Nidec
尼得科
All for dreams

FLEXWAVE

精密控制用减速机

A High precision reducer

WP series

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日本电产新宝(浙江)有限公司
NIDEC-SHIMPO (ZHEJIANG) CORPORATION

FLEXWAVE hits the scene

FLEXWAVE 的誕生

FLEX WAVE

“技术磨练”正是我们坚持的信念。

日本电产新宝引以为傲的减速机技术。
通过不断完善技术，诞生了新型减速机。

机器人需求增加，针对精密控制用减速机的期待不断提高。
我们汇集迄今培养的技术力量，
完成了可以满足顾客要求的轻量紧凑、大速比、低背隙的减速机。
“FLEXWAVE”。抓住机遇，融入梦想。
活跃在机器人及机床等各种领域。

"Relentless Refinement of Technology",

Nidec-Shimpo Corporation is a global leader in various high precision gear technologies. Based on increased demand for higher accuracy from machine tool and robot manufacturers, we’ve utilized our expertise to develop a new gear reduction mechanism.

This mechanism, called Flexwave, addresses the need for high torque density in a lightweight, compact package, combined with zero backlash and high reduction ratios. As a result, manufacturers of high performance robots, machine tools and other automation equipment will see increased performance and competitiveness in their respective markets.

INDEX

零部件构成

Parts Configuration

封闭型 Closed Type

WPC- □ - □ -CN (CF)

封闭型 Closed Type Component

部件型

WPU- □ - □ -CN (CF)

封闭型 Closed Type Unit

组合型

开放型 Open type

WPS- □ - □ -SN

开放型 Open Type Simple unit

简易组合型

WPU- □ - □ -SNJ

开放型 Open Type Input shaft unit

组合型（输入轴）

WPU- □ - □ -SNH

开放型 Open Type Hollow unit

组合型（中空轴）

凸轮
（椭圆形）
Cam
(elliptic)

薄壁轴承
（薄壁、变形）
Elastic bearing
(thin / flexible)

柔性齿轮
（薄壁、变形）
Flex gear
(thin / flexible)

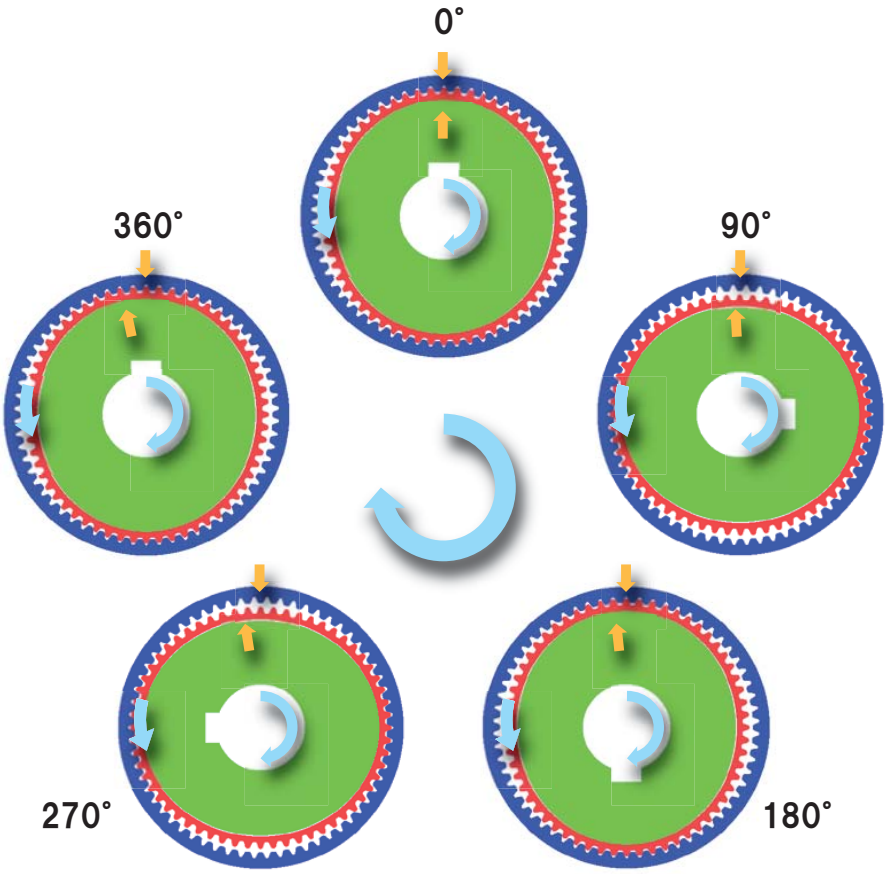
内齿轮
Internal gear

减速机构

Reduction Mechanism

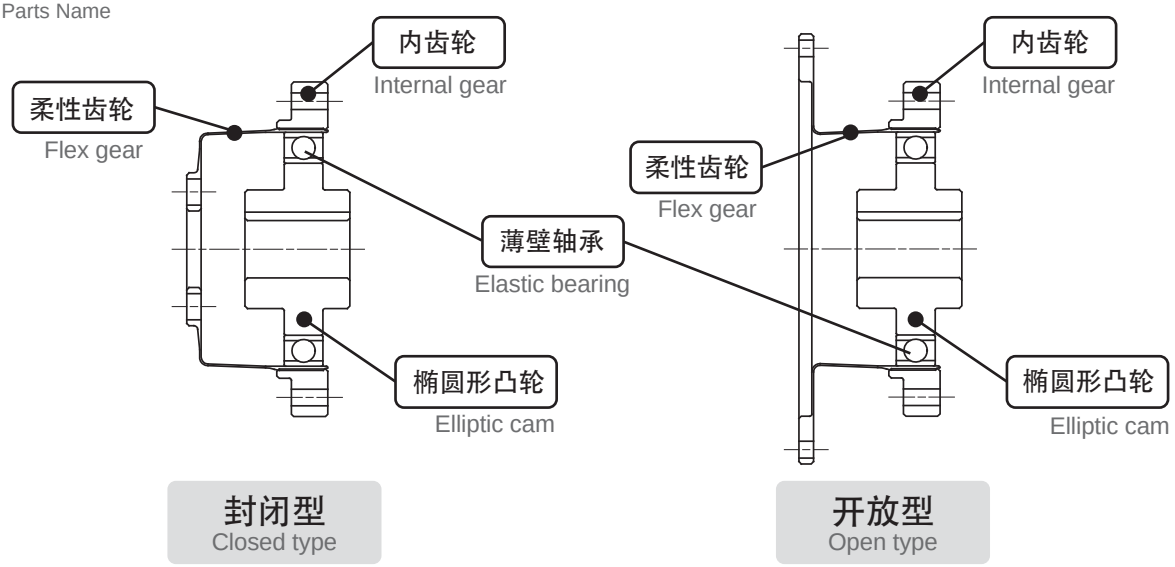
- 通过凸轮使薄壁轴承、柔性齿轮呈椭圆状形变。
- 柔性齿轮与内齿轮在椭圆形长轴部分发生啮合。
- 固定内齿轮，使凸轮沿顺时针方向旋转 360° 时，柔性齿轮会沿逆时针方向移动内齿轮与柔性齿轮的齿数差部分。

- Flex gear and elastic bearing take elliptic shape with the cam inserted.
- Flex gear and internal gear are engaged at both ends of the long axis of the ellipse in a stable manner.
- With the internal gear fixed, when the cam (input) is rotated clockwise, the flex gear (output) rotates counterclockwise. And its rotational speed is determined by the tooth count differential between two gears.



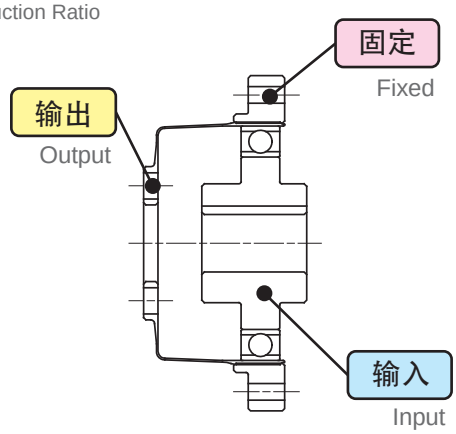
部品名称

Parts Name



减速比

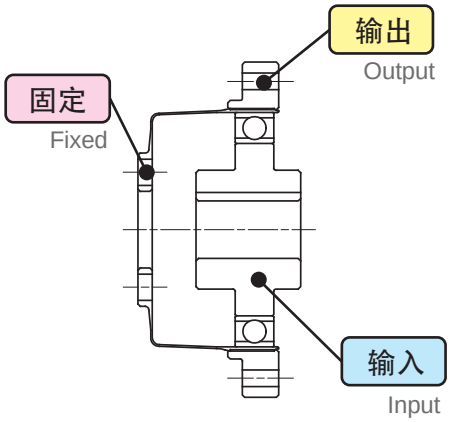
Reduction Ratio



$$\text{减速比 Reduction ratio} = \frac{-1}{R}$$

※输入旋转方向与输出旋转方向相反

*The input and output rotation directions are opposite.



$$\text{减速比 Reduction ratio} = \frac{1}{R+1}$$

※输入旋转方向与输出旋转方向相同

*The input and output rotation directions are same.

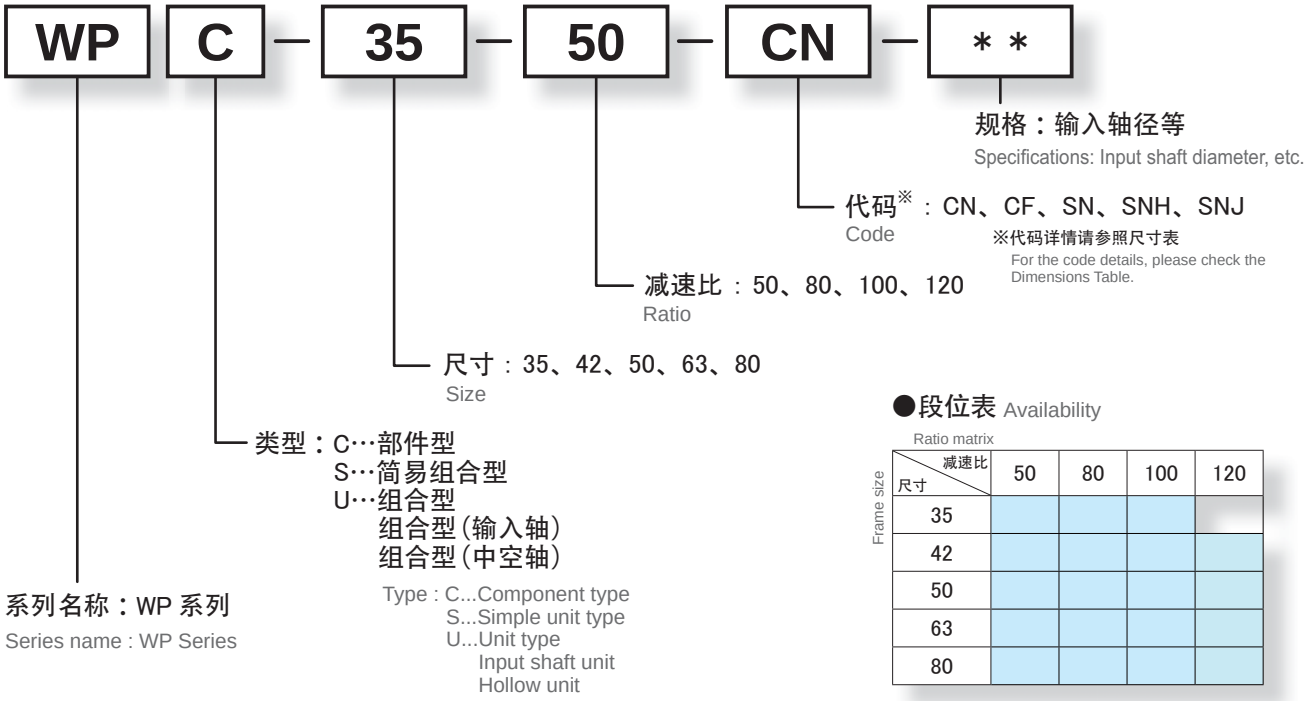
● R 為減速機規表中的減速比

R represents the 'Ratio' figure in the specifications table on the next page.

標準型

Standard type

减速机型号 Reducer Model Nomenclature



●段位表 Availability

Ratio matrix

Frame size 尺寸 \ 减速比	50	80	100	120
35				
42				
50				
63				
80				

减速机规格 Reducer Specifications

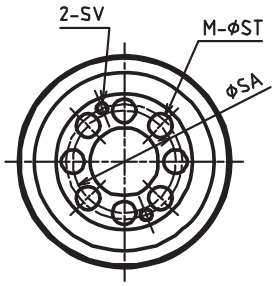
尺寸 Size	减速比 Ratio R※1	※2 容许平均力矩 Nominal output torque [Nm]	※3 容许最大力矩 Maximum output torque [Nm]	※4 紧急最大力矩 Emergency stop torque [Nm]	※5 容许平均输入转速 Nominal input speed [r/min]	※6 容许最高输入转速 Maximum input speed [r/min]
35	50	7	23	46	3000	8500
	80	9	27	55		
	100	9	32	63		
42	50	21	44	91	3000	7300
	80	26	50	102		
	100	28	63	129		
	120	28	63	129		
50	50	33	73	127	3000	6500
	80	40	86	149		
	100	47	96	172		
	120	47	96	172		
63	50	51	127	242	3000	5600
	80	66	142	266		
	100	70	163	295		
	120	70	163	295		
80	50	89	253	447	3000	4800
	80	122	316	590		
	100	142	346	673		
	120	142	346	673		

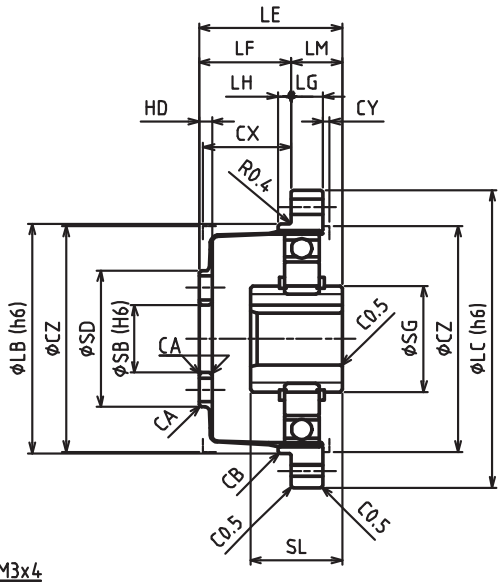
※1 请将 R 值代入前页所述公式内，求得减速比
※2 输入转速为 2000r/min 时的容许最大值
※3 启动、停止时的容许最大值
※4 发生撞击时的容许最大值
※5 运转过程中，平均输入转速的容许最大值
※6 运转过程中，输入转速的容许最大值

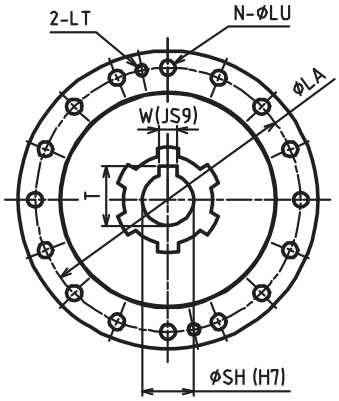
*1 Reduction ratio is to be calculated by the formula in the previous page, using R value in this table.
*2 The maximum allowable value at the input rotation speed of 2000r/min
*3 The maximum torque when starting and stopping.
*4 The maximum torque when it receives shock.
*5 The maximum average input speed.
*6 The maximum input speed.

