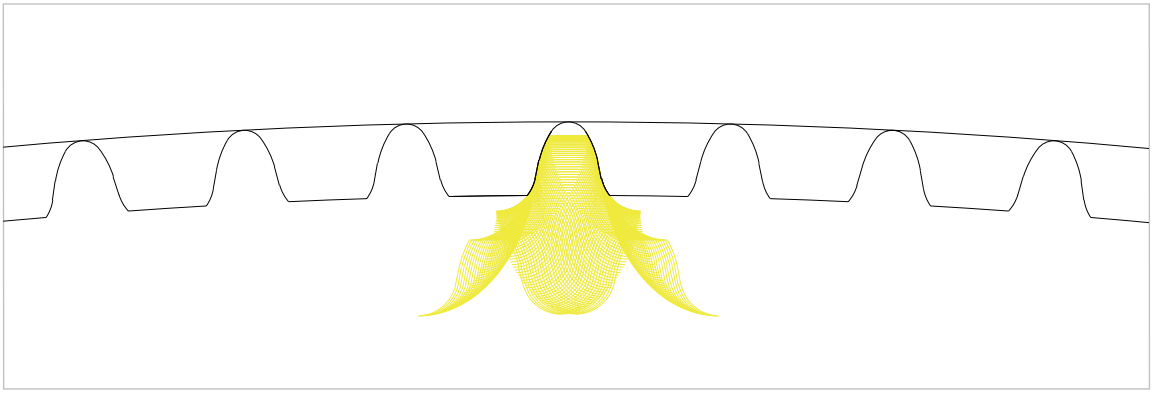
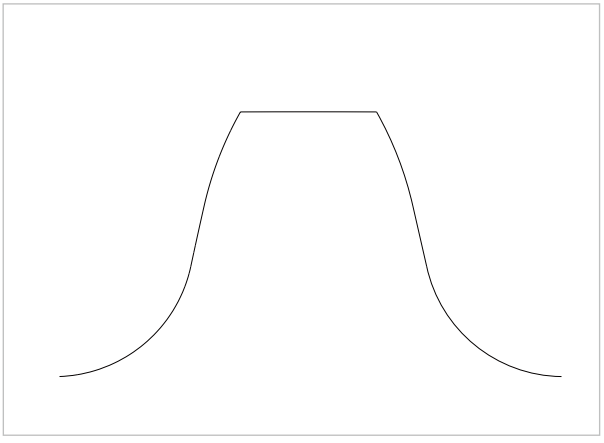
Tooth profile

- 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°C~+40°C	-20°C~+100°C	○	◎
LF-II	GREEN	0°C~+40°C	-20°C~+100°C	○	◎

○ 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	$\Phi 37_{-0.1}^{0} * \varphi 39.6_{0}^{+0.1} * 0.75_{0}^{+0.1}$	53 * 1.5	$\varphi 53_{-0.1}^{0} * \varphi 56.8_{0}^{+0.1} * 1.15_{0}^{+0.1}$
	17	46.5 * 1	$\varphi 46.5_{-0.1}^{0} * \varphi 49.1_{0}^{+0.1} * 0.75_{0}^{+0.1}$	64 * 1	$\varphi 64_{-0.1}^{0} * \varphi 66.6_{0}^{+0.1} * 0.75_{0}^{+0.1}$
LHT-II	20	55 * 1	$\varphi 55_{-0.1}^{0} * \varphi 57.6_{0}^{+0.1} * 0.75_{0}^{+0.1}$	73 * 1.5	$\varphi 73_{-0.1}^{0} * \varphi 76.8_{0}^{+0.1} * 1.15_{0}^{+0.1}$
	25	68 * 1	$\varphi 68_{-0.1}^{0} * \varphi 70.6_{0}^{+0.1} * 0.75_{0}^{+0.1}$	90 * 1.5	$\varphi 90_{-0.1}^{0} * \varphi 94.2_{0}^{+0.1} * 1.15_{0}^{+0.1}$
	32	88 * 1.5	$\varphi 88_{-0.1}^{0} * \varphi 92_{0}^{+0.1} * 1.15_{0}^{+0.1}$	119 * 1.5	$\varphi 119_{-0.1}^{0} * \varphi 123.1_{0}^{+0.1} * 1.15_{0}^{+0.1}$

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.

