	30	0.3	21	2.1	58	5.9				
	100	16	1.6	37	3.8	27	2.8	71	7.2				
20	50	17	1.7	39	4.0	24	2.4	69	7.0	6500	3500	≤20	10000
	80	21	2.1	46	4.7	30	3.1	81	0.8				
	100	28	2.9	57	5.8	34	3.5	95	9.7				

LSD-I series

LSD-14-XX-U-I

LSD-17-XX-U-I

LSD-20-XX-U-I

■ For detailed information of product, please confirm it with delivery specification figure

LFS series

A combination product that with light weight, ultra-flat. Using cross-roller bearing.

LFS Integrated series

Combined harmonic reducer with the high-performance small motor, with the highest input characteristics under the same gear conditions.
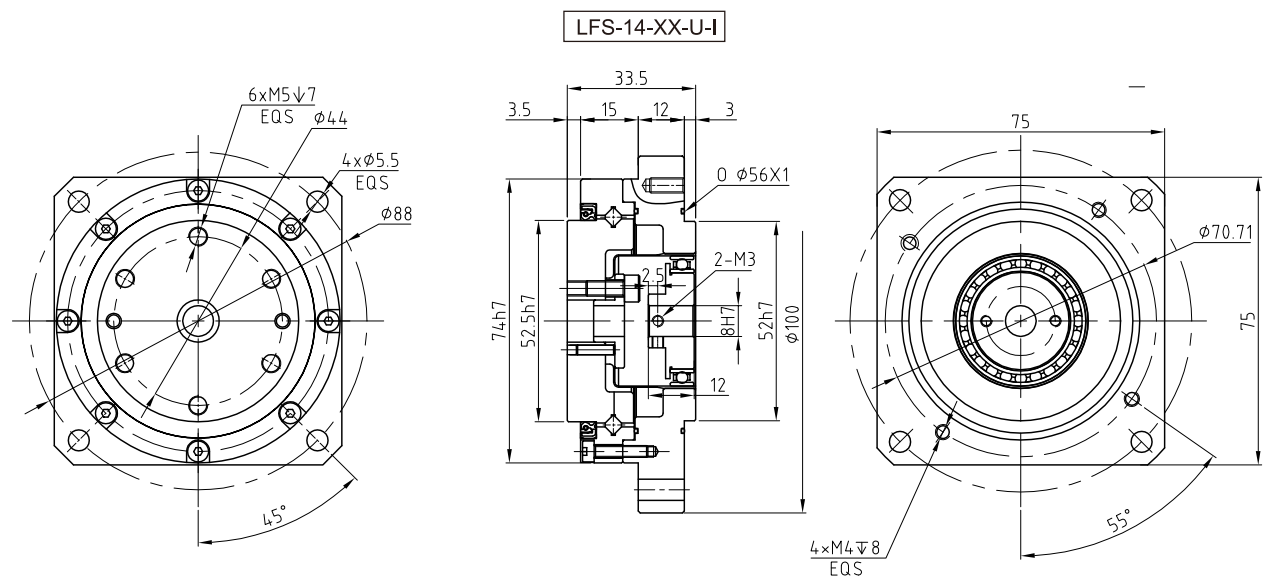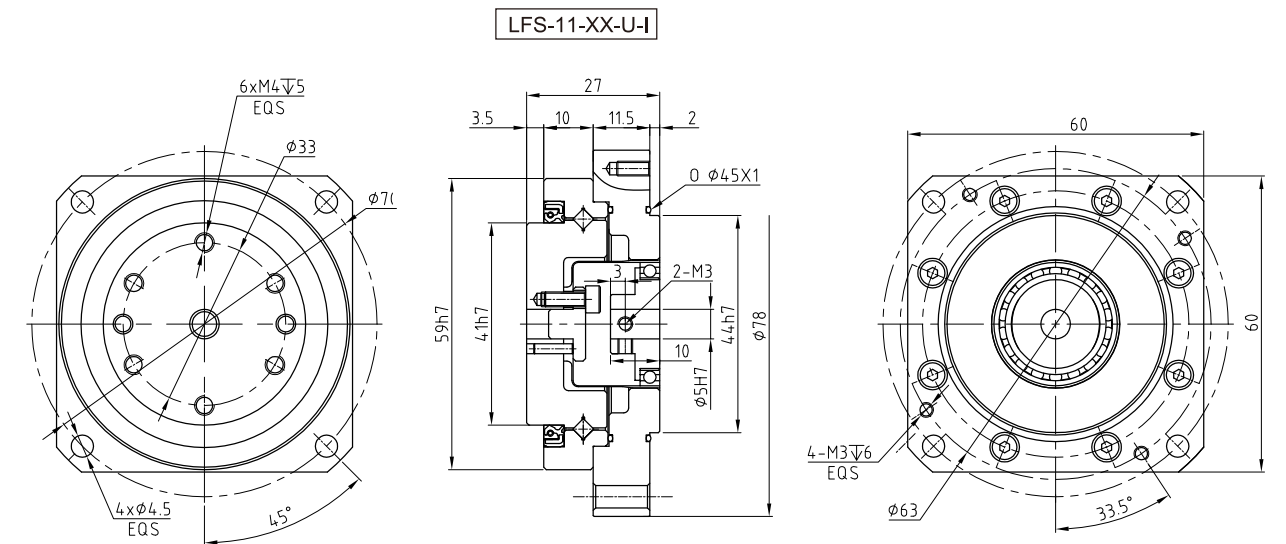
Application

| Industrial robot | Service Robots | Medical Devices |

| Automation and special equipment |

| LFS-I | LFS Integrated series |

Rated parameter table of LFS series

Model	Reduction ratio	Rated torque at 2000r/min input		Permissible peak torque at start and stop		Permissible maximum value for average load torque		Permissible maximum momentary torque		Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Grease)	backlash	Design life
		Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	Nm	Kgfm	r/min	r/min	Arc Sec	Hour
11	50	3.5	0.4	8.3	0.9	5.5	0.6	17	1.7	8500	3000	≤20	10000
	80	5	0.5	11	1.1	8.9	0.9	25	2.5				
	100	5	0.5	11	1.1	8.9	0.9	25	2.5				
14	50	5.4	0.6	18	1.8	6.9	0.7	35	3.6	8500	3000	≤20	10000
	80	7.8	0.8	28	2.9	11	1.1	54	5.5				
	100	7.8	0.8	28	2.9	11	1.1	54	5.5				

LFS-11-XX-U-I

LFS-14-XX-U-I

■ For detailed information of product, please confirm it with delivery specification figure..

LHT series

Hollow type (LHT-III) Input axial type (LHT-IV)

Simple type (LHT-I/LHT-II) Simple type (LHT-V)

LHT series
A combination product that with large diameter hollow hole, flat shape, which is easy to operate.