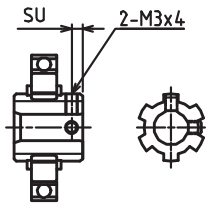
封闭型 部件型
Closed Type, Component

WPC- □ - □ -CN
WPC- □ - □ -CF









INPUT SHAFT FOR 35&42

尺寸 Size	重量 Weight	惯性力矩 Moment of inertia
	kg	$\times10^{-4}$kgm^2
35	0.10	0.0383
42	0.17	0.0855
50	0.26	0.207
63	0.43	0.544
80	0.91	1.63

[mm]

尺寸 Size	LA	LB	LC	N※1	LU	LT	LE	LF	LG	LH	LM	SG	SH	SL	W
35	44	38	50	8 (6)	3.5	M3	28.5	17.5	6	2	11	15.8	6	18.5	–
42	54	48	60	16 (12)	3.5	M3	32.5	20	6.5	2.5	12.5	15.8	8	20.7	–
50	62	54	70	16 (12)	3.5	M3	33.5	21.5	7.5	3	12	24.8	12	21.5	4
63	75	67	85	16 (12)	4.5	M4	37	24	10	3	13	27.8	14	21.6	5
80	100	90	110	16 (12)	5.5	M5	44	28	14	3	16	27.8	14	23.6	5

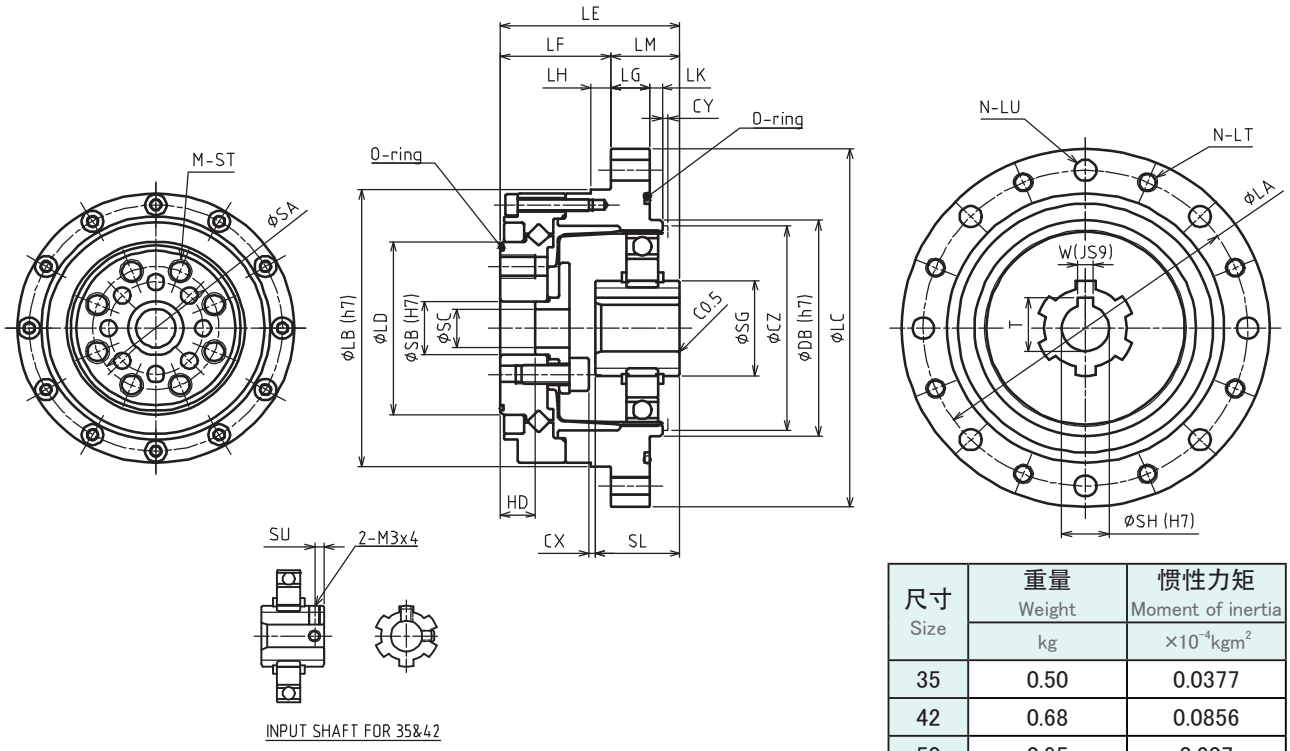
尺寸 Size	T	SU	SA	SB	SD	M	ST	SV	HD	CA	CB	CX	CY	CZ
35	–	2.5	17	11	23.5	6	4.5	M3	2.4	C0.5	C0.3	17	1	38
42	–	3	19	10	27	6	5.5	M3	3	C0.5	C0.3	19	1	45
50	13.8	–	24	16	32	8	5.5	M3	3	C0.5	C0.5	20.5	1.5	53
63	16.3	–	30	20	40	8	6.5	M4	3	C0.5	C0.5	23	1.5	66
80	16.3	–	40	26	52	8	8.8	M5	3.2	C0.5	C0.5	26.8	1.5	86

※1 -CN 及 -CF 中尺寸不同。（ ）内为 -CF 的数值。
※2 关于输入部位详情，请参照单独尺寸图。

*1 -CN and -CF are different in dimensions. The -CF value is shown in ( ).
*2 For details in the input section, please check the drawings.

封闭型 组合型
Closed Type, Unit

WPU- □ - □ -CN
WPU- □ - □ -CF



尺寸 Size	重量 Weight	惯性力矩 Moment of inertia
	kg	$\times 10^{-4}$kgm^2
35	0.50	0.0377
42	0.68	0.0856
50	0.95	0.207
63	1.5	0.544
80	3.3	1.63

[mm]

尺寸 Size	LA	LB	LC	LD	N※1	LT	LU	LE	LF	LG	LH	LK	LM	DB	SG
35	65	56	73	31	8 (6)	M4	4.5	41	27	7	3.5	2	14	38	15.8
42	71	63	79	38	8 (6)	M4	4.5	45	29	8	4	2	16	48	15.8
50	82	72	93	45	8 (6)	M5	5.5	45.5	28	10	5	3	17.5	56	24.8
63	96	86	107	58	10 (8)	M5	5.5	52	36	10	5	3	16	67	27.8
80	125	113	138	78	12	M6	6.5	62	45	12	5	3	17	90	27.8

尺寸 Size	SH	SL	W	T	SU	SA	SB	SC	M	ST	HD	CX	CY	CZ
35	6	18.5	–	–	2.5	23	11	8	6	M4 × 8	9.5	1.6	1	38
42	8	20.7	–	–	3	27	10	7	6	M5 × 8	9.5	1.3	1	45
50	12	21.5	4	13.8	–	32	14	10	8	M6 × 9	9	1.5	1.5	53
63	14	21.6	5	16.3	–	42	20	15	8	M8 × 10	12	3.4	1.5	66
80	14	23.6	5	16.3	–	55	26	20	8	M10 × 12	15	5.2	1.5	86

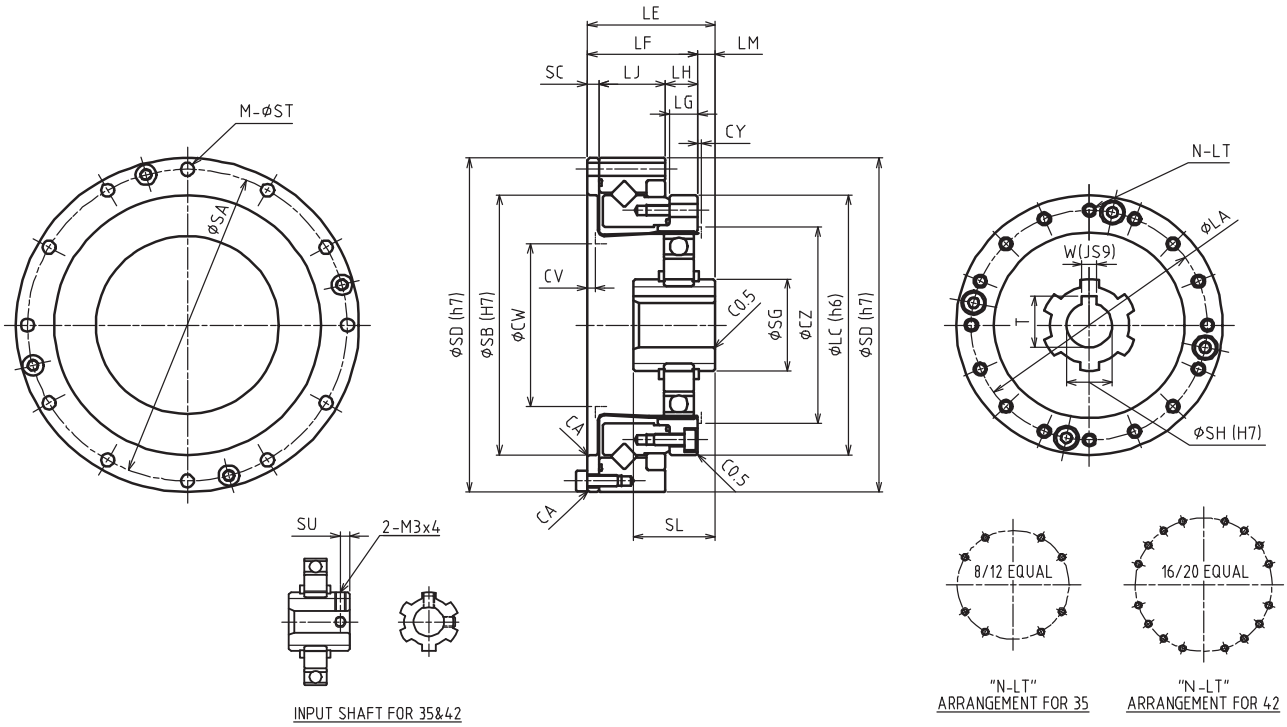
※1 -CN 及 -CF 中尺寸不同。（ ）内为 -CF 的数值。
※2 关于输入部位详情，请参照单独尺寸图。

*1 -CN and -CF are different in dimensions. The -CF value is shown in ( ).
*2 For details in the input section, please check the drawings.

开放型 简易组合型
Open type, Simple unit

WPS- □ - □ -SN

尺寸 Size	重量 Weight	惯性力矩 Moment of inertia
	kg	$\times 10^{-4}$kgm^2
35	0.39	0.0391
42	0.55	0.0870
50	0.79	0.209
63	1.3	0.549
80	2.7	1.65



[mm]

尺寸 Size	LA	LC	LE	LF	LG	LH	LJ	LM	SG	SH	SL	W	T	SU	SA	SB
35	44	50	28.5	23.5	6	7	14.1	5	15.8	6	18.5	–	–	2.5	64	48
42	54	60	32.5	26.5	6.5	7.5	16	6	15.8	8	20.7	–	–	3	74	60
50	62	70	33.5	29	7.5	8.5	17.5	4.5	24.8	12	21.5	4	13.8	–	84	70
63	77	85	37	34	10	12	18.7	3	27.8	14	21.6	5	16.3	–	102	88
80	100	110	44	42	14	15	23.4	2	27.8	14	23.6	5	16.3	–	132	114

尺寸 Size	SC	SD	M	ST	CA	CY	CZ	CV	CW	N	LT
35	2.4	70	8	3.5	C0.3	1	38	1.6	31	8	M3 × 5, ϕ 3.5 × 6
42	3	80	12	3.5	C0.3	1	45	2	37	16	M3 × 6, ϕ 3.5 × 6.5
50	3	90	12	3.5	C0.3	1.5	53	2	44	16	M3 × 6, ϕ 3.5 × 7.5
63	3.3	110	12	4.5	C0.3	1.5	66	2	56	16	M4 × 7, ϕ 4.5 × 10
80	3.6	142	12	5.5	C0.5	1.5	86	2	72	16	M5 × 8, ϕ 5.5 × 14