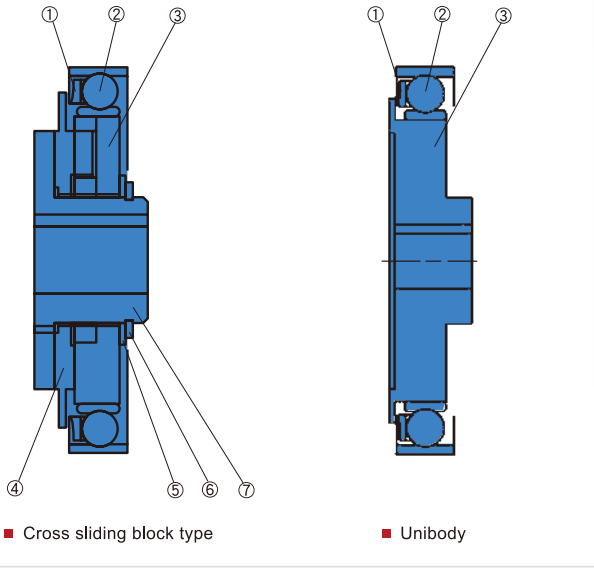
Permissible average input rotational speed

It's the average value of input speed.

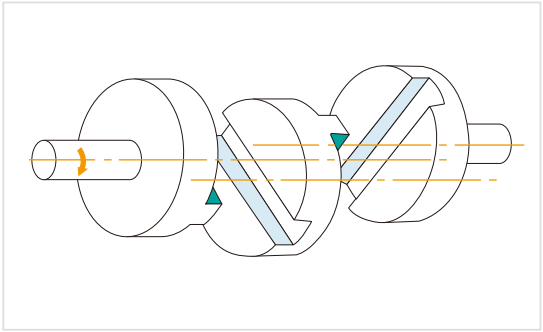
Wave generator

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:



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

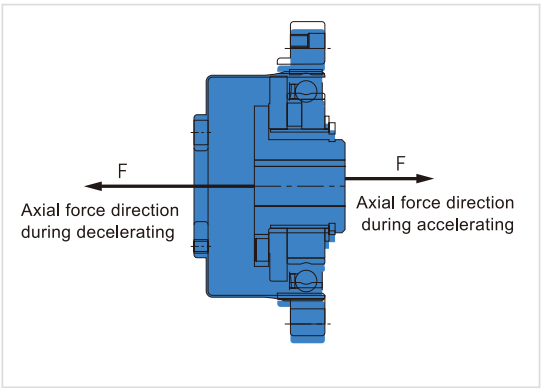


❶ Holder of flexible bearing
❷ Flexible baring
❸ Wave generator
❹ Cross sliding block
❺ Gasket
❻ Ring-shield
❼ Power input shaft

Axial force and axial fixation of wave generator

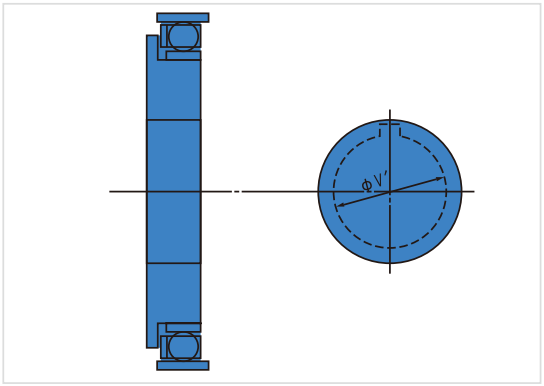
The axial force on wave generator begins to work due to elastic deformation of flexspline.
When used as a reducer, the axial force moves towards to the inside of the flexspline.
When used as a speed increaser, the axial force's movement is opposite to the direction of the deceleration.
The design of 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