LHN series
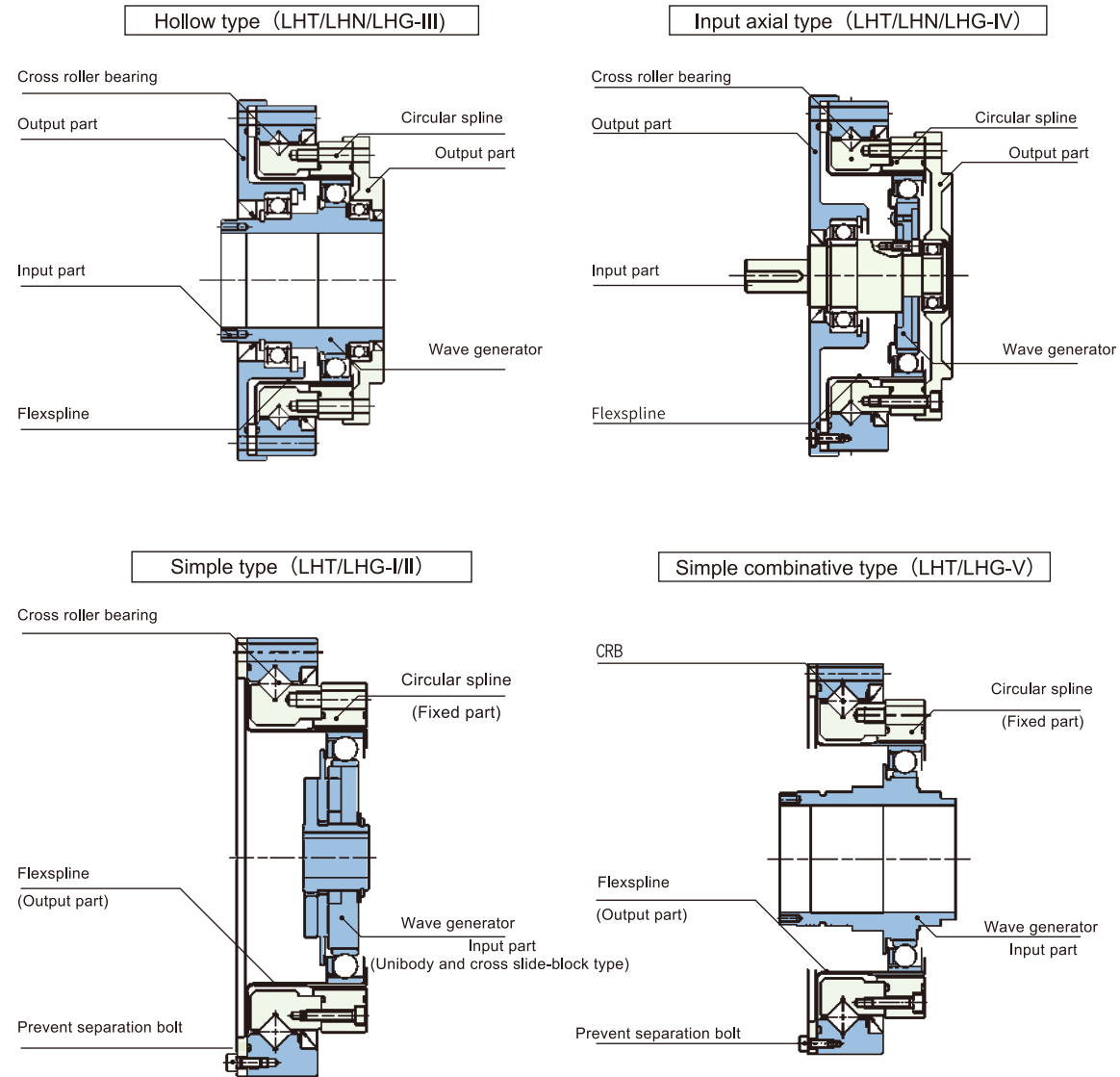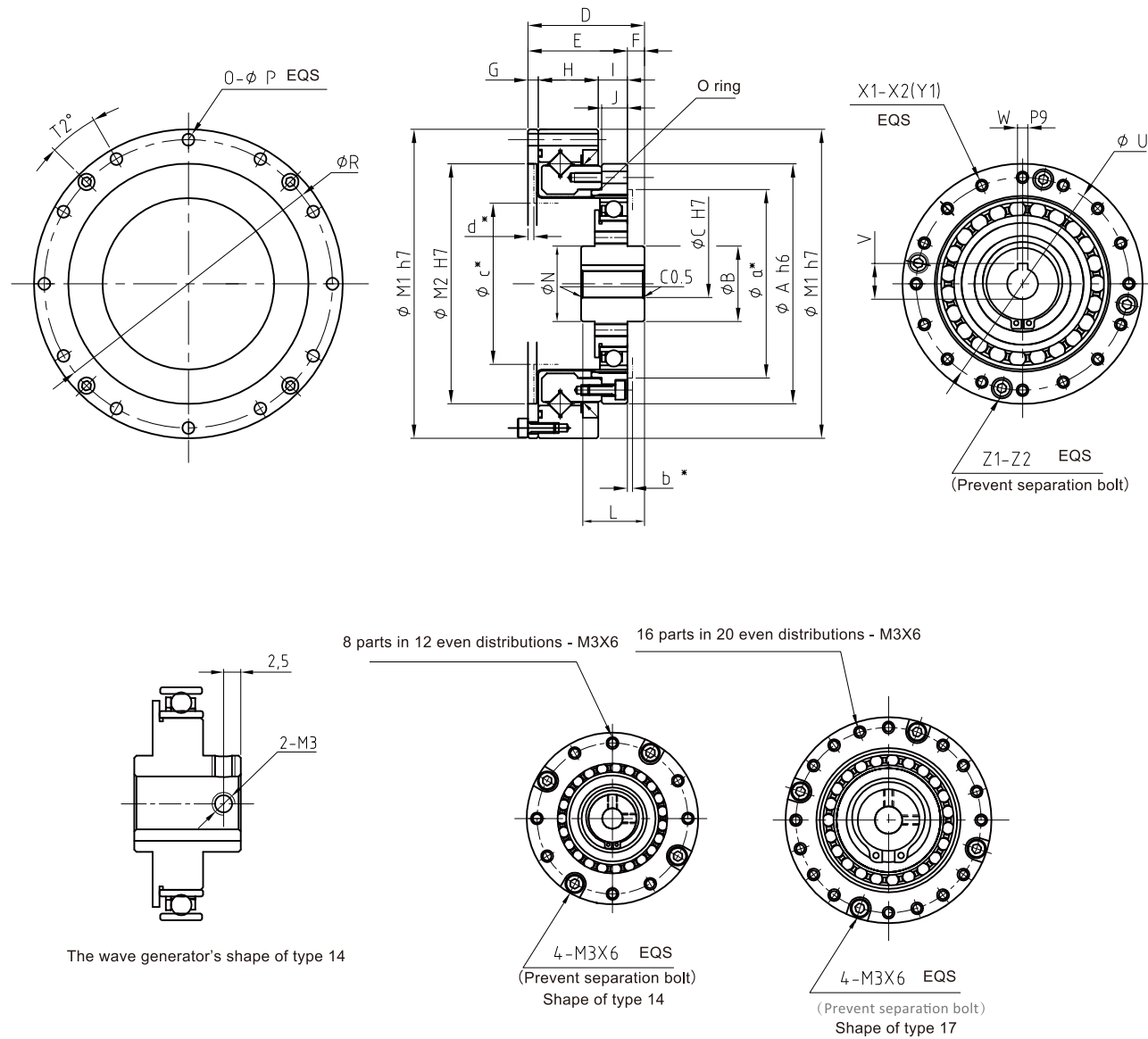Light weight product, 20% lighter than standard products.

LHG series
High torque. Compare with standard products, LHG series' torque capacity is 30% higher. And the service life is increased by 43%, with high load capacity and high reliability.