※1 关于输入部位详情，请参照单独尺寸图。

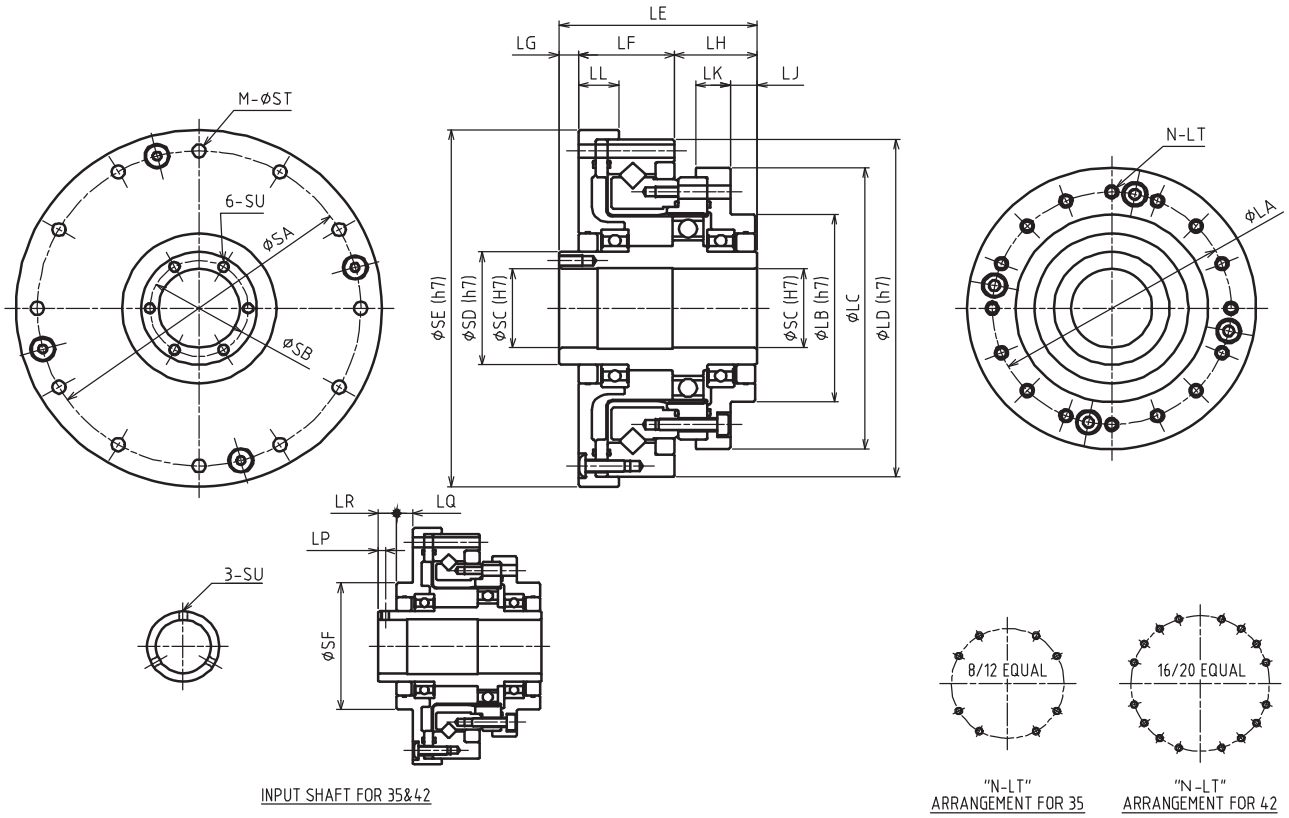
*1 For details in the input section, please check the drawings.

开放型 组合型（中空轴）

Open type, Unit (hollow shaft)

WPU- □ - □ -SNH

尺寸 Size	重量 Weight	惯性力矩 Moment of inertia
	kg	$\times 10^{-4}$kgm^2
35	0.57	0.103
42	0.79	0.230
50	1.1	0.460
63	1.7	1.24
80	3.4	3.18



INPUT SHAFT FOR 35&42

"N-LT" ARRANGEMENT FOR 35

"N-LT" ARRANGEMENT FOR 42

[mm]

尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LL	LP	LQ	LR
35	44	36	54	70	52.5	20.5	12	20	7.5	8	9	2.5	5.5	6.5
42	54	45	64	80	56.5	23	12	21.5	8.5	8.5	10	2.5	5.5	6.5
50	62	50	75	90	51.5	25	5	21.5	7	9	10.5	–	–	–
63	77	60	90	110	55.5	26	6	23.5	6	8.5	10.5	–	–	–
80	100	85	115	142	65.5	32	7	26.5	5	9.5	12	–	–	–

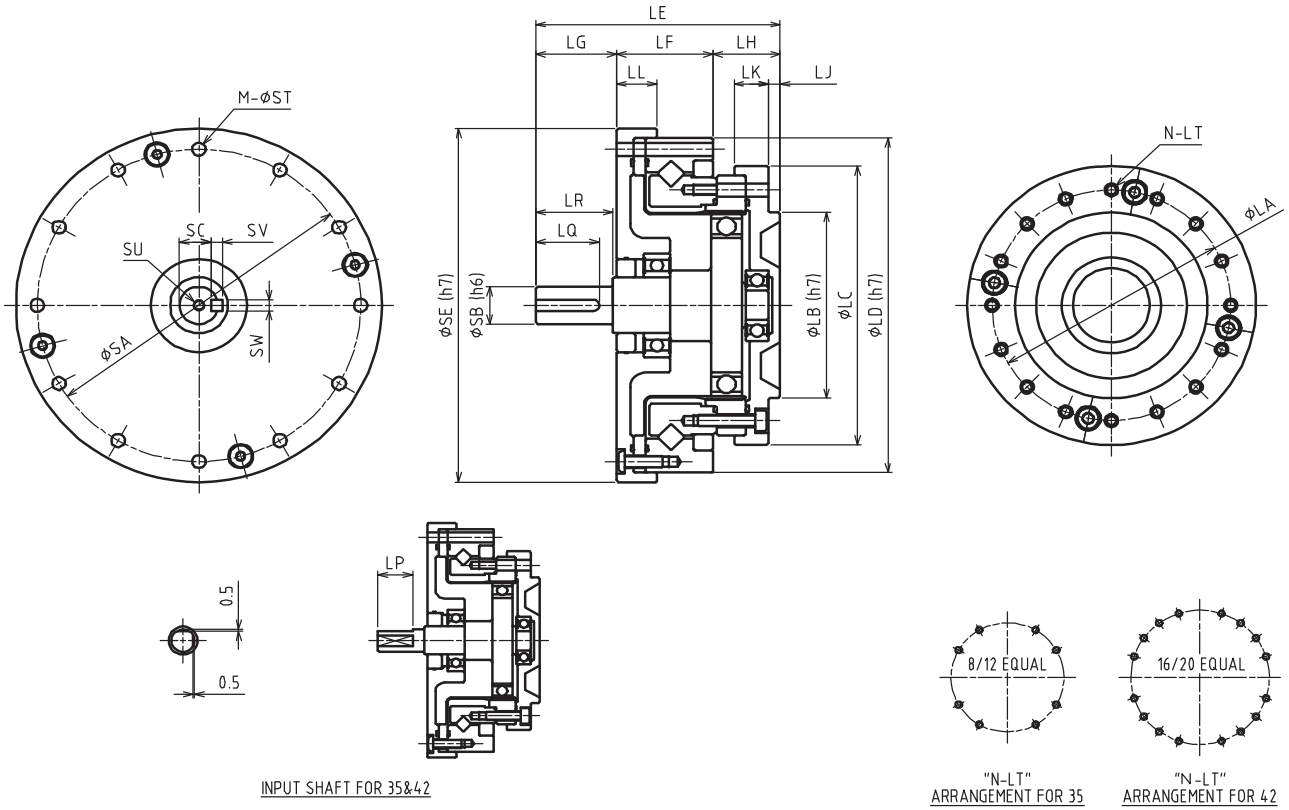
尺寸 Size	SA	SB	SC	SD	SE	SF	M	ST	SU	N	LT
35	64	–	14	20	74	36	8	3.5	M3	8	M3 × 5, ϕ 3.5 × 11.5
42	74	–	19	25	84	45	12	3.5	M3	16	M3 × 6, ϕ 3.5 × 12
50	84	25.5	21	30	95	–	12	3.5	M3 × 6	16	M3 × 6, ϕ 3.5 × 13.5
63	102	33.5	29	38	115	–	12	4.5	M3 × 6	16	M4 × 7, ϕ 4.5 × 15.5
80	132	40.5	36	45	147	–	12	5.5	M3 × 6	16	M5 × 8, ϕ 5.5 × 20.5

开放型 组合型（输入轴）

Open type, Unit (input shaft)

WPU- □ - □ -SNJ

尺寸 Size	重量 Weight	惯性力矩 Moment of inertia
	kg	$\times 10^{-4}$kgm^2
35	0.48	0.0376
42	0.69	0.0897
50	1.0	0.208
63	1.6	0.554
80	3.2	1.74



INPUT SHAFT FOR 35&42

"N-LT" ARRANGEMENT FOR 35

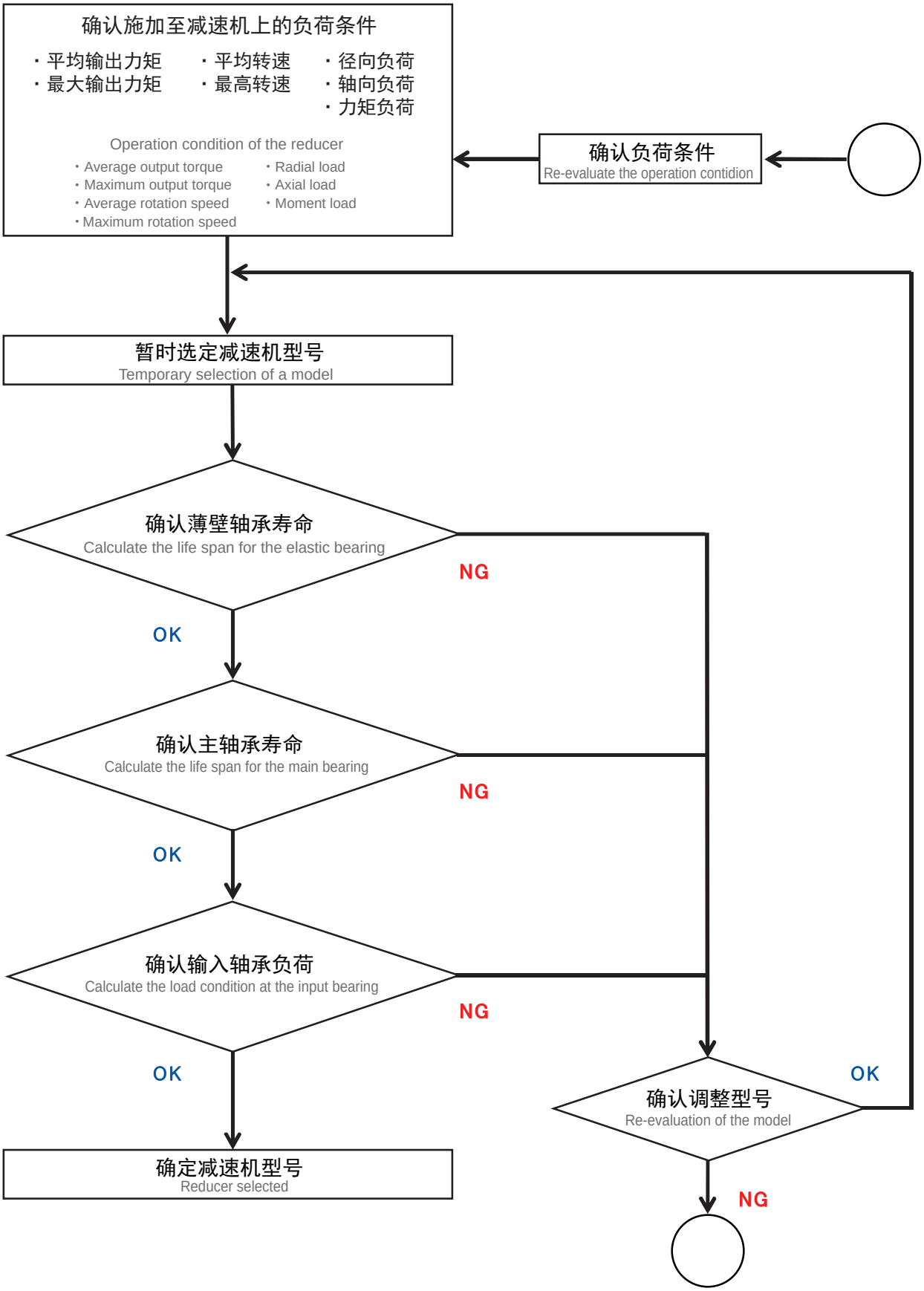
"N-LT" ARRANGEMENT FOR 42

[mm]

尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LL	LP	LQ	LR
35	44	36	54	70	50.5	20.5	15	15	2.5	8	9	11	–	–
42	54	45	64	80	56	23	17	16	3	8.5	10	12	–	–
50	62	50	75	90	63.5	25	21	17.5	3	9	10.5	–	16.5	20
63	77	60	90	110	72.5	26	26	20.5	3	8.5	10.5	–	22.5	25
80	100	85	115	142	84.5	32	26	26.5	5	9.5	12	–	22.5	25

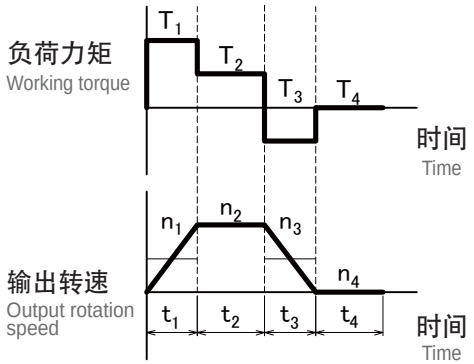
尺寸 Size	SA	SB	SC	SE	SV	SW	M	ST	SU	N	LT
35	64	6	–	74	–	–	8	3.5	–	8	M3 × 5, ϕ 3.5 × 11.5
42	74	8	–	84	–	–	12	3.5	–	16	M3 × 6, ϕ 3.5 × 12
50	84	10	8.2	95	3	3	12	3.5	M3 × 6	16	M3 × 6, ϕ 3.5 × 13.5
63	102	14	11	115	5	5	12	4.5	M3 × 6	16	M4 × 7, ϕ 4.5 × 15.5
80	132	14	11	147	5	5	12	5.5	M3 × 6	16	M5 × 8, ϕ 5.5 × 20.5

型号选定流程 Model selection flow



■薄壁轴承寿命计算 Life span for the elastic bearing

■运转类型 Operation cycle example



①平均输出力矩 / 最大输出力矩的计算
Calculation formula for output torque

平均输出力矩 Average output torque	Tao	Nm	$Tao=\sqrt[3]{\frac{n_1 \cdot t_1 \cdot \lvert T_1\rvert^3 + n_2 \cdot t_2 \cdot \lvert T_2\rvert^3 + \cdots + n_n \cdot t_n \cdot \lvert T_n\rvert^3}{n_1 \cdot t_1 + n_2 \cdot t_2 \cdots n_n \cdot t_n}}$
最大输出力矩 Peak output torque value	Tmo	Nm	*Tmo = T_1, T_2, ••• T_n 的最大值* *Tmo = Largest among T_1, T_2, … T_n*

请确认最大输出力矩为容许最大输出值以下。
Please make sure the peak output torque is below the maximum output torque in the specification table