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

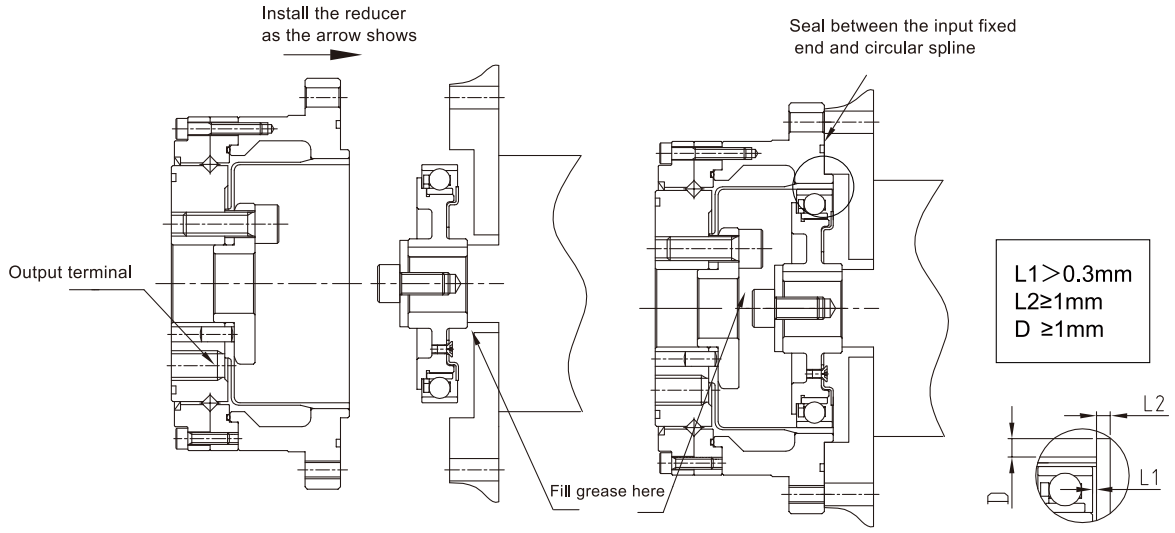
unit: mm

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

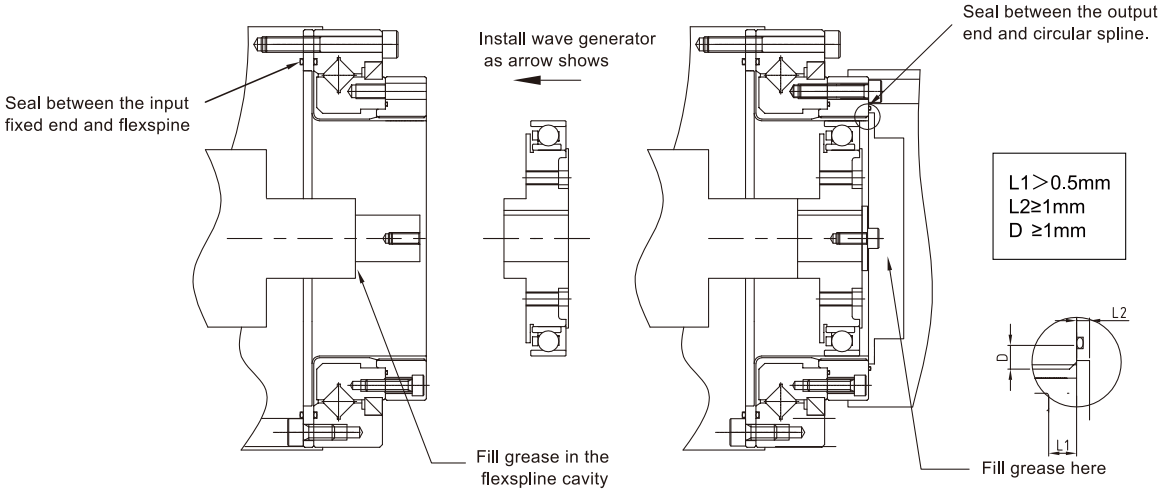
The aperture of the wave generator can be customized according to customer requirements.
Please contact with the authorized distributor in case of any changes in the table.