Application

Industrial robot Service Robots Medical Devices

Automation and special equipment Printed circuit manufacturing equipment

Combinative structure of LHT series

Hollow type (LHT/LHN/LHG-III)

Cross roller bearing
Output part
Circular spline
Output part
Input part
Wave generator
Flexspline

Input axial type (LHT/LHN/LHG-IV)

Cross roller bearing
Output part
Circular spline
Output part
Input part
Wave generator
Flexspline

Simple type (LHT/LHG-I/II)

Cross roller bearing
Circular spline (Fixed part)
Flexspline (Output part)
Wave generator
Input part (Unibody and cross slide-block type)
Prevent separation bolt

Simple combinative type (LHT/LHG-V)

CRB
Circular spline (Fixed part)
Flexspline (Output part)
Wave generator
Input part
Prevent separation bolt

Rated parameter table of LHT/LHN series

Model	Reduction ratio	Rated torque at 2000r/min input		Permissible peak torque at start and stop		Permissible maximum value for average load torque		Permissible maximum momentary torque		Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Greaae)	Backlash	Desian life
		Nm	kgfm	Nm	kgfm	Nm	kgfm	Nm	kgfm	r/min	r/min	Arc Sec	Hour
14	50	5.4	0.55	18	1.8	6.9	0.70	35	3.6	8500	3500	≤20	10000
	80	7.8	0.80	23	2.4	11	1.1	47	4.8				15000
	100	7.8	0.80	28	2.9	11	1.1	54	5.5				15000
	120	7.8	0.80	28	2.9	11	1.1	54	5.5				15000
17	50	16	1.6	34	3.5	26	2.6	70	7.1	7300	3500	≤20	10000
	80	22	2.2	43	4.4	27	2.7	87	8.9				15000
	100	24	2.4	54	5.5	39	4.0	110	11				15000
	120	24	2.4	54	5.5	39	4.0	86	8.8				15000
20	50	25	2.5	56	5.7	34	3.5	98	10	6500	3500	≤20	10000
	80	34	3.5	74	7.5	47	4.8	127	13				15000
	100	40	4.1	82	8.4	49	5.0	147	15				15000
	120	40	4.1	87	8.9	49	5.0	147	15				15000
	160	40	4.1	92	9.4	49	5.0	147	15				15000
25	50	39	4.0	98	10	55	5.6	186	19	5600	3500	≤20	10000
	80	63	6.4	137	14	87	8.9	255	26				15000
	100	67	6.8	157	16	108	11	284	29				15000
	120	67	6.8	167	17	108	11	304	31				15000
32	50	76	7.8	216	22	108	11	382	39	4800	3500	≤20	10000
	80	118	12	304	31	167	17	568	58				15000
	100	137	14	333	34	216	22	647	66				15000
	120	137	14	353	36	216	22	686	70				15000
40	50	137	14	402	41	196	20	686	70	4000	3000	≤20	10000
	80	206	21	519	53	284	29	980	100				15000
	100	265	27	568	58	372	38	1080	110				15000
	120	294	30	617	63	451	46	1180	120				15000

Rated parameter table of LHG series

Model	Reduction ratio	Rated torque at 2000r/min input		Permissible peak torque at start and stop		Permissible maximum value for average load torque		Permissible maximum momentary torque		Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Greaae)	Backlash	Desian life
		Nm	kgfm	Nm	kgfm	Nm	kgfm	Nm	kgfm	r/min	r/min	Arc Sec	Hour
14	50	7	0.7	23	2.3	9	0.9	46	4.7	8500	3500	≤20	10000
	80	10	1.0	30	3.1	14	1.4	61	6.2				15000
	100	10	1.0	36	3.7	14	1.4	70	7.2				15000
	120	10	1.0	36	3.7	14	1.4	70	7.2				15000
17	50	21	2.1	44	4.5	34	3.4	91	9	7300	3500	≤20	10000
	80	29	2.9	56	5.7	35	3.6	113	12				15000
	100	31	3.2	70	7.2	51	5.2	143	15				15000
	120	31	3.2	70	7.2	51	5.2	112	11				15000
20	50	33	3.3	73	7.4	44	4.5	127	13	6500	3500	≤20	10000
	80	44	4.5	96	9.8	61	6.2	165	17				15000
	100	52	5.3	107	10.9	64	6.5	191	20				15000
	120	52	5.3	113	11.5	64	6.5	191	20				15000
	160	52	5.3	120	12.2	64	6.5	191	20				15000
25	50	51	5.2	127	13	72	7.3	242	25	5600	3500	≤20	10000
	80	82	8.4	178	18	113	12	332	34				15000
	100	87	8.9	204	21	140	14	369	38				15000
	120	87	8.9	217	22	140	14	395	40				15000
32	50	99	10	281	29	140	14	497	51	4800	3500	≤20	10000
	80	153	16	395	40	217	22	738	75				15000
	100	178	18	433	44	281	29	841	86				15000
	120	178	18	459	47	281	29	892	91				15000
40	50	178	18	523	53	255	26	892	91	4000	3000	≤20	10000
	80	268	27	675	69	369	38	1270	130				15000
	100	345	35	738	75	484	49	1400	143				15000
	120	382	39	802	82	586	60	1530	156				15000

O-φ P EQS

X1-X2(Y1) EQS

O ring

Z1-Z2 EQS
(Prevent separation bolt)

The wave generator's shape of type 14

8 parts in 12 even distributions - M3X6

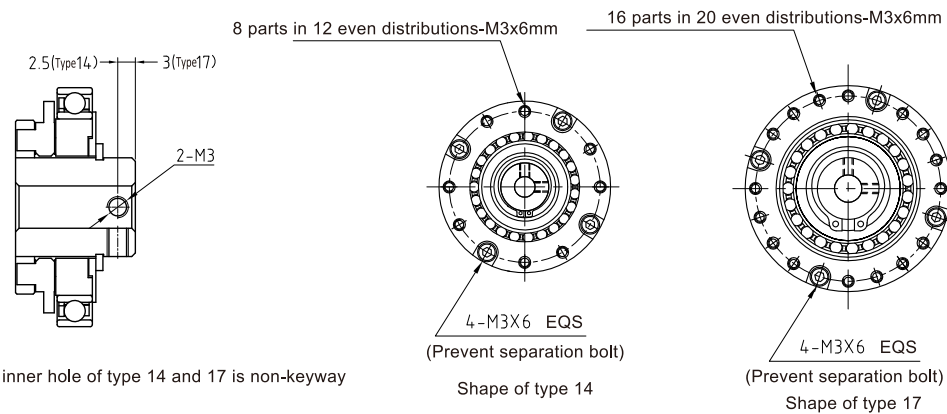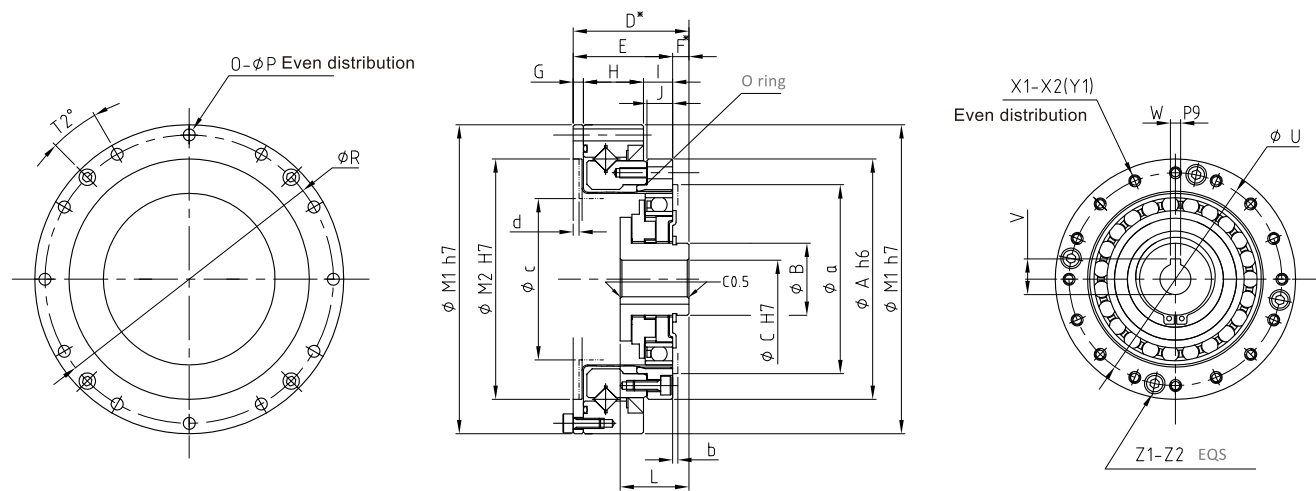16 parts in 20 even distributions - M3X6