②平均输入转速 / 最高输入转速的计算
Calculation formula for input speed

平均输出转速 Average output rotation speed	nao	r/min	$nao = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 \cdots n_n \cdot t_n}{t_1 + t_2 + \cdots + t_n}$
最高输出转速 Peak output rotation speed	nmo	r/min	*nmo = n_1, n_2, ••• n_n 的最大值* *nmo = Largest among n_1, n_2, … n_n*
平均输入转速 Average input speed	nai	r/min	$nai = nao \times R$ （R = 减速比 ） *(R = ratio)*
最高输入转速 Peak input speed value	nmi	r/min	$nmi = nmo \times R$ （R = 减速比 ） *(R = ratio)*

请确认最高输入转速为容许最高输入转速值以下。
Please make sure the peak input speed value is below the maximum input speed in the specification table

③寿命时间的计算
Calculation formula for life span

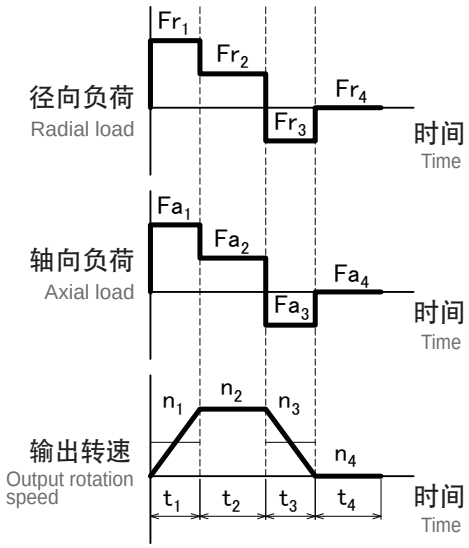
薄壁轴承寿命时间 Part life span for the elastic bearing	Lhe	h	$Lhe = 7000 \times \left(\frac{Tar}{Tao}\right)^3 \times \left(\frac{nar}{nai}\right)$
额定力矩 Rating torque	Tar	Nm	性能表中所记容许平均力矩 Nominal output torque in the specification table
额定输入转速 Rating input rotation speed	nar	r/min	2000 r/min

■主轴承规格（交叉滚子轴承） Main bearing specification(Cross roller bearing)

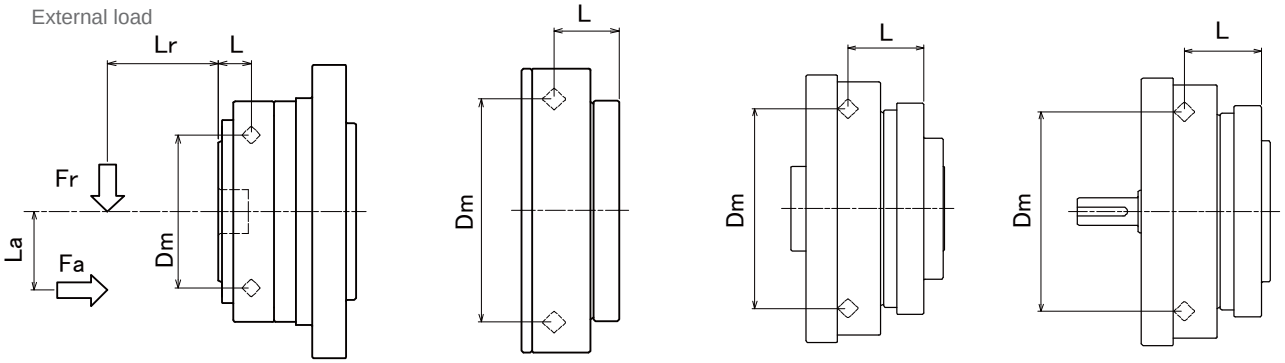
系列 Series	尺寸 Size	滚轴节圆直径 Pitch circle diameter of the bearing rollers	偏移量 Offset	基本动态额定负荷 Basic dynamic load rating	基本静态额定负荷 Basic static load rating	容许力矩 Allowable moment	力矩刚性 Moment rigidity
		Dm	L	C	Co	Mal	Km
		m	m	N	N	Nm	× 10^4 Nm/rad
WPU-□-□-C□	35	0.0335	0.0088	5620	6540	36.5	7.35
	42	0.0410	0.0098	6340	8170	55.8	8.02
	50	0.0485	0.0098	10400	13300	91.0	13.5
	63	0.0620	0.0108	15800	21100	156	27.7
	80	0.0815	0.0128	24400	35600	313	66.0
WPS-□-□-SN	35	0.0505	0.0162	7110	10200	74.0	14.4
	42	0.0598	0.0180	10900	15200	124	19.7
	50	0.0708	0.0194	17200	24700	187	40.1
	63	0.0856	0.0234	25100	37400	258	71.5
	80	0.114	0.0292	43300	67600	580	188
WPU-□-□-SNH WPU-□-□-SNJ	35	0.0505	0.0217	7110	10200	74.0	14.4
	42	0.0598	0.0235	10900	15200	124	19.7
	50	0.0708	0.0254	17200	24700	187	40.1
	63	0.0856	0.0289	25100	37400	258	71.5
	80	0.114	0.0357	43300	67600	580	188

■主轴承寿命计算 Part life span for the main bearing

■运转类型 Operation cycle example



■外部负荷 External load



①最大负荷惯量的计算

Calculation formula for the largest working moment

最大负荷惯量 Peak working moment	Mm	Nm	$Mm = Frm \cdot (Lr + L) + Fam \cdot La$
最大径向负荷 Peak radial load	Frm	N	$Frm = Fr_1,\ Fr_2 \cdots Fr_n$ 的最大值 Frm = Largest among Fr_1, Fr_2, … Fr_n
最大轴向负荷 Peak axial load	Fam	N	$Fam = Fa_1,\ Fa_2,\ \cdots Fa_n$ 的最大值 Fam = Largest among Fa_1, Fa_2, … Fa_n

请确认最大负荷惯量为容许惯量值以下。

Please make sure the peak working moment is below the maximum allowable moment

②平均径向负荷 / 轴向负荷 / 平均输出转速 / 平均负荷惯量的计算

Calculation formula for the Average radial load, Axial load, Average output rotation speed, Average working moment

平均径向负荷 Average radial load	Fra	N	$Fra = \sqrt[10/3]{\dfrac{n_1 \cdot t_1 \cdot \lvert Fr_1 \rvert^{10/3} + n_2 \cdot t_2 \cdot \lvert Fr_2 \rvert^{10/3} + \cdots + n_n \cdot t_n \cdot \lvert Fr_n \rvert^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots + n_n \cdot t_n}}$
平均轴向负荷 Axial load	Faa	N	$Faa = \sqrt[10/3]{\dfrac{n_1 \cdot t_1 \cdot \lvert Fa_1 \rvert^{10/3} + n_2 \cdot t_2 \cdot \lvert Fa_2 \rvert^{10/3} + \cdots + n_n \cdot t_n \cdot \lvert Fa_n \rvert^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots + n_n \cdot t_n}}$
平均输出转速 Average output rotation speed	nao	r/min	$nao = \dfrac{n_1 \cdot t_1 + n_2 \cdot t_2 \cdots n_n \cdot t_n}{t_1 + t_2 + \cdots + t_n}$
平均负荷惯量 Average working moment	Ma	Nm	$Ma = Fra \cdot (Lr + L) + Faa \cdot La$

③负荷系数 / 动态等价径向负荷的计算

Calculation formula for the Loading factor, Equivalent radial load

负荷系数 Loading factor	Xc, Yc	–	$\dfrac{Faa}{Fra + 2Ma/Dm} \leqq 1.5$ 时，Xc = 1.0，Yc = 0.45
			$\dfrac{Faa}{Fra + 2Ma/Dm} > 1.5$ 时，Xc = 0.67，Yc = 0.67
动态等价径向负荷 Equivalent radial load	Pc	N	$Pc = Xc \cdot (Fra + 2Ma/Dm) + Yc \cdot Faa$

④主轴承寿命时间的计算

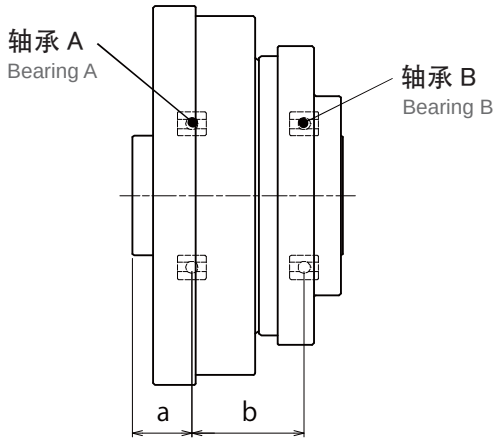
Life span for the main bearing

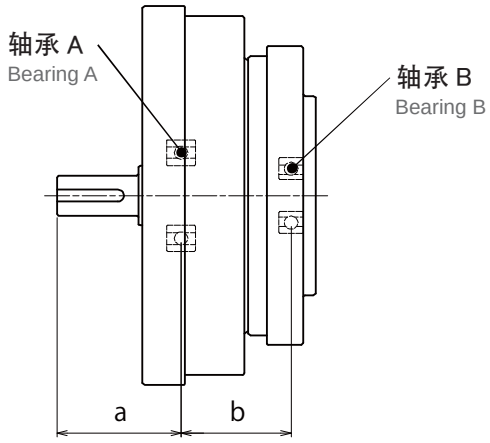
主轴承寿命时间 Life span for the main bearing	Lhc	h	$Lhc = \dfrac{10^6}{60 \cdot nao} \cdot \left(\dfrac{C}{fw \cdot Pc} \right)^{\frac{10}{3}}$
冲击系数 Impact factor	fw	–	1.0：未伴随冲击时　no shock
			1.2：伴随些许冲击时　with some shock
			1.5：伴随振动冲击时　with shock and vibration

输入轴容许负荷
Maximum load at input shaft

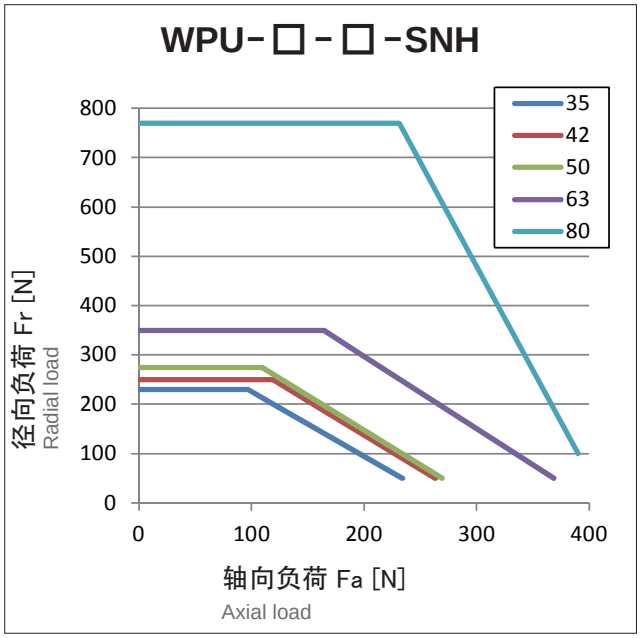
■轴承规格（开放型，组合型）Bearing specification (Open type, Unit)

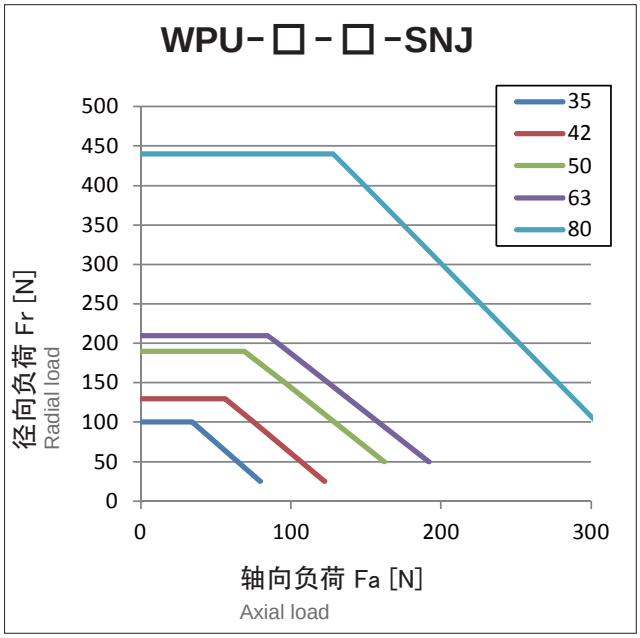
系列 Series	尺寸 Size	轴承 A Bearing A		轴承 B Bearing B		a	b
		基本动态额定负荷 Basic dynamic load rating	基本静态额定负荷 Basic static load rating	基本动态额定负荷 Basic dynamic load rating	基本静态额定负荷 Basic static load rating		
		C	Co	C	Co		
		N	N	N	N	mm	mm
WPU-□-□-SNH	35	4000	2470	4000	2470	16	27
	42	4300	2950	4300	2950	16	31
	50	4500	3450	4500	3450	14.5	27.5
	63	4900	4350	4900	4350	15.5	30.8
	80	14100	10900	5350	5250	19	37.0
WPU-□-□-SNJ	35	2240	910	1080	430	24	21.5
	42	2700	1270	1610	710	27	23.5
	50	4350	2260	2240	910	31.5	26
	63	5600	2830	2700	1270	37.5	29
	80	9400	5000	4350	2260	39	38.5





■容许负荷（平均输入转速：2000r/min、寿命时间：7000h）
Maximum load (Average input rotation speed : 2000r/min, Life span : 7000h)





■润滑剂的使用 Grease

Sumiplex MP No.2（日本住矿润滑剂株式会社）
Sumiplex MP No.2 (SUMICO LUBRICANT CO., LTD.)

■润滑剂的涂抹 Grease application

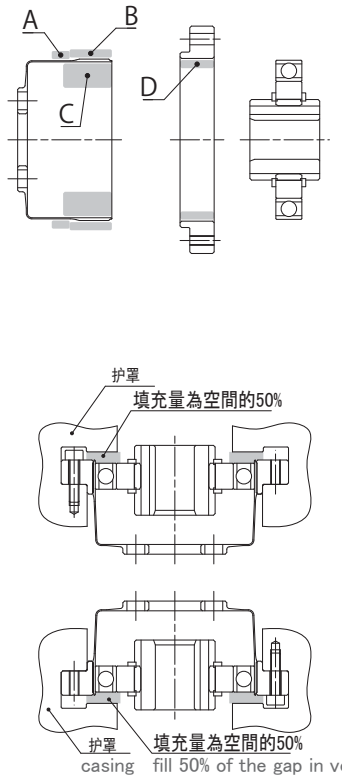
WPC（部件型）及 WPS（简易组合型）按照下表要求涂抹润滑剂。
For WPC (Component type) and WPS (Simple unit type), please apply grease according to the table below.