Installation procedure

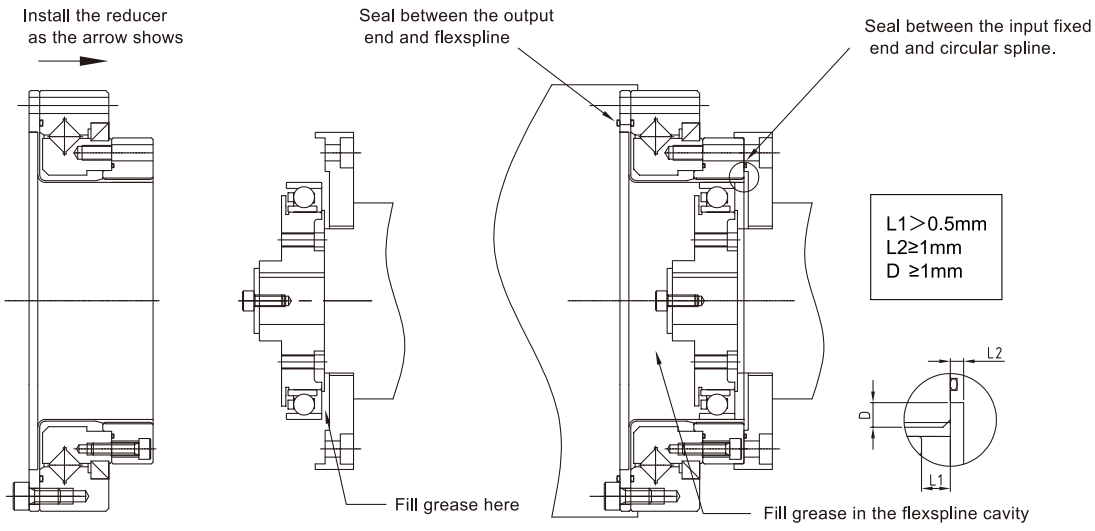
Installation of LSS series



The first method of installation for LHT-I/II Series



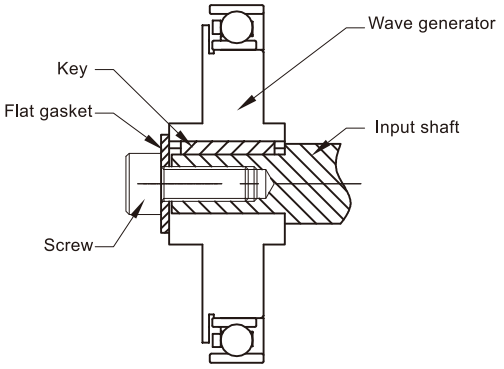
The second method of installation for LHT-I/II series



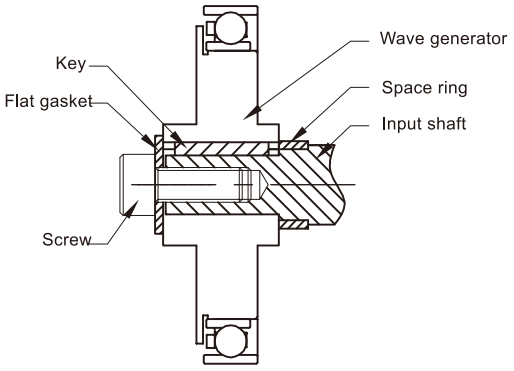
Installation procedure

The connecting and fixing method of wave generator

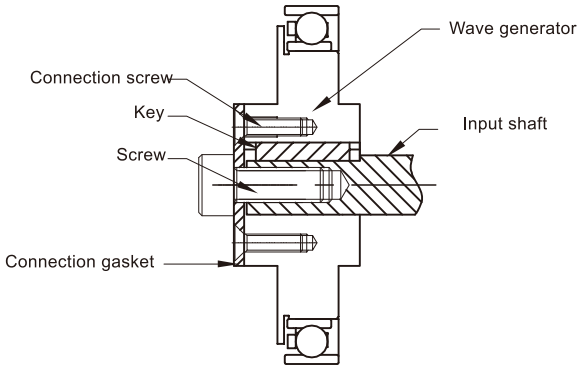
1.Input shaft has a shaft shoulder, it can be connected with wave generator directly. As shown in the figure.