4-M3X6 EQS
(Prevent separation bolt)
Shape of type 14

4-M3X6 EQS
(Prevent separation bolt)
Shape of type 17

■ For detailed information of product, please confirm it with delivery specification figure.

Symbol \ Type	14	17	20	25	32
ΦAh6	50	60	70	85	110
ΦB	14	16	22	24	35
ΦCH7	8	8	8	14	19
D	$28.5_{-0.1}^{0}$	$32.5_{-0.1}^{0}$	$33.5_{-0.1}^{0}$	$37_{-0.1}^{0}$	$44_{-0.1}^{0}$
E	23.5	26.5	29	34	42
F	5	6	4.5	3	2
G	2.4	3	3	3.3	3.6
H	14.1	16	17.5	18.7	23.4
I	7	7.5	8.5	12	15
J	6	6.5	7.5	10	14
L	$15.5_{-0.1}^{0}$	$19_{-0.1}^{0}$	$18.5_{-0.1}^{0}$	$19.5_{-0.1}^{0}$	$20.5_{-0.1}^{0}$
M1h7	70	80	90	110	142
M2H7	48#	60	70	88	114
ΦN	14	16	22	22	35
O	8	12	12	12	12
ΦP	3.5	3.5	3.5	4.5	5.5
ΦR	64	74	84	102	132
T2(Angle)	22.5°	15°	15°	15°	15°
ΦU	44	54	62	77	100
V	$9.4_{0}^{+0.1}$	$9.4_{0}^{+0.1}$	$9.4_{0}^{+0.1}$	$16.3_{0}^{+0.1}$	$21.8_{0}^{+0.1}$
WP9	3	3	3	5	6
X1	8 parts in 12 even distributions	16 parts in 20 even distributions	16	16	16
X2	M3×6	M3×6	M3×6	M4×8	M5×10
Y1	3.5×6	3.5×6.5	3.5×7.5	4.5×10	5.5×14
Z1	4	4	4	4	4
Z2	M3×6	M3×6	M3×8	M3×10	M4×16
Φα	36.5	45	54.5	64.5	86
b	1	1	1.5	1.5	2
Φc	31	38	48	58	77
d	1.2	1.7	1.7	1.9	2.1
Φe	/	12	18	18	26
f	/	2	2	2	2
g	/	M2.5	M2.5	M2.5	M3

■ The size marked with * symbol refers to the axial connection position and tolerance of three parts, which are wave generator, flexspline, circular spline. The size will have an influence on performance and intensity, therefore, please strictly abide by it.
■ There is also difference in tolerance owing to different manufacturing method(casting and machining) for parts and components. For size without giving clear indication of tolerance, please contact with our company or authorized distributor if you needed more information.
■ Owing to flexspline can be distorted, please use inwall size greater than φa.b.c and lesser than d in order to prevent it from being in touch with shell.
■ Wave generator is individually packaged when delivering the product.
■ The size marked # can be customized according to customer's requirement. For more details, please consult with our authorized distributor.
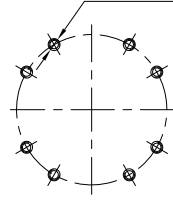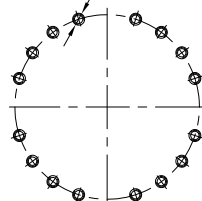
0-ΦP Even distribution

ΦR

O ring

X1-X2(Y1)
Even distribution

Z1-Z2 EQS

8 parts in 12 even distributions-M3x6mm

16 parts in 20 even distributions-M3x6mm

2.5(Type14) 3(Type17)

2-M3

4-M3X6 EQS
(Prevent separation bolt)
Shape of type 14

4-M3X6 EQS
(Prevent separation bolt)
Shape of type 17

The generator inner hole of type 14 and 17 is non-keyway

- For detailed information of product, please confirm it with delivery specification figure..

Type / Symbol	14	17	20	25	32
ΦAh6	50	60	70	85	110
ΦB	14	18	21	26	26
ΦCH7	6	8	11	14	14
D	$28.5_{-0.1}^{0}$	$32.5_{-0.1}^{0}$	$33.5_{-0.1}^{0}$	$37_{-0.1}^{0}$	$44_{-0.1}^{0}$
E	23.5	26.5	29	34	42
F	5	6	4.5	3	2
G	2.4	3	3	3.3	3.6
H	14.1	16	17.5	18.7	23.4
I	7	7.5	8.5	12	15
J	6	6.5	7.5	10	14
L	$17.6_{-0.1}^{0}$	$19.5_{-0.1}^{0}$	$20.1_{-0.1}^{0}$	$20.2_{-0.1}^{0}$	$22_{-0.1}^{0}$
M1h7	70	80	90	110	142
M2H7	48#	60	70	88	114
O	8	12	12	12	12
ΦP	3.5	3.5	3.5	4.5	5.5
ΦR	64	74	84	102	132
T2(Angel)	22.5°	15°	15°	15°	15°
ΦU	44	54	62	77	100
V	/	/	$12.8_{0}^{+0.1}$	$16.3_{0}^{+0.1}$	$16.3_{0}^{+0.1}$
WP9	/	/	4	5	5
X1	8 part in 12 even distributions	16 part in 20 even distributions	16	16	16
X2	M3×6	M3×6	M3×6	M4×8	M5×10
Y1	3.5×6	3.5×6.5	3.5×7.5	4.5×10	5.5×14
Z1	4	4	4	4	4
Z2	M3×6	M3×6	M3×8	M3×8	M4×10
Φα	36.5	45	54.5	64.5	86
b	1	1	1.5	1.5	2
ΦC	31	38	48	58	77
d	1.2	1.7	1.7	1.9	2.1

- The size marked with * symbol refers to the axial connection position and tolerance of three parts, which are wave generator, flexspline, circular spline. The size will have an influence on performance and intensity, therefore, please strictly abide by it.
- There is also difference in tolerance owing to different manufacturing method(casting and machining) for parts and components. For size without giving clear indication of tolerance, please contact with our company or authorized distributor if you needed more information.
- Owing to flexspline can be distorted, please use inwall size greater than φa,b,c and lesser than d in order to prevent it from being in touch with shell.
- Wave generator is individually packaged when delivering the product.
- The size marked # can be customized according to customer's requirement. For more details, please consult with our authorized distributor.