■润滑剂涂抹量 Grease application ［g］

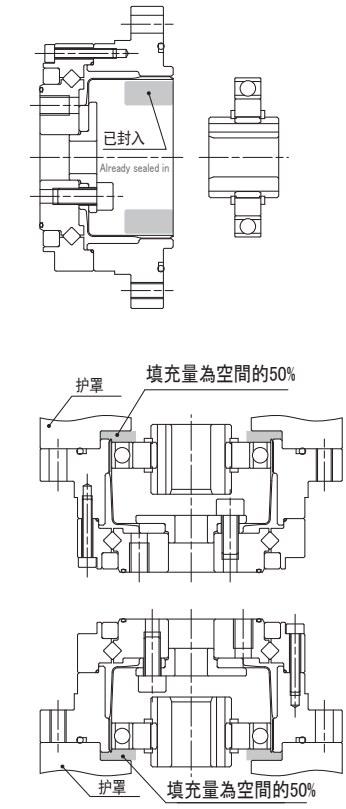
尺寸 Size	涂抹部位 Applied part			
	A	B	C	D
35	0.3	0.3	6.0	0.3
42	0.5	0.5	10	0.5
50	0.8	0.8	16	0.8
63	1.5	1.5	30	1.5
80	3.0	3.0	60	3.0

■润滑剂涂抹部位 Grease application location

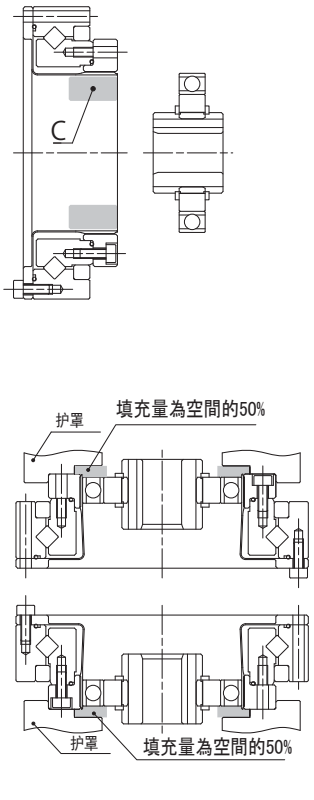
WPC



WPU

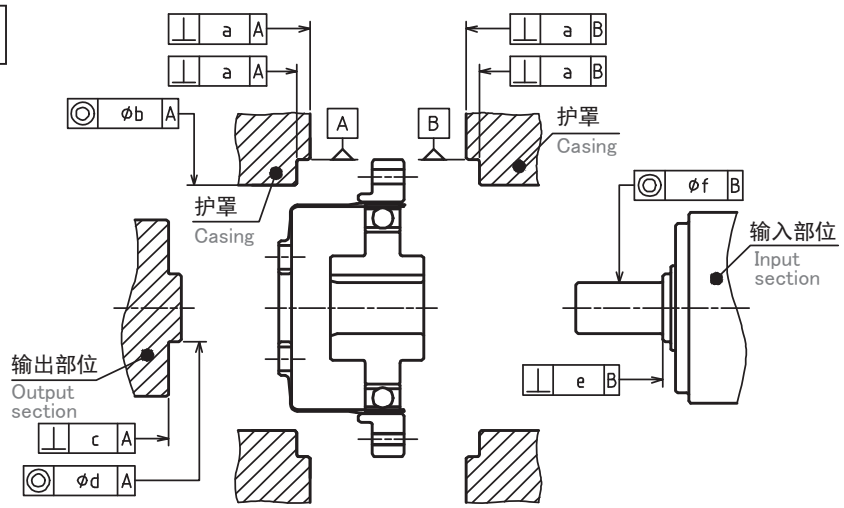


WPS



■安装精度 Attachment fixture requirement

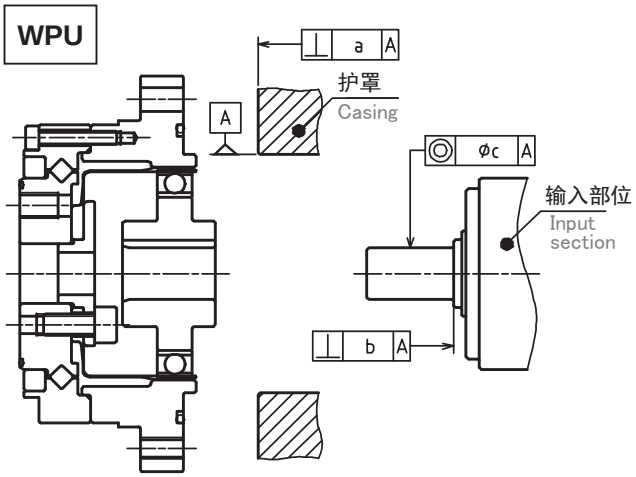
WPC



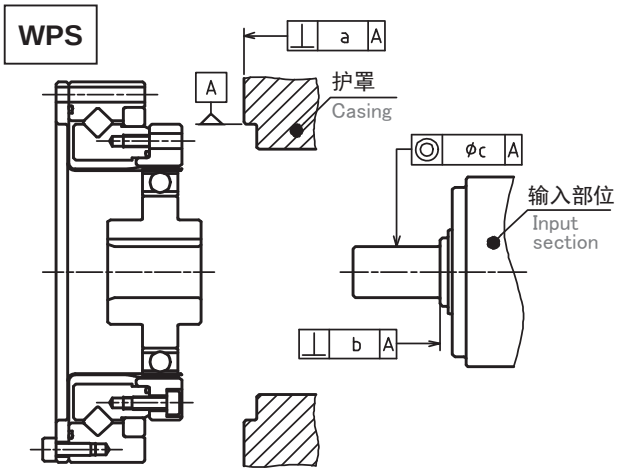
WPC [mm]

尺寸 Size	35	42	50	63	80
a	0.015	0.015	0.018	0.018	0.023
b	0.016	0.020	0.020	0.024	0.024
c	0.010	0.012	0.014	0.016	0.020
d	0.013	0.013	0.015	0.018	0.020
e	0.012	0.012	0.014	0.016	0.016
f	0.016	0.020	0.024	0.024	0.024

WPU



WPS



WPU [mm]

尺寸 Size	35	42	50	63	80
a	0.020	0.020	0.020	0.025	0.025
b	0.012	0.012	0.014	0.016	0.016
c	0.016	0.020	0.024	0.024	0.024

WPS [mm]

尺寸 Size	35	42	50	63	80
a	0.020	0.020	0.020	0.025	0.025
b	0.012	0.012	0.014	0.016	0.016
c	0.016	0.020	0.024	0.024	0.024

安装螺丝 Bolting

螺丝紧固力矩如下表所示。
通过螺丝个数（因 -CF、-CN 而不同）及紧固力矩调整，可传导力矩存在差异，所以请注意确认。

Please refer to the table below for the bolt tightening torque.
Please be noted that the transmittable torque varies depending on the bolt count (different between CF and CN) and tightening torque.

螺丝紧固力矩 Tightening torque for bolts

螺丝尺寸	Bolt size	M3	M4	M5	M6	M8	M10
紧固力矩［Nm］	Tightening torque	1.9	4.3	8.7	15	36	71

推建议螺丝：强度区分 12.9 以上
Recommended bolt : Strength rating above 12.9

传导力矩（封闭型、组合型）

Bolt specifications and Transmitting torque (Closed type, Unit)

安装输出法兰 Output flange attachment

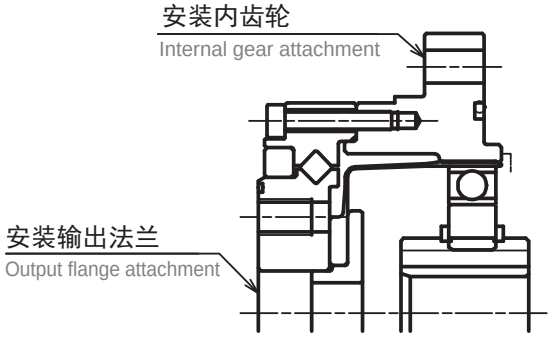
尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M4	M5	M6	M8	M10
螺丝个数	Bolt count	6	6	8	8	8
安装 PCD［mm］	Bolt PCD	23	27	32	42	55
紧固力矩［Nm］	Tightening torque	4.3	8.7	15	36	71
传导力矩［Nm］	Transmitting torque	56	106	238	566	1177

安装内齿轮（CN）Internal Gear Attachment

尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M4	M4	M5	M5	M6
螺丝个数	Bolt count	8	8	8	10	12
安装 PCD［mm］	Bolt PCD	65	71	82	96	125
紧固力矩［Nm］	Tightening torque	4.3	4.3	8.7	8.7	15
传导力矩［Nm］	Transmitting torque	210	230	430	629	1392

安装内齿轮（CF）Internal Gear Attachment

尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M4	M4	M5	M5	–
螺丝个数	Bolt count	6	6	6	8	–
安装 PCD［mm］	Bolt PCD	65	71	82	96	–
紧固力矩［Nm］	Tightening torque	4.3	4.3	8.7	8.7	–
传导力矩［Nm］	Transmitting torque	158	172	322	503	–



传导力矩（封闭型、部件型）
Bolt specifications and Transmitting torque (Closed type, Component)

安装柔性齿轮 Flex Gear Attachment

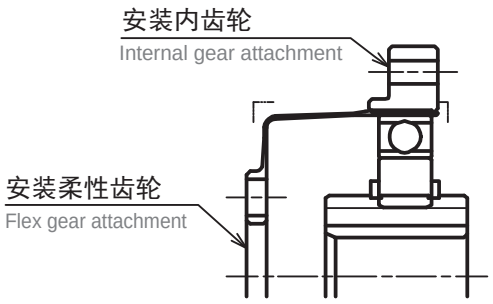
尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M4	M5	M5	M6	M8
螺丝个数	Bolt count	6	6	8	8	8
安装 PCD［mm］	Bolt PCD	17	19	24	30	40
紧固力矩［Nm］	Tightening torque	4.3	8.7	8.7	15	36
传导力矩［Nm］	Transmitting torque	41	75	126	223	539

安装内齿轮（CN） Internal Gear Attachment

尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M3	M3	M3	M4	M5
螺丝个数	Bolt count	8	16	16	16	16
安装 PCD［mm］	Bolt PCD	44	54	62	75	100
紧固力矩［Nm］	Tightening torque	1.9	1.9	1.9	4.3	8.7
传导力矩［Nm］	Transmitting torque	82	200	230	485	1048

安装内齿轮（CF） Internal Gear Attachment

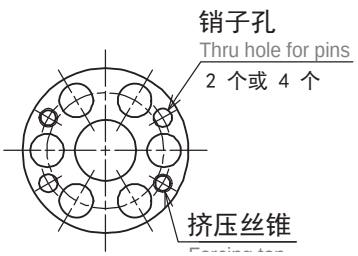
尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M3	M3	M3	M4	M5
螺丝个数	Bolt count	6	12	12	12	12
安装 PCD［mm］	Bolt PCD	44	54	62	75	100
紧固力矩［Nm］	Tightening torque	1.9	1.9	1.9	4.3	8.7
传导力矩［Nm］	Transmitting torque	61	150	172	364	786



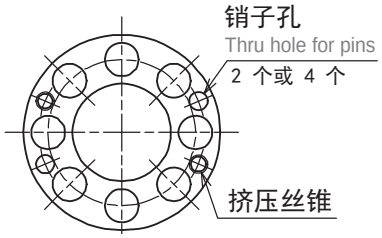
◆销子孔的追加 Reinforcement

柔性齿轮安装的传导力矩未满足要求时，请同时使用销子。
销子孔可根据需求追加。

Pins can be added if the transmittable torque at the flex gear interface is not sufficient.
As an option, holes can be added.



WP-35, 42



WP-50, 63, 80

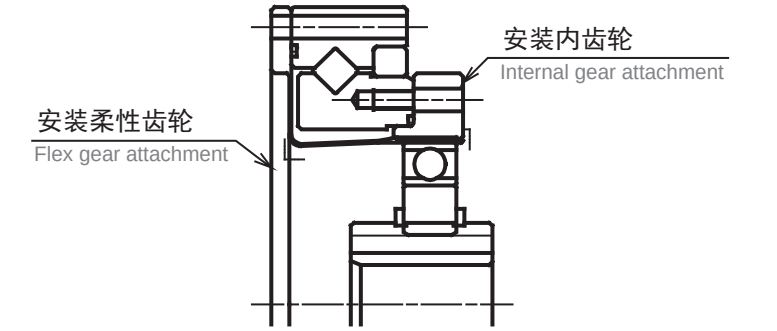
传导力矩（开放型）
Bolt specifications and Transmitting torque (Open type)

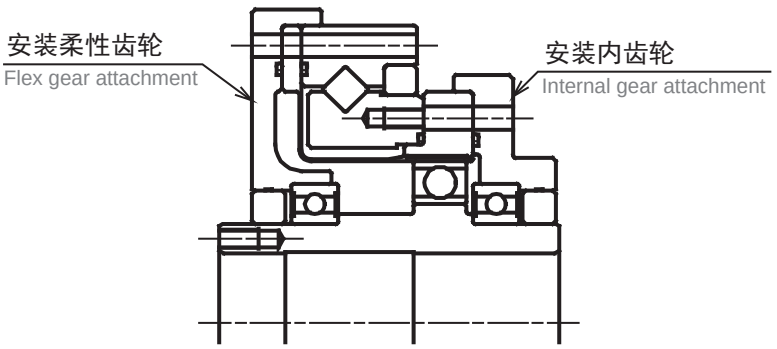
安装柔性齿轮 Flex Gear Attachment

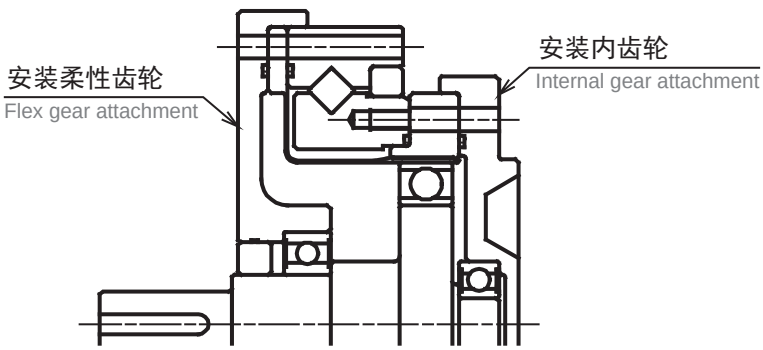
尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M3	M3	M3	M4	M5
螺丝个数	Bolt count	8	12	12	12	12
安装 PCD［mm］	Bolt PCD	64	74	84	102	132
紧固力矩［Nm］	Tightening torque	1.9	1.9	1.9	4.3	8.7
传导力矩［Nm］	Transmitting torque	119	206	234	495	1037