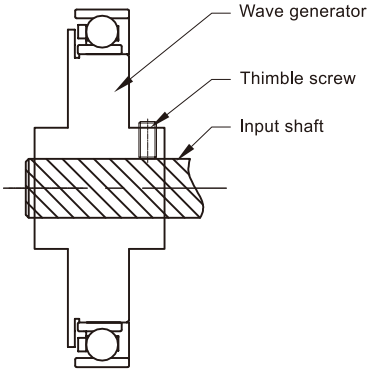
2.Input shaft has a shaft shoulder, but it's too long. You can add a space ring on the shaft(the parallelism of space ring should be within 0.01mm) , then connect and fix with the wave generator. As shown in the figure.



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.



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.

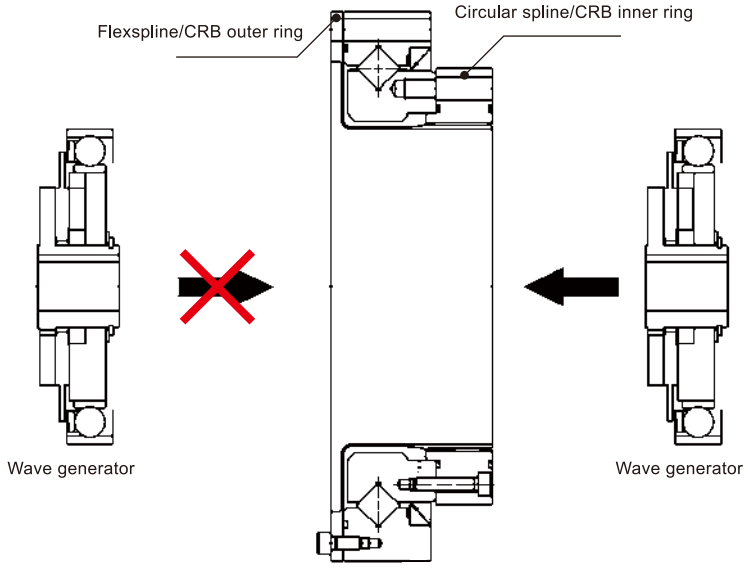


Assembly considerations

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



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.