16 parts in 20 even distributions-M3x6mm

8 parts in 12 even distributions-M3x6mm

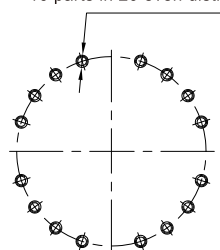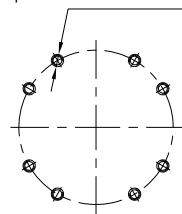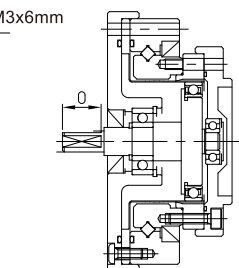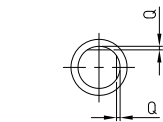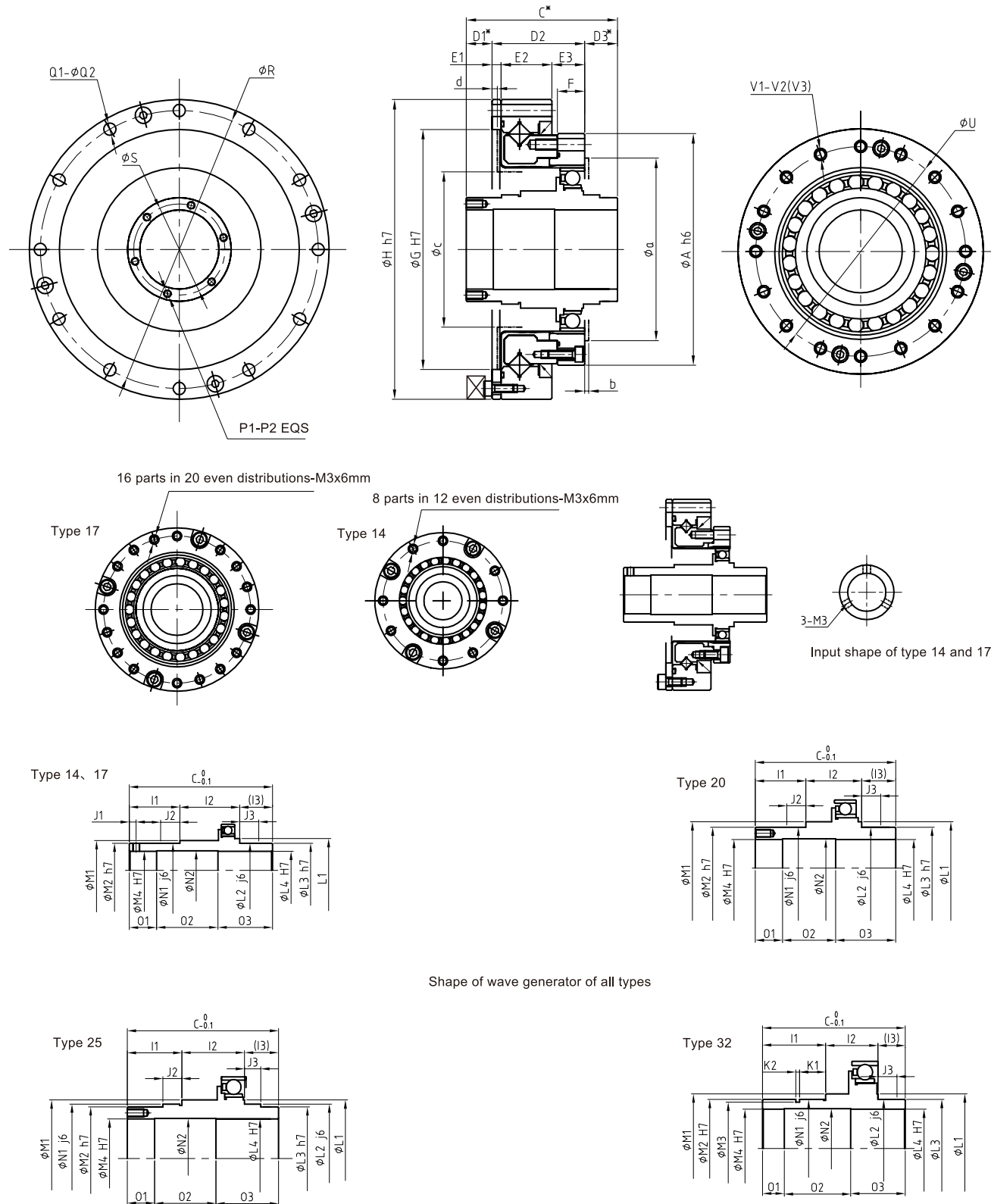Type 17　　　Type 14　　　Input shape of type 14 and type 17　　　Type 14、17

■ For detailed information of product, please confirm it with delivery specification figure..

Symbol \ Type	14	17	20	25	32	40
ΦAh7	70	80	90	110	142	170
ΦB	54	64	75	90	115	140
ΦCh7	36	45	50	60	85	100
ΦDh7	74	84	95	115	147	175
ΦEh7	20	25	30	38	45	59
ΦFh7	14	19	21	29	36	46
G	52.5	56.5	51.5	55.5	65.5	79
H	12	12	5	6	7	8
I	20.5	23	25	26	32	38
J	20	21.5	21.5	23.5	26.5	33
k	6.5	6.5	/	/	/	/
L	9	10	10.5	10.5	12	14
M	8	8.5	9	8.5	9.5	13
N	7.5	8.5	7	6	5	7
ΦP(P)	(2.5)	(2.5)	25.5	33.5	40.5	52
Q	3	3	6	6	6	6
R	M3	M3	M3×6	M3×6	M3×6	M4×8
ΦS	64	74	84	102	132	158
T	8	12	12	12	12	12
ΦU	3.5	3.5	3.5	4.5	5.5	6.6
ΦV	44	54	62	77	100	122
W	8 part in 12 even distributions	16 part in 20 even distributions	16	16	16	16
X	M3×6	M3×6	M3×6	M4×8	M5×8	M6×10
X	φ3.5×11.5	φ3.5×12	φ3.5×13.5	Φ4.5×15.5	Φ5.5×20.5	Φ6.6×25
ΦY	36	45	/	/	/	/
Z	55	5.5	/	/	/	/

■ Owing to different manufacturing method for parts and components.
For size without giving clear indication of tolerance, please contact with our company or authorized distributor if you needed more information.

16 parts in 20 even distributions-M3x6mm

8 parts in 12 even distributions-M3x6mm

Type 17

Type 14

Input shape of type 14 and type 17

Enlarged drawing of type 14 and 17

■ For detailed information of product, please confirm it with delivery specification figure.

Type / Symbol	14	17	20	25	32
ΦAh7	70	80	90	110	142
ΦB	54	64	75	90	115
ΦCh7	36	45	50	60	85
ΦDh7	74	84	95	115	147
ΦEh6	6	8	10	14	14
F	50.5	56	63.5	72.5	84.5
G	15	17	21	26	26
H	20.5	23	25	26	32
I	15	16	17.5	20.5	26.5
J	14	16	20	25	25
k	9	10	10.5	10.5	12
L	8	8.5	9	8.5	9.5
M	2.5	3	3	3	5
O	11	12	16.5	22.5	22.5
P	/	/	$8.2_{-0.1}^{0}$	$11_{-0.1}^{0}$	$11_{-0.1}^{0}$
Q	0.5	0.5	$3_{-0.025}^{0}$	$5_{-0.03}^{0}$	$5_{-0.03}^{0}$
R	/	/	$3_{-0.025}^{0}$	$5_{-0.03}^{0}$	$5_{-0.03}^{0}$
S	/	/	M3×6	M5×10	M5×10
ΦT	64	74	84	102	132
U	8	12	12	12	12
ΦV	3.5	3.5	3.5	4.5	5.5
ΦW	44	54	62	77	100
X	8 part in 12 even distributions	16 part in 20 even distributions	16	16	16
Y	M3×6	M3×6	M3×6	M4×8	M5×8
	3.5×11.5	3.5×12	3.5×13.5	4.5×15.5	5.5×20.5

■ owing to different manufacturing method for parts and components.
For size without giving clear indication of tolerance, please contact with our company or authorized distributor if you needed more information.