安装内齿轮 Internal Gear Attachment

尺寸	Size	35	42	50	63	80
螺丝尺寸	Bolt size	M3	M3	M3	M4	M5
螺丝个数	Bolt count	8	16	16	16	16
安装 PCD［mm］	Bolt PCD	44	54	62	77	100
紧固力矩［Nm］	Tightening torque	1.9	1.9	1.9	4.3	8.7
传导力矩［Nm］	Transmitting torque	82	200	230	498	1048







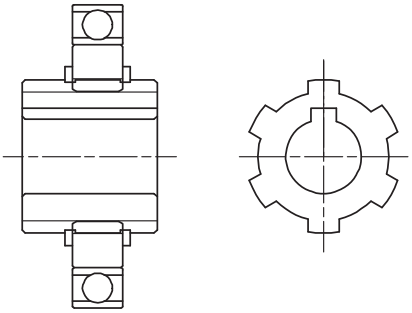
输入部位构造

输入部位构造分为花键型（自动调心构造）与刚构型，因输入孔径等差异而不同。
详细信息请确认尺寸图。

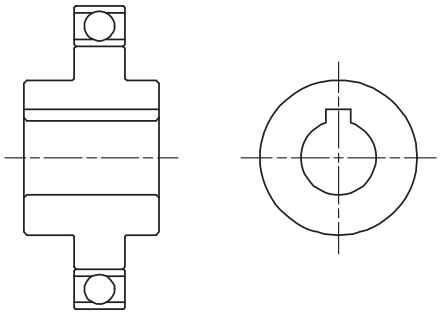
Input section structure

There are two types of input section structure, spline type (self-centering feature) and rigid type.

■花键型（自动调心构造）
Spline type (self-centering)



■刚构型
Rigid type

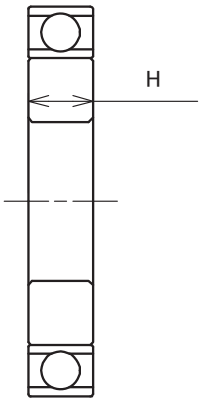


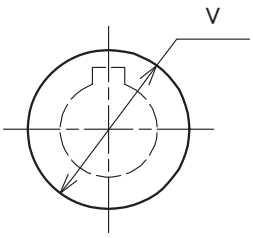
凸轮孔径尺寸

凸轮孔径尺寸可变更。
若在下表标准孔径尺寸以下时，则为花键型，
在标准孔径～最大孔径范围，则为刚构型。
若需下表范围以外尺寸，请另行咨询我公司。

Cam hole diameter

The diameter of the cam opening is customizable. Holes smaller than the 'standard hole size' in the table will be built in the spline type. Holes equal to or larger than the 'standard hole size' and smaller than the 'maximum hole size' will be built in the rigid type. Please contact us if you need sizes outside the specification in the table.





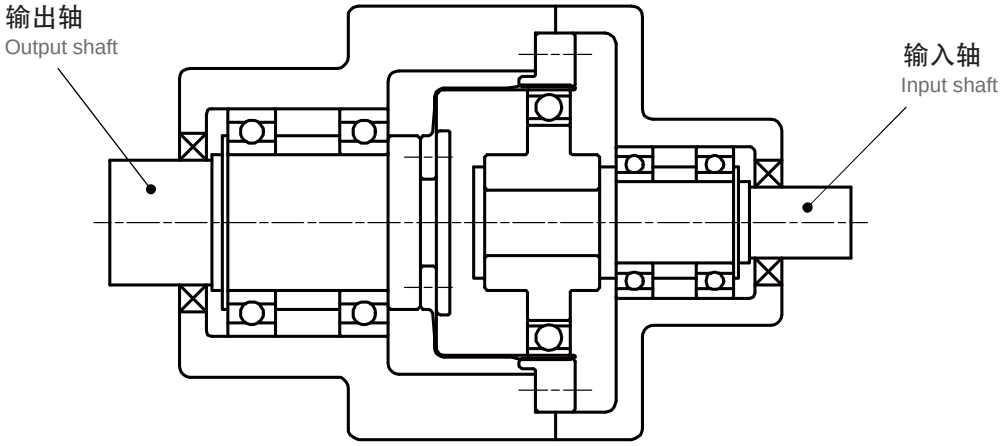
凸轮尺寸 Cam dimension [mm]

尺寸 Size	35	42	50	63	80
标准孔径 standard bore size	6	8	12	14	14
最大孔径 V maximum bore size	17	20	23	28	36
最小厚度 H minimum thickness	6	7	8	9	11

输入 / 输出轴的支撑（WPC- □ - □ -C □） Shaft installation instruction

输入轴 / 输出轴请采用承受作用于轴部的径向负荷 / 轴向负荷的支撑构造。（下图为参考实例）

Please design the support structure for input shaft and output shaft so that both radial and axial loads are supported. (Diagram below shows an example)

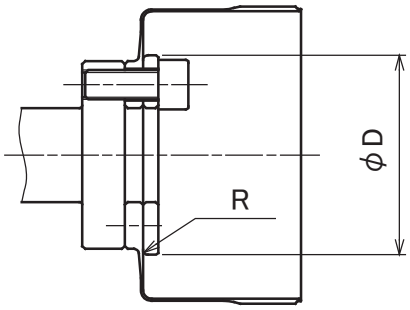


安装方法（WPC- □ - □ -C □）

Attachment flange requirement

安装与柔性齿轮相连接的法兰时，为了防止造成柔性齿轮破损，请保证下表所示尺寸。

For the attachment flange that comes in contact with flex gear, please build the corner radius according to the table below, in order to prevent damage.



[mm]

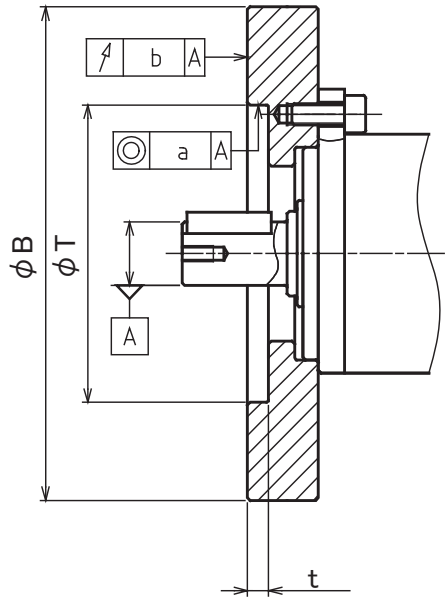
符号 Item	35	42	50	63	80
D	24.5	29	34	42	55
R	1.2	1.2	1.4	1.5	2

电机安装用法兰尺寸（WPU- □ - □ -C □）

Size requirement of the flange for motor attachment

将电机安装至组合型组件产品时，需要安装专用法兰。电机安装专用法兰尺寸请按照下表所示要求执行。

An attachment flange is required in order to attach a unit type Flexwave to the motor. The table below shows the dimension requirement for the flange.



[mm]

符号 Item	35	42	50	63	80
B	73	79	93	107	138
T	38H7	48H7	56H7	67H7	90H7
t	3	3	4.5	4.5	4.5
a	0.03	0.04	0.04	0.04	0.04
b	0.03	0.04	0.04	0.04	0.04

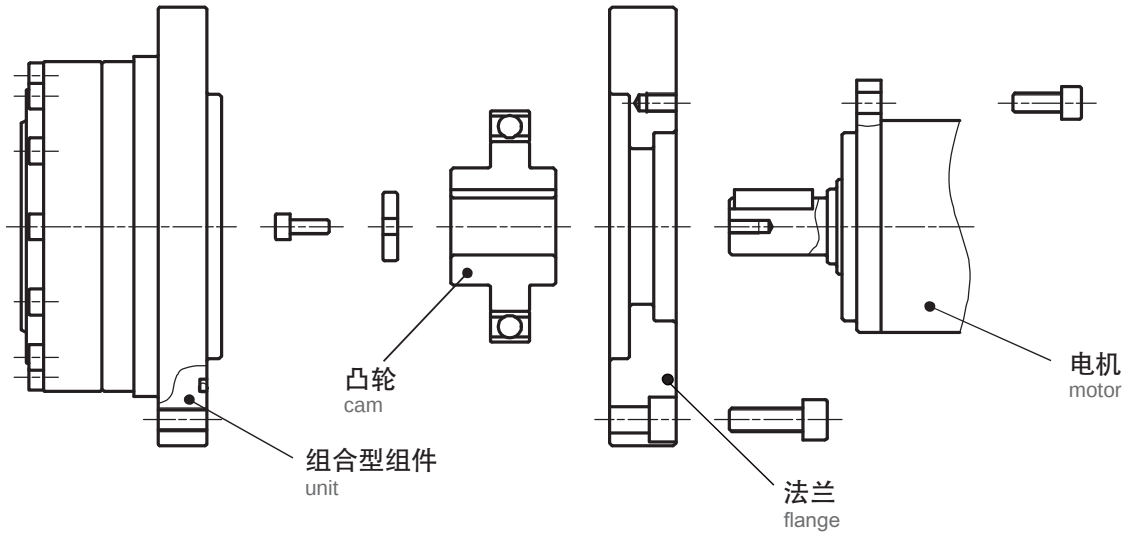
电机安装方法（WPU-□-□-C□） Motor installation procedure

■安装步骤 1

- 将法兰安装至电机上
- 将凸轮（轴承）安装至电机轴上
- 安装至组合型产品组件

Procedure 1

- Attach the flange on to the motor
- Attach the cam with elastic bearings to the motor shaft
- Attach the unit

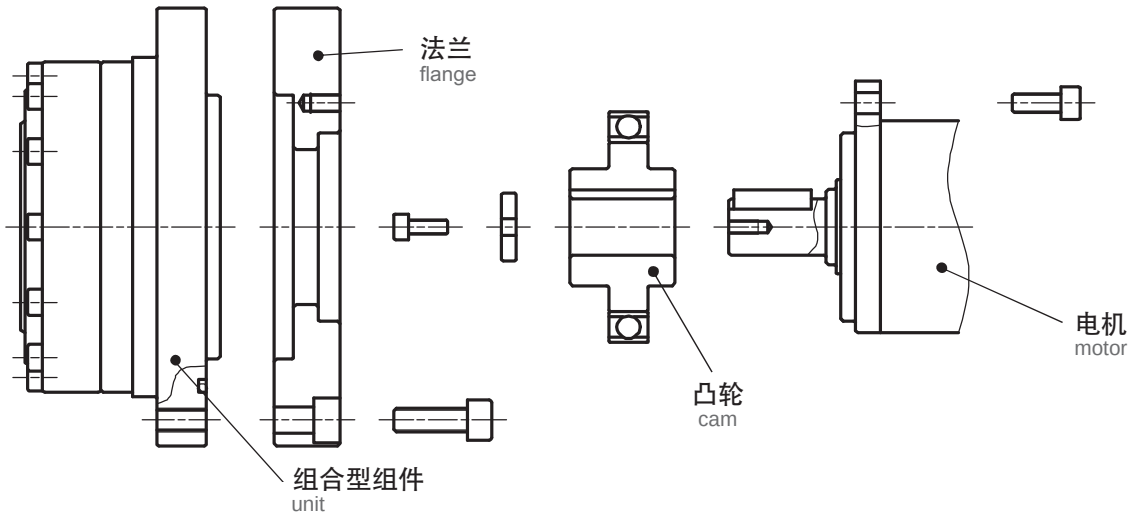


■安装步骤 2

- 将凸轮（轴承）安装至电机轴上
- 将法兰安装至电机上
- 安装至组合型产品组件

Procedure 2

- Attach the cam with elastic bearings to the motor shaft
- Attach the flange on to the motor
- Attach the unit



安装操作时的注意事项 Caution during installation

- 组装各零部件时，不可过度用力顶压。
- 注意不可倾斜插入输入 ASSY（凸轮、电机）。

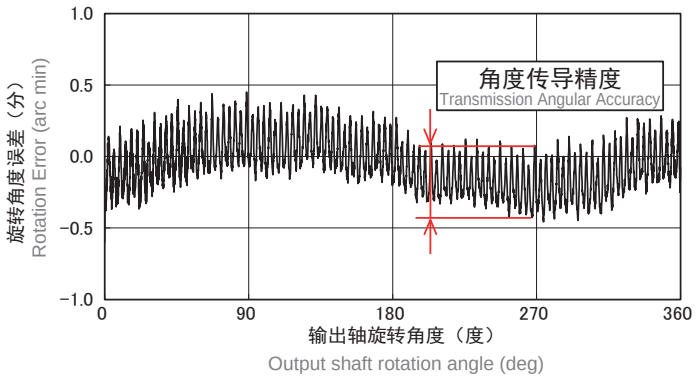
- Do not use excessive force while mating parts
- Please watch for tilting during input section assembly (motor insertion into cam)

角度传导精度 Transmission Angular Accuracy

角度传导精度定义

在无负荷条件下使输入轴旋转时，理论上输出旋转角度与实际输出旋转角度的差值。

What is Transmission Angular Accuracy?
It is the difference between the measured output rotation angle and the theoretical angle, while input shaft is rotated with no load.