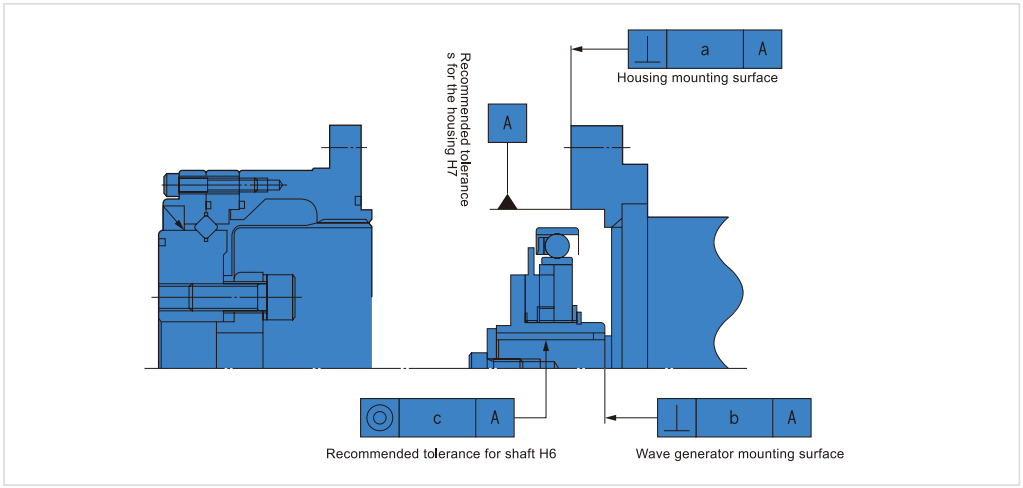
• Rust prevention

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

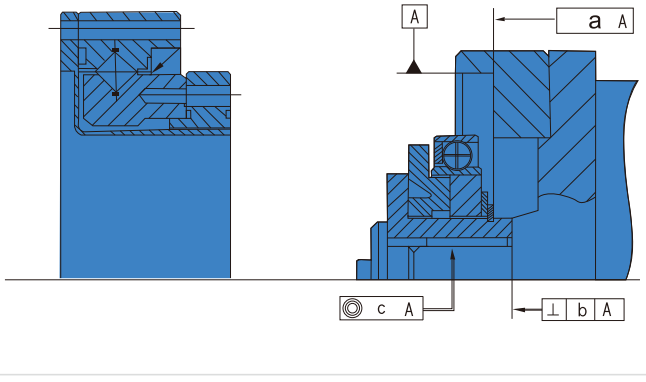
unit: mm

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

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 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
LHD-20	M b di 140Nm	M b peak 280Nm	M b max 560Nm
	F t di 650N	F t peak 1150N	F t max 1980N
	F a di 650N	F a peak 1150N	F a max 1980N
LHD-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
LHD-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
LHD-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

LSD Series

LSD-I

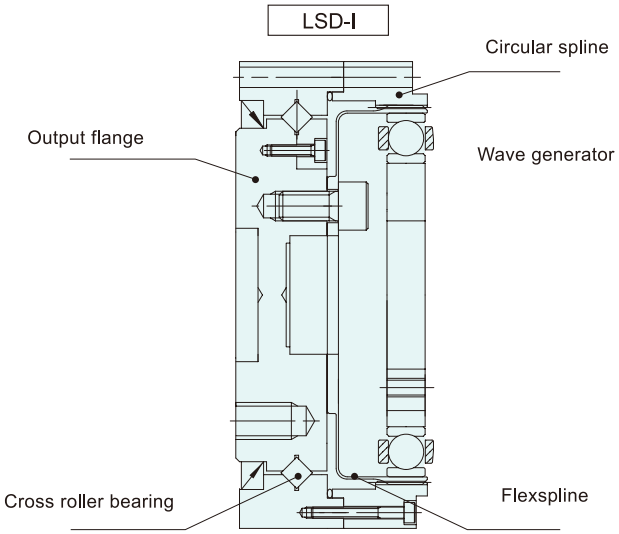
LSD Series

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.