Q1-ΦQ2 ΦR ΦS P1-P2 EQS

V1-V2(V3) ΦU

16 parts in 20 even distributions-M3x6mm
Type 17

8 parts in 12 even distributions-M3x6mm
Type 14

Input shape of type 14 and 17

3-M3

Type 14、17

Type 20

Type 25

Type 32

Shape of wave generator of all types

- For detailed information of product, please confirm it with delivery specification figure.

Type / Symbol	14	17	20	25	32
ΦAh6	50	60	70	80	110
C	52.5	56.5	51.5	55.5	65.5
D1	15.5	15	8	9.5	12
D2	23.5	26.5	29	34	42
D3	13.5	15	14.5	12	12
E1	2.4	3	3	3.6	3.6
E2	14.1	16	17.5	18.7	23.4
E3	7	7.5	8.5	12	15
F	6	6.5	7.5	10	14
ΦG	48	60	70	88	114
ΦH	70	80	90	110	142
11	18.5	19.5	18.5	20	29
12	22	23.5	20.5	23	24
13	12	13.5	12.5	12.5	12.5
J1	2.5	2.5	/	/	/
J2	7	7	7	6.5	/
J3	7	7	7	6.5	7
K1	/	/	/	/	1.7
K2	/	/	/	/	12
ΦL1	23	29	34	43	50
ΦL2	20	25	30	40	45
ΦL3	20	25	30	38	45
ΦL4	14	19	21	29	36
ΦM1	22	28	34	43	50
ΦM2	20	25	30	38	45
ΦM3	/	/	/	/	42.5
ΦM4	14	19	21	29	36
ΦN1j6	20	25	30	38	45
ΦN2	14.5	19.5	21.5	29.5	36.5
O1	10	10	10	10	10
O2	22.5	24.5	19.5	22.5	30.5
O3	20	22	22	23	25
P1	3	3	6	6	6
P2	M3	M3	M3×6	M3×6	M3
Q1	8	12	12	12	12
Q2	3.5	3.5	3.5	4.5	5.5
ΦR	64	74	84	102	132
ΦS	/	/	25.5	33.5	40.5
ΦU	44	54	62	77	100
V1	8 part in 12 even distributions	16 part in 20 even distributions	16	16	16
V2	M3×5	M3×6	M3×6	M4×8	M5×10
V3	Φ3.5×6	Φ3.5×6.5	Φ3.5×7.5	Φ4.5×10	Φ5.5×14
Φα	36.5	45	54.5	64.5	86
b	1	1	1.7	1.5	2
Φc	31	38	48	58	77
d	1.2	1.7	1.7	1.9	2.1

- The size marked with * symbol refers to the axial connection position and tolerance of three parts, which are wave generator, flexspline, circular spline. The size will have an influence on performance and intensity, therefore, please strictly abide by it.
- There is also difference in tolerance owing to different manufacturing method(casting and machining) for parts and components. For size without giving clear indication of tolerance, please contact with our company or authorized distributor if you needed more information.
- Owing to flexspline can be distorted, please use inwall size greater than φa.b.c and lesser than d in order to prevent it from being in touch with shell.
- Wave generator is individually packaged when delivering the product.

LHD serie

LHD series' flexspline with flanging ultra short tube structure. Which can be used when circular spline fixed, and the flexspline as end output. It can also used to fix the flexspline, and the circular spline as end output. The axial length of LHD-I is shortened by 50%, LHD-III is shortened by 15%, without changing product performance.

Application

Industrial robot

Humanoid robot

Semiconductor manufacturing equipment

FPD manufacturing equipment

Space equipment

Combinative structure of LHD series
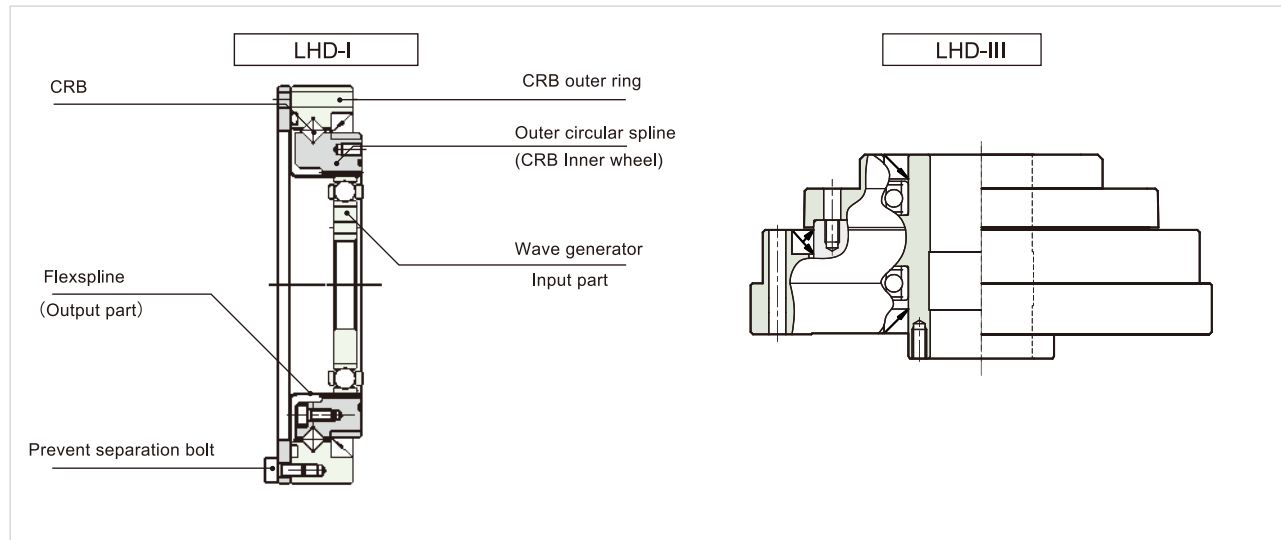
LHD-I
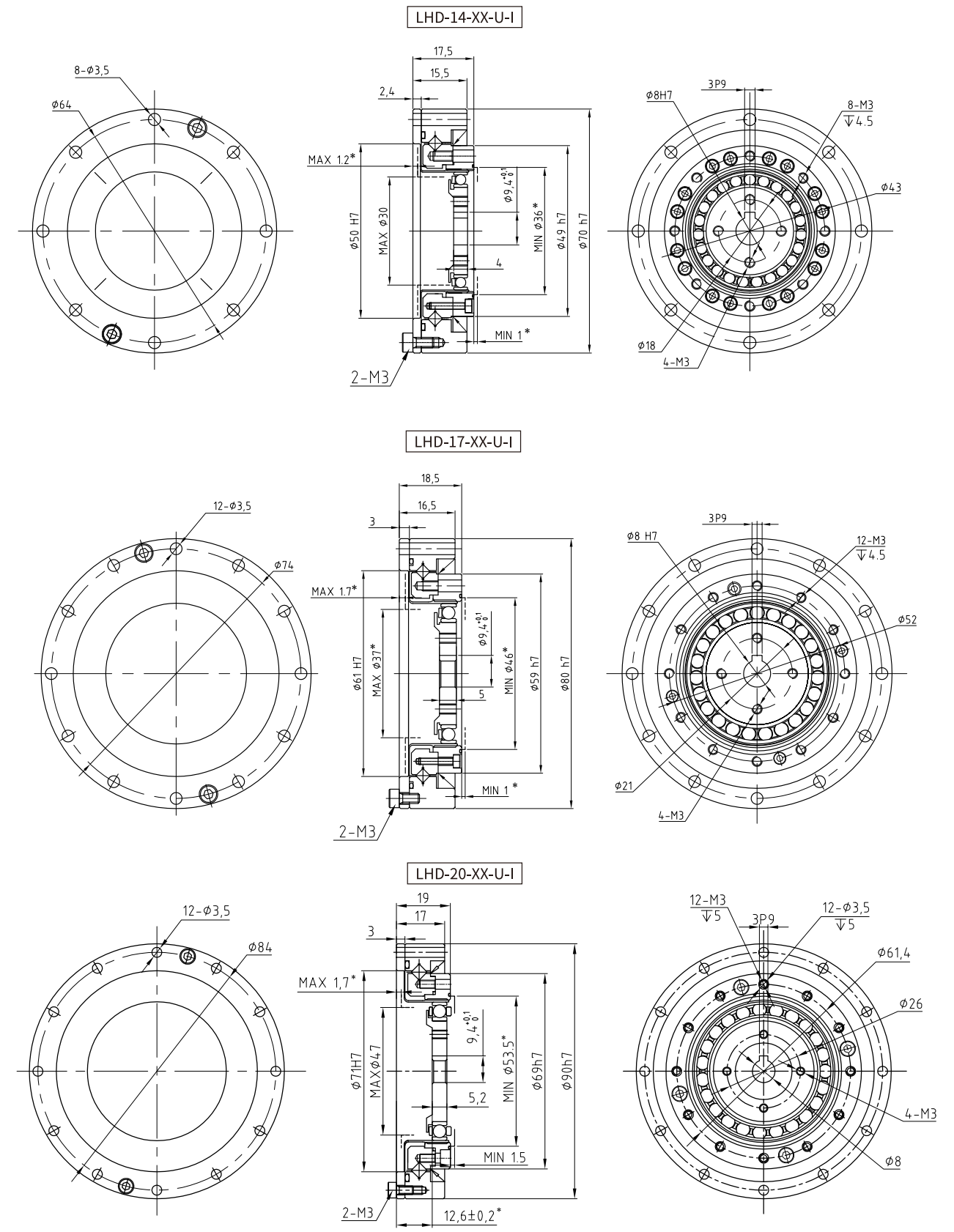
LHD-III