[arc min]

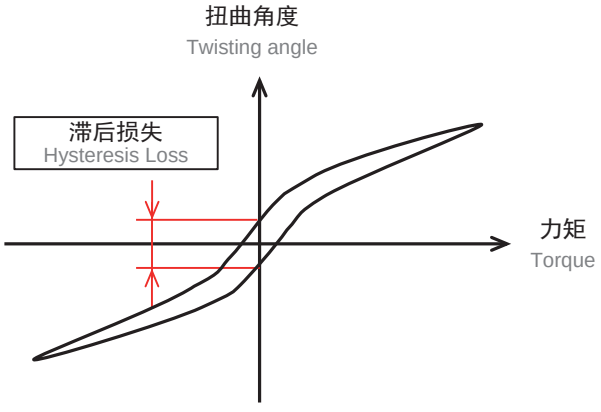
减速比 Ratio	尺寸 Size				
	35	42	50	63	80
50	2.0	2.0	1.5	1.0	1.0
80	1.5	1.5	1.0	1.0	1.0
100	1.5	1.5	1.0	1.0	1.0
120	–	1.5	1.0	1.0	1.0

滞后损失 Hysteresis Loss

滞后损失定义

输入侧固定后，将力矩施加至输出侧且 0 力矩时的扭曲角度差。

What is Hysteresis Loss?
When torque load is applied at the output shaft in alternate direction repeatedly with input shaft fixed, there is residual twisting angle when torque is back to zero.
In this context, hysteresis loss is the difference in the forward and backward twisting angle.



[arc min]

减速比 Ratio	尺寸 Size				
	35	42	50	63	80
50	2.0	2.0	2.0	2.0	2.0
80	1.5	1.5	1.0	1.0	1.0
100	1.5	1.5	1.0	1.0	1.0
120	–	1.5	1.0	1.0	1.0

最大背隙 Maximum Backlash

最大背隙定义

输入部采用花键型组件时的输出侧松动间隙。

（齿轮相咬合部位背隙为 0，所以刚构型组件背隙为 0）

What is Maximum Backlash?

In this context, maximum backlash is the output backlash for spline type input shaft. (Backlash is zero for rigid type input, because gear engagement backlash is zero.)

[arc sec]

减速比 Ratio	尺寸 Size				
	35	42	50	63	80
50	27	27	18	16	16
80	17	17	11	10	10
100	13	13	9	8	8
120	–	11	7	7	7

刚性（封闭型、组合型）Stiffness (Closed type, Unit)

剛剛性定义

固定输入侧，将力矩施加至输出侧时的弹簧常数与扭曲角度。

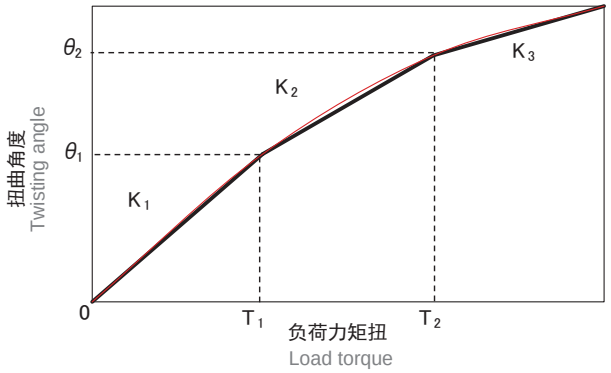
What is Stiffness?

In this context, stiffness is the output shaft twisting angle and the spring coefficient, while torque load is applied to the output shaft with input side fixed.

K1…力矩 0 ～ T1 的弹簧常数
Spring coefficient at 0 ～ T_1 torque

K2…力矩 T1 ～ T2 的弹簧常数
Spring coefficient at T_1 ～ T_2 torque

K3…力矩 T_2 ～ 的弹簧常数
Spring coefficient at T_2 ～ torque



减速比 Ratio	記号 item	単位 unit	尺寸 Size				
			35	42	50	63	80
–	T_1	Nm	2	3.9	7	14	29
–	T_2	Nm	6.9	12	25	48	108
50	K_1	× 10^4Nm/rad	0.28	0.69	1.1	2.7	5.6
	K_2	× 10^4Nm/rad	0.45	0.85	1.7	3.3	7.1
	K_3	× 10^4Nm/rad	0.55	1.1	2.5	4.0	8.3
	θ_1	arcmin	2.3	2.2	2.0	1.8	2.0
	θ_2	arcmin	5.7	4.5	5.3	5.5	6.5
80 100 120	K_1	× 10^4Nm/rad	0.45	0.92	1.2	3.3	6.9
	K_2	× 10^4Nm/rad	0.63	1.1	1.8	3.7	8.1
	K_3	× 10^4Nm/rad	0.70	1.3	2.2	4.5	10
	θ_1	arcmin	1.8	1.3	1.8	1.6	1.7
	θ_2	arcmin	4.7	3.5	4.8	4.4	4.9

※ 表中数值为平均值。
Average value shown in the table

■启动力矩 Starting Torque

启动力矩定义

由输入侧使其旋转时，输入侧开始旋转的力矩。
（无负荷，环境温度：25℃）

What is Starting Torque?

Input torque needed for input side to start rotating (no load, ambient temperature : 25℃)

[cNm]

减速比 Ratio	尺寸 Size				
	35	42	50	63	80
50	1.7	3.9	5.5	8.7	19
80	1.9	4.2	6.0	9.5	21
100	1.6	3.5	5.0	7.9	18
120	–	2.8	4.0	6.3	14

※ 根据使用条件不同，数值存在差异，所以上表作为参考值使用。
For reference only. Torque value may vary depending on the condition.

■加速启动力矩 Output Starting Torque

加速启动力矩定义

由输出侧使其旋转时，输出侧开始旋转的力矩。
（无负荷，环境温度：25℃）

What is Output Starting Torque?

Output torque needed for output side to start rotating (no load, ambient temperature : 25℃)

[Nm]

减速比 Ratio	尺寸 Size				
	35	42	50	63	80
50	1.3	2.6	4.5	5.7	12
80	1.9	4.0	6.8	8.6	19
100	2.1	4.4	7.5	9.5	21
120	–	5.3	9.0	11	25

※ 根据使用条件不同，数值存在差异，所以上表作为参考值使用。
For reference only. Torque value may vary depending on the condition.

■无负荷运转力矩（封闭型，组合型）

No-load Running Torque (Closed type, Unit)

无负荷运转力矩定义

在无负荷条件下，使其旋转所需必要的输入侧力矩。
（平均值，环境温度：25℃）

What is No-load Running Torque?

Input torque needed to keep it running with no load (average value, ambient temperature : 25℃)

[cNm]

减速比 Ratio	記号	尺寸 Size				
		35	42	50	63	80
50	500r/min	3.1	5.1	11.2	13.7	26.1
	1000r/min	3.4	5.4	12.4	15.2	28.6
	2000r/min	3.6	5.9	13.6	16.9	31.3
	3500r/min	3.9	6.3	14.9	18.8	34.2
80	500r/min	4.3	7.7	8.4	15.6	28.6
	1000r/min	4.6	8.3	9.2	17.3	31.2
	2000r/min	5.0	8.9	10.1	19.2	34.2
	3500r/min	5.4	9.6	11.1	21.4	37.4
100	500r/min	2.9	7.4	9.5	14.2	22.5
	1000r/min	3.1	8.0	10.5	15.7	24.6
	2000r/min	3.3	8.6	11.5	17.5	26.9
	3500r/min	3.6	9.2	12.6	19.4	29.4
120	500r/min	–	6.1	9.2	12.4	26.3
	1000r/min	–	6.5	10.1	13.8	28.8
	2000r/min	–	7.0	11.1	15.3	31.5
	3500r/min	–	7.5	12.2	17.0	34.5

※ 根据使用条件不同，数值存在差异，所以上表作为参考值使用。
For reference only. Torque value may vary depending on the condition.

效率（封闭型，组合型）
Efficiency (Closed type, Unit)

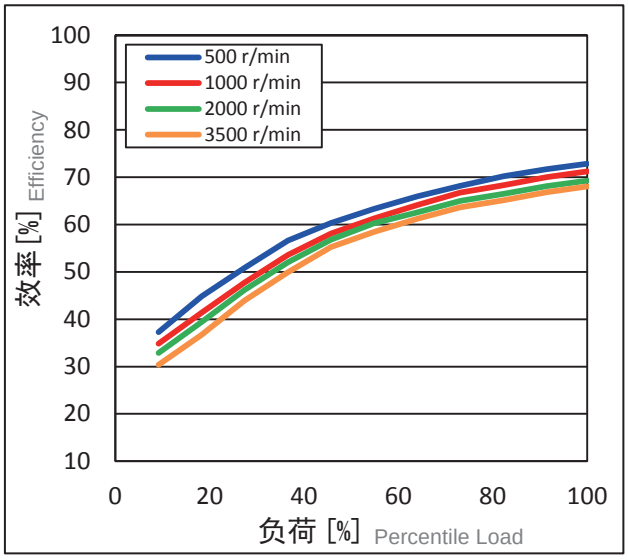
- 负荷 [%]：负荷力矩 / 容许平均力矩
- 环境温度：25℃

※ 图表为实测数据的平均值。

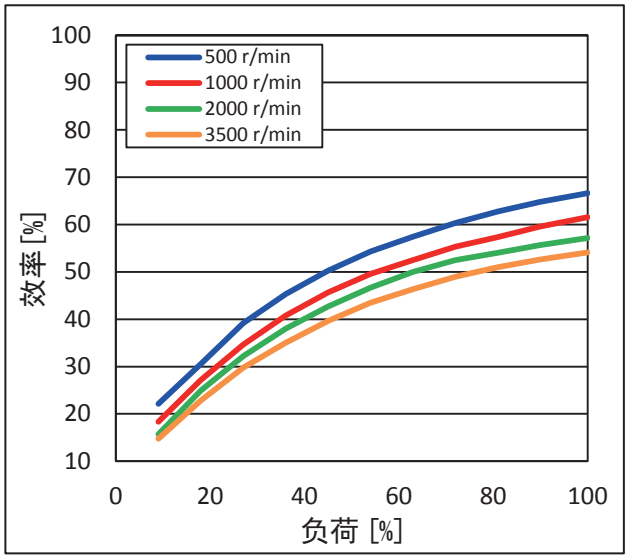
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature : 25℃

* These diagrams represent the average value of the actual measurement.

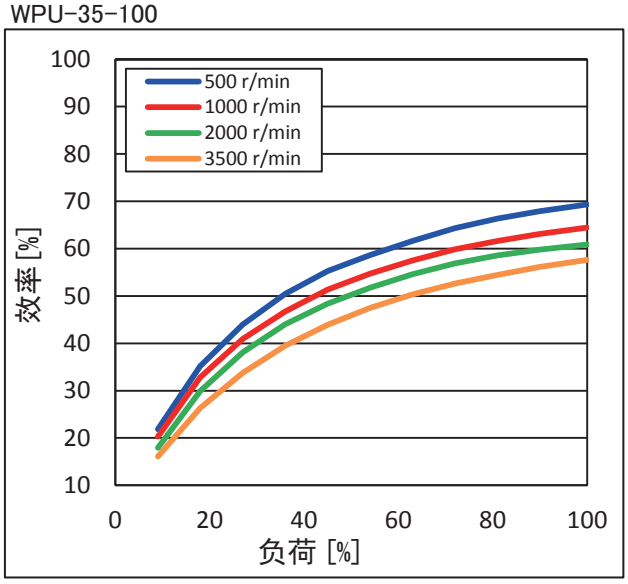
WPU-35-50



WPU-35-80



WPU-35-100



效率（封闭型，组合型）
Efficiency (Closed type, Unit)

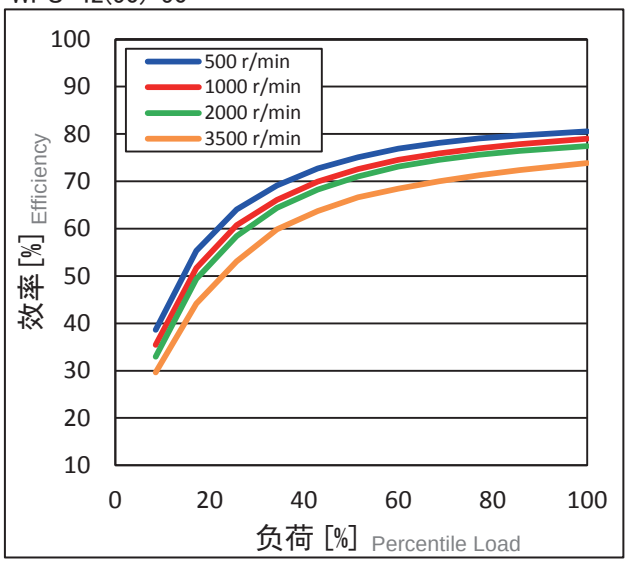
- 负荷 [%]：负荷力矩 / 容许平均力矩
- 环境温度：25℃

※ 图表为实测数据的平均值。

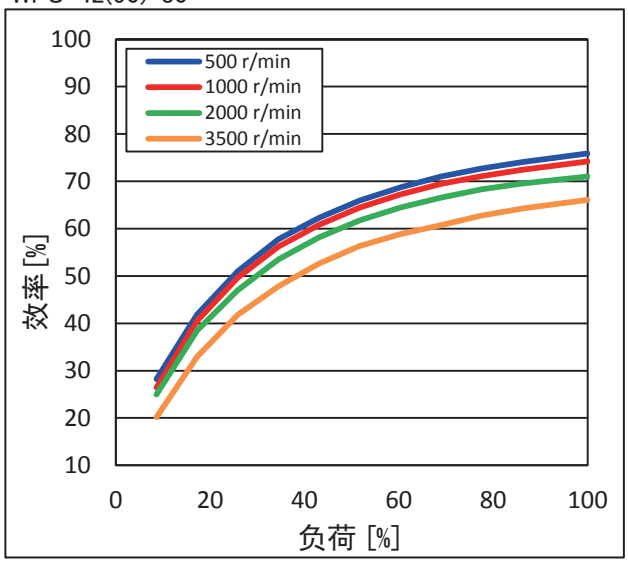
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature : 25℃

* These diagrams represent the average value of the actual measurement.