Application

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

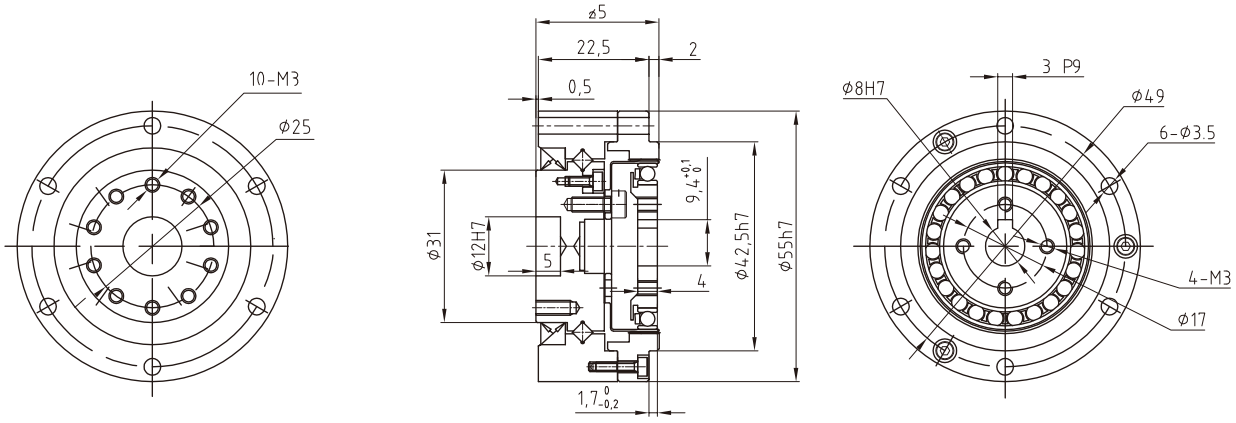
Combinative structure of LSD series



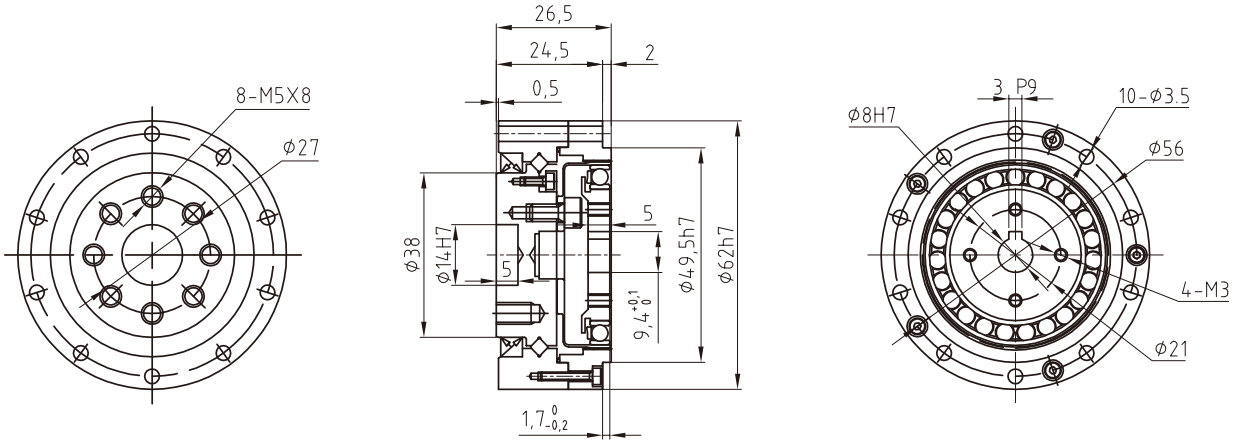
Rated parameter table of LSD series

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	⩽30	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	⩽30	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	⩽30	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				

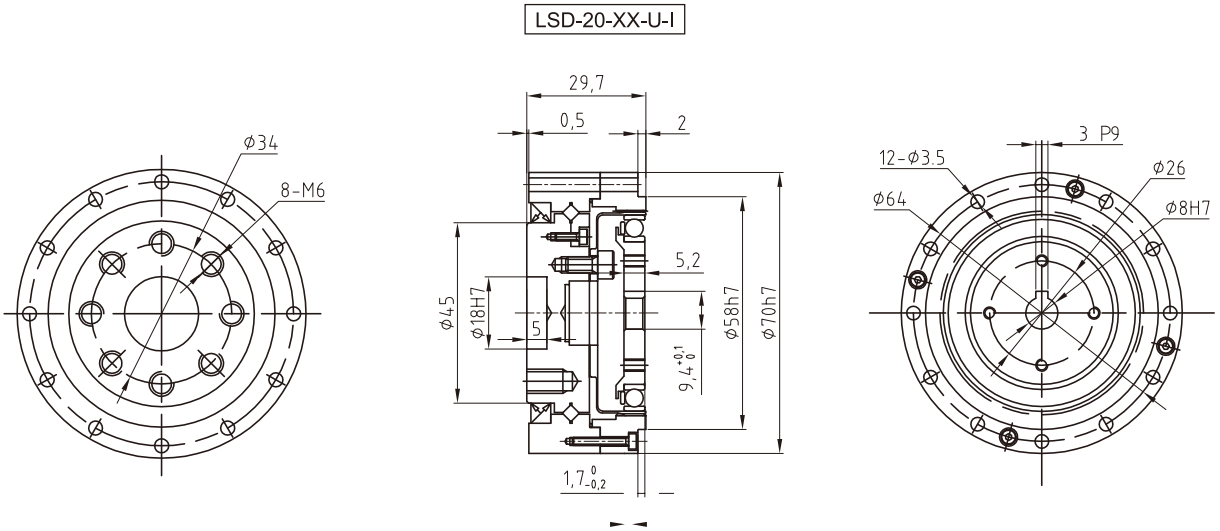
LSD-14-XX-U-I



LSD-17-XX-U-I



LSD-20-XX-U-I



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