CRB
CRB outer ring
Outer circular spline
(CRB Inner wheel)
Wave generator
Input part
Flexspline
(Output part)
Prevent separation bolt

Rated parameter table of LHD series

Model	Reduction ratio	Rated torque at 2000r/min input	Permissible peak torque at start and stop	Permissible maximum value for average load torque	Permissible maximum momentary torque	Permissible maximum input rotational speed(Grease)	Permissible average input rotational speed(Greaae)	Backlash	Desian life
		Nm	Nm	Nm	Nm	r/min	r/min	Arc Sec	Hour
14	50	3.7	12	4.8	23	8500	3500	≤20	9000
	80	5.1	15	6.2	29				10000
	100	5.4	19	7.7	35				10000
17	50	11	23	18	48	7300	3500	≤20	9000
	80	14	29	21	54				10000
	100	16	37	27	71				10000
20	50	17	39	24	69	6500	3500	≤20	9000
	80	23	49	28	78				10000
	100	28	57	34	95				10000
25	50	27	69	38	127	5600	3500	≤20	9000
	80	42	91	62	157				10000
	100	47	110	75	184				10000
32	50	53	151	75	268	4000	3000	≤20	9000
	80	79	202	126	350				10000
	100	96	233	151	420				10000
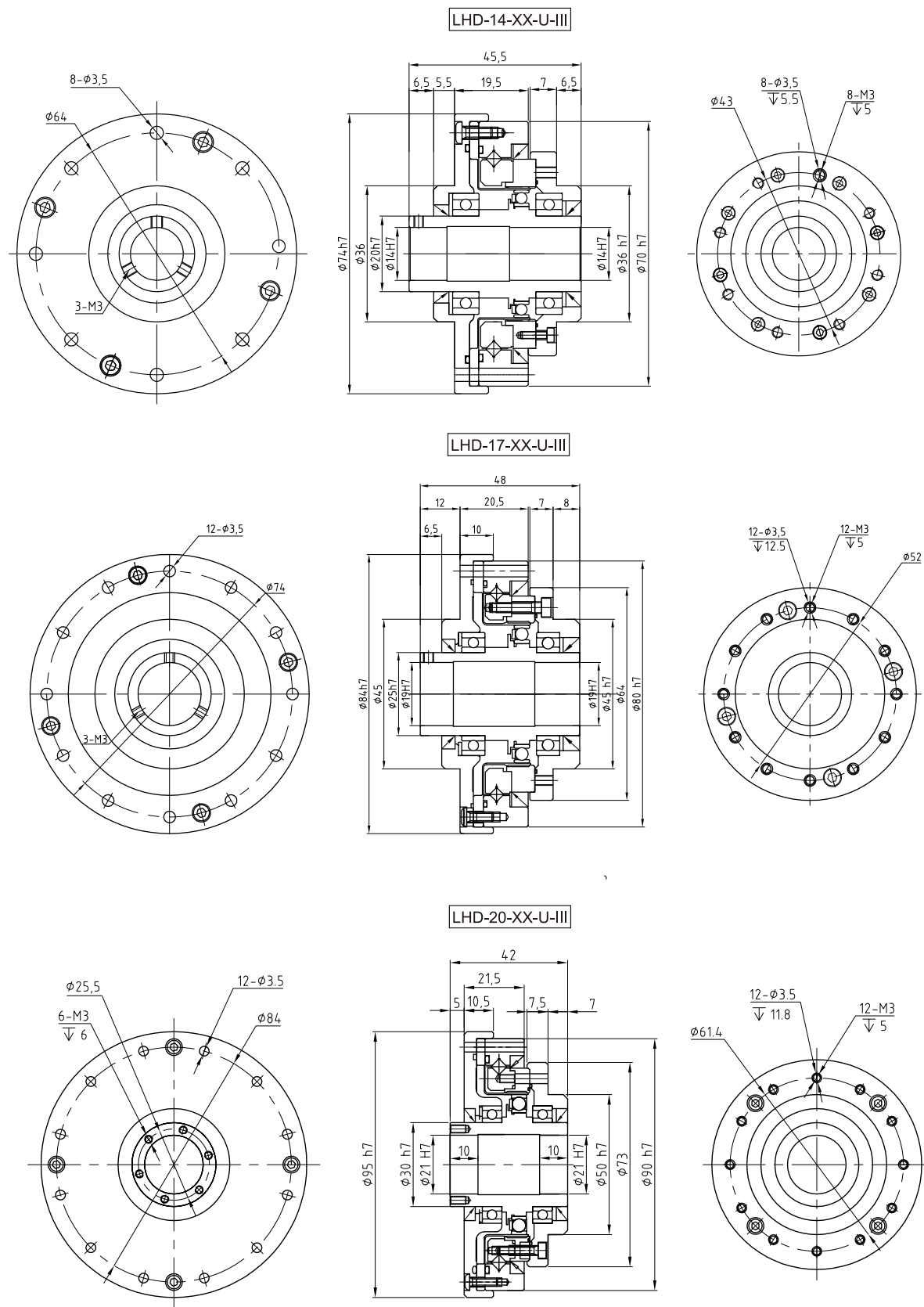
LHD-I size chart

LHD-14-XX-U-I

LHD-17-XX-U-I

LHD-20-XX-U-I

■ For detailed information of product, please confirm it with delivery specification figure.