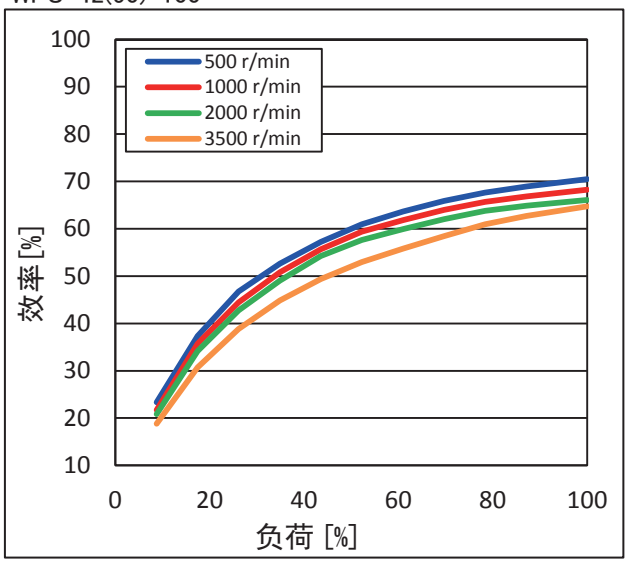
WPU-42(50)-50



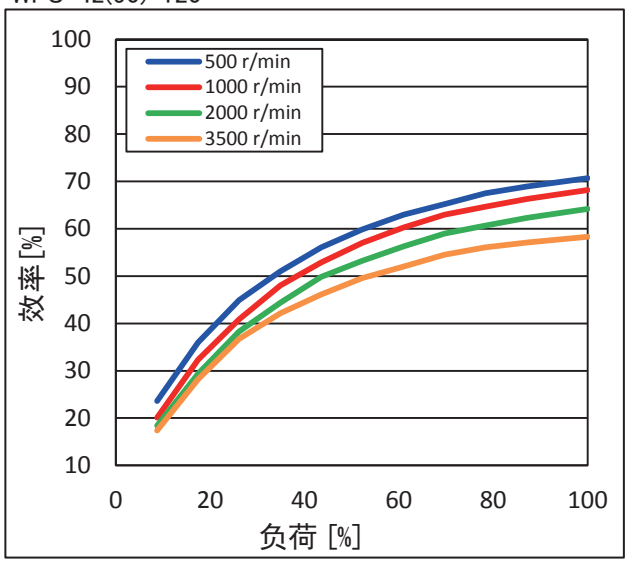
WPU-42(50)-80



WPU-42(50)-100



WPU-42(50)-120



效率（封闭型，组合型）
Efficiency (Closed type, Unit)

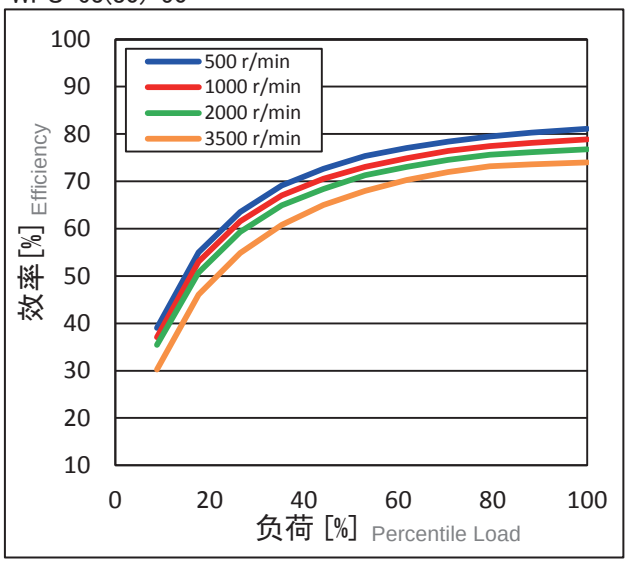
- 负荷 [%]：负荷力矩 / 容许平均力矩
- 环境温度：25℃

※ 图表为实测数据的平均值。

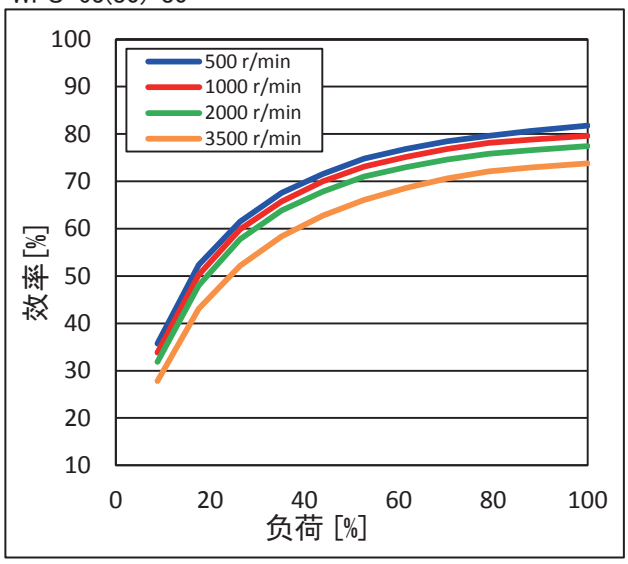
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature : 25℃

* These diagrams represent the average value of the actual measurement.

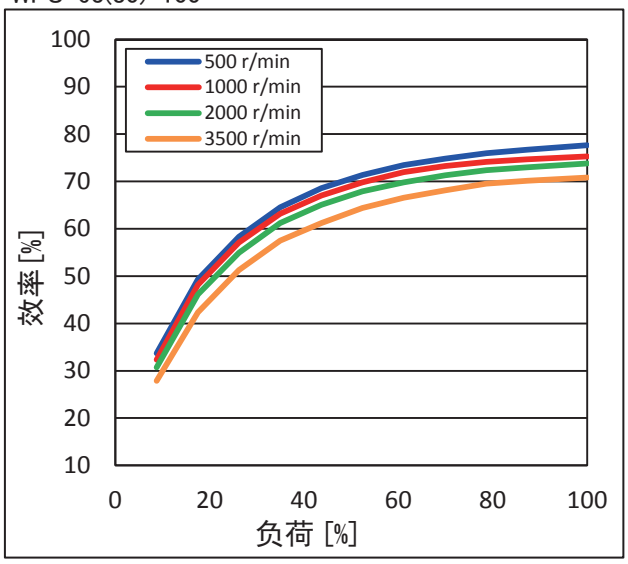
WPU-63(80)-50



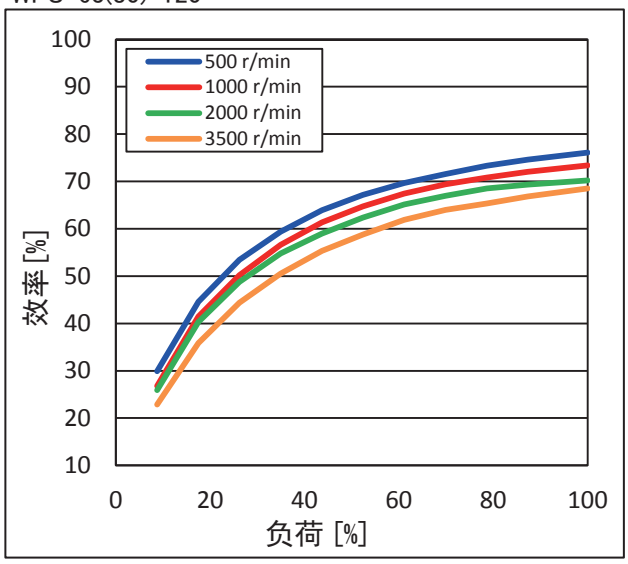
WPU-63(80)-80



WPU-63(80)-100



WPU-63(80)-120



扁平型

Flat type

减速机型号 / 规格

Reducer Model / Specifications

减速机型号 Reducer Model Nomenclature

WP **U** — **35** — **50** — **CD**

- **WP**：系列名称 ： WP 系列 / Series name : WP Series
- **U**：类型：C…部件型 / S…简易组合型 / U…组合型 / 组合型（中空轴）
  Type : C...Component type / S...Simple unit type / U...Unit type / Hollow unit
- **35**：尺寸 ： 35、42、50、63、80 / Size
- **50**：减速比 ： 50、80、100、120 / Ratio
- **CD**：代码※ ： CD、CDH、SD、SDH / Code
  ※ 代码详情请参照尺寸表
  For the code details, please check the Dimensions Table.

●段位表 Availability

Ratio matrix

Frame size 尺寸 \ 减速比	50	80	100	120
35				
42				
50				
63				
80				

减速机规格 Reducer Specifications

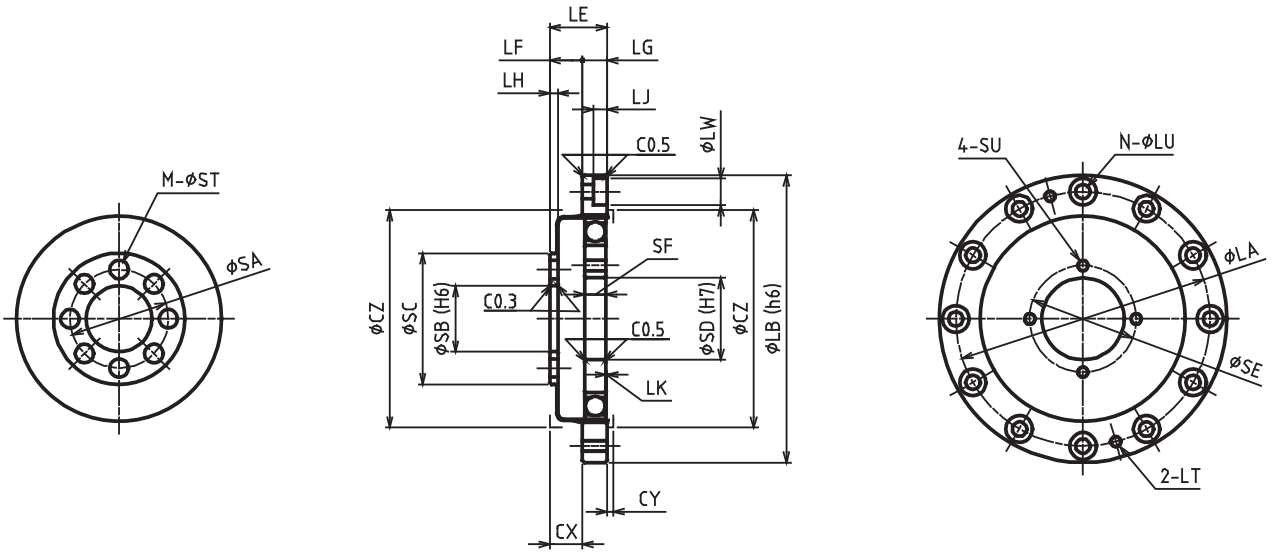
尺寸 Size	减速比 Ratio R	※1 容许平均力矩 Nominal output torque [Nm]	※2 容许最大力矩 Maximum output torque [Nm]	※3 紧急最大力矩 Emergency stop torque [Nm]	※4 容许平均输入转速 Nominal input speed [r/min]	※5 容许最高输入转速 Maximum input speed [r/min]
35	50	3.7	12	24	3000	8500
	80	5.4	16	29		
	100	5.4	19	31		
42	50	11	23	48	3000	7300
	80	15	29	52		
	100	16	37	55		
	120	16	37	55		
50	50	17	39	69	3000	6500
	80	24	51	75		
	100	28	57	76		
	120	28	57	76		
63	50	27	69	127	3000	5600
	80	44	96	147		
	100	47	110	152		
	120	47	110	152		
80	50	53	151	268	3000	4800
	80	82	212	334		
	100	96	233	359		
	120	96	233	359		

※1 输入转速为 2000r/min 时的容许最大值
※2 启动、停止时的容许最大值
※3 发生撞击时的容许最大值
※4 运转过程中，平均输入转速的容许最大值
※5 运转过程中，输入转速的容许最大值

*1 The maximum allowable value at the input rotation speed of 2000r/min
*2 The maximum torque when starting and stopping.
*3 The maximum torque when it receives shock.
*4 The maximum average input speed.
*5 The maximum input speed.

封闭型 部件型
Closed Type, Component

WPC- □ - □ -CD



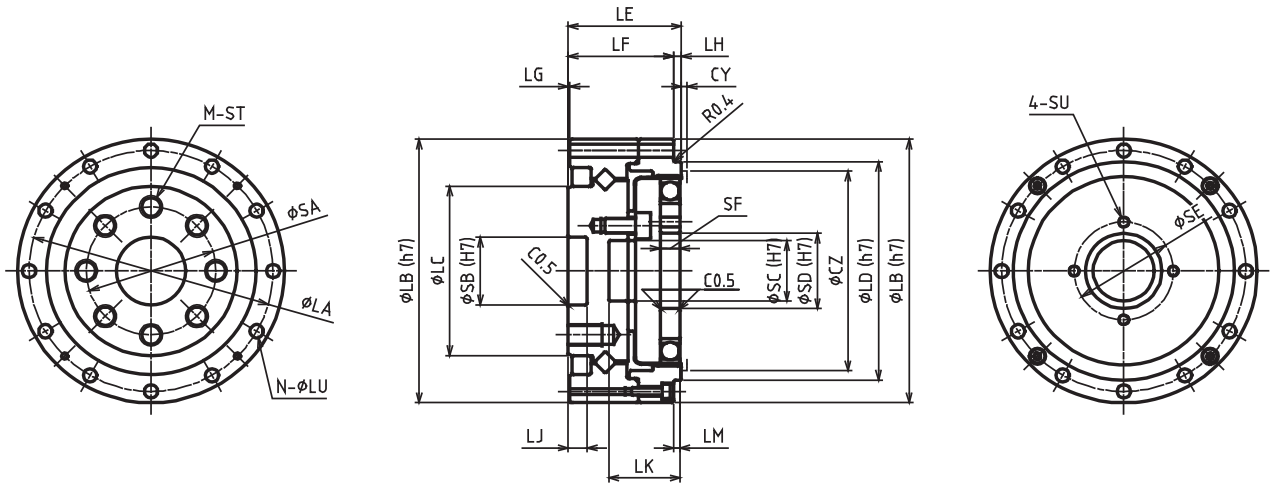
[mm]

尺寸 Size	LA	LB	LE	LF	LG	LH	LJ	LK	N	LU	LW	LT
35	44	50	11	6.5	4.5	1.4	–	0.3	6	3.5	–	M3
42	54	60	12.5	7.5	5	1.7	–	0.3	8	3.5	–	M3
50	62	70	14	8	6	2	3.3	0.3	12	3.5	6.5	M3
63	75	85	17	10	7	2	3.3	0.4	12	3.5	6.5	M3
80	100	110	22	13	9	2.5	4.4	0.5	12	4.5	8	M4

尺寸 Size	SA	SB	SC	SD	SE	SF	CX	CY	CZ	M	ST	SU
35	17	11	23.5	11	17	4	6.5	1	38	8	3.5	M3
42	19.5	11	27	15	21	5	7.5	1	45	8	4.5	M3
50	24	16	32	20	26	5.2	8	1.5	53	8	4.5	M3
63	30	20	40	24	30	6.3	10	1.5	66	8	5.5	M3
80	41	30	52	32	40	8.6	13	2	86	10	6.5	M4

封闭型 组合型
Closed Type, Unit

WPU- □ - □ -CD