LHD-14-XX-U-III

LHD-17-XX-U-III

LHD-20-XX-U-III

■ For detailed information of product, please confirm it with delivery specification figure.

SERVICE

Warranty

Regulations of warranty period and warranty scope of Laifual Drive as follows:

Warranty period

Warranty period is the earlier time between one year after delivery or working time of 2,000 hours on condition that it is used in normal assembly state and lubrication condition recorded in product content.

Warranty scope

Our company is responsible for maintenance or replacement of the product when malfunction resulting from manufacturing defect under warranty period.

However, following situations are out of warranty scope.

● Damage results from unsuitable operation or illegal use by clients.
● Damage results from modification or repair that is not carried out by our company.
● Damage not caused by the product.
● Damage results from natural disaster and the like but not the responsibility of our company.
  What's more, the warranty mentioned here is only for our product.
  Other loss caused by damage of the product and related man-hour and cost of assembly and disassembly of equipment is out of the scope of our company's responsibilities.

Trademark

The following trademark has been registered in China.

Certification

Application

Metal Working Machine	Processing Machines	Measurement, Analytical and Test Systems	Medical Equipment
Telescopes	Energy	Communication Equipment	Crating and Packaging Machines
Space Equipment	Robots	Humanoid Robots	Glass and Ceramic Manufacturing Systems
Printing, Bookbinding and Paper	Printed Circuit Board Manufacturing Machines	Aircraft	Semiconductor Manufacturing Systems
Flat Panel Display Manufacturing Systems	Wood, Light Metal and Plastic Machine Tools	Paper-making Machines	Optical Machines
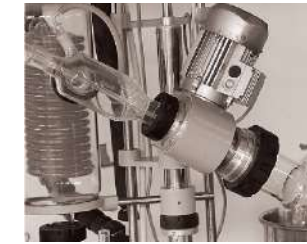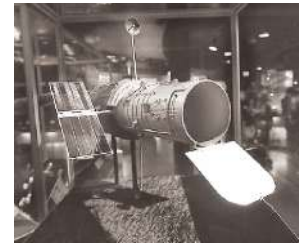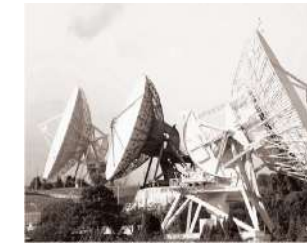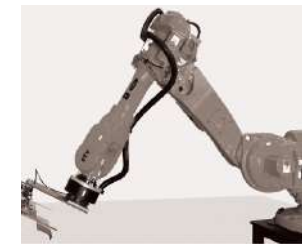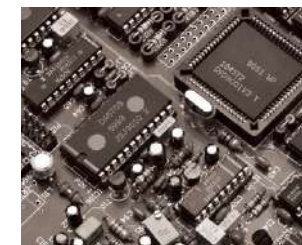
⚠ **Warning** Means that improper use or handling could result in a risk of death or serious injury.

⚠ **Caution** Means that improper use or handling could result in personal injury or loss of property.

Application restriction

This product cannot be used for the following applications:

· Space flight facility
· Aircraft equipment
· Nuclear power equipment
· Equipment and apparatus used in domestic homes
· Vacuum equipment

· Automotive equipment
· Personal recreation equipment
· Equipment that directly works on human bodies
· Equipment for transport of humans
· Equipment for use in a special environment

■ Please consult with our authorized distributor in advance for applications mentioned above.

■ Fail-safe devices that prevent an accident must be designed into the equipment when the products are used in any equipment that could result in personal injury or damage to property in the event of product failure.

Design Precaution

Be certain to read the catalog when designing the equipment.

Use only in the proper environment

Please ensure to comply with the following environmental conditions:

⚠ Caution
- Ambient temperature 0-40℃.
- No splashing of water or oil.
- Do not expose to corrosive or explosive gas.
- No dust such as metal powder.

Install the equipment properly

⚠ Caution
- Carry out the assembly and installation precisely as specified in the catalog.
- Observe our recommended fastening methods (including bolts used and tightening torques). Improper assembly may cause problems such as vibration, reduction in life, deterioration of precision and product failure in operation.

Install the equipment with the required precision

⚠ Caution
- Please design and assemble parts correctly, to ensure the recommended installation accuracy in the catalog.
- Failure to hold the recommended tolerances may cause problems such as vibration,reduction in life, deterioration of precision and product failure.

Use the specified lubricant

⚠ Caution
- Do not use the lubricant recommended by the company, can reduce the life of the product. Replace the lubricant as recommended.
- The complete units are factory lubricated .Do not mix with other kinds of grease.

Precautions for use:Be sure to read the catalog when operating

Please take the product and parts carefully

⚠ Caution
- Please do not use a hammer etc to strike all parts and assembly units forcefully. In addition, please make sure fissure and scars won't be taken place because of falling down etc. Otherwise it will lead to damage.
- The performance cannot be guaranteed when is used under the condition of damage. It might lead to failures like damage etc.

Please do not exceed its allowable torque when used

⚠ Caution
- Please do not exceed allowable maximum torque of first moment when exerting torque. Otherwise untight bolt, waggle and damage of buck-up part might be occurred, which will lead to malfunction.
- If output shaft is directly linked to articulated arm etc, there's a chance that it might be damaged because of collision of articulated arm, which the output shaft cannot not be controlled.

Please do not alter matching components

⚠ Caution
- All components of the product is made out of processing a complete set.
Specified properties cannot be guaranteed when using it with other sets.

Please do not disassemble combo products

⚠ Caution
- Disassembling and reassembling the combo product are strictly prohibited. Otherwise, there is no way to regain its original performance.

Usage of lubricating grease

Installation notes

⚠ Caution
- An inflammation may be caused if it splashes into eyes. Please wear protective glasses etc when operation in order to keep it from the eyes.
- An inflammation may be caused if it touches the skin. Please wear protective gloves etc when operation in order to keep it from the skin.
- Please do not devour (diarrhea and vomit etc will be caused)
- Please note do not cut your finger when opening the container. Please wear protective gloves well.
- Please keep it away from children.

Emergency management

⚠ Caution
- Once it splashes into eyes, please wash it for 15 minutes with clean water immediately and receive treatment.
- Once it touches the skin, please use the water and soap to wash it fully.
- Once it's being swallowed, please do not try hard vomiting but immediately receive the doctor's treatment.

Treatment of waste oil and container

⚠ Caution
- Regulations require the user is in duty bound to carry out treatment method. Please handle it properly according to relevant laws and regulations. When in doubt, please consult the authorized agent first, then handle it correctly.
- Please do not exert pressure to an empty container. By doing this may cause it fracture.
- Please do not weld, heat, trepan or trim to the container. Otherwise, it may burn up the residue inside.

Storage methods

⚠ Caution
- Please seal it tight after used, in order to prevent dusts and moisture etc from mixing in. Avoid direct sunlight.
- As to products with long-term inventory, make sure performance and rust protection.
- For surface treatment, please refer to the delivery figure.

About scrapping

⚠ Caution **Disposal should be carried out in accordance with the industrial waste standard .**
•Please process it in accordance with industrial waste when scrapping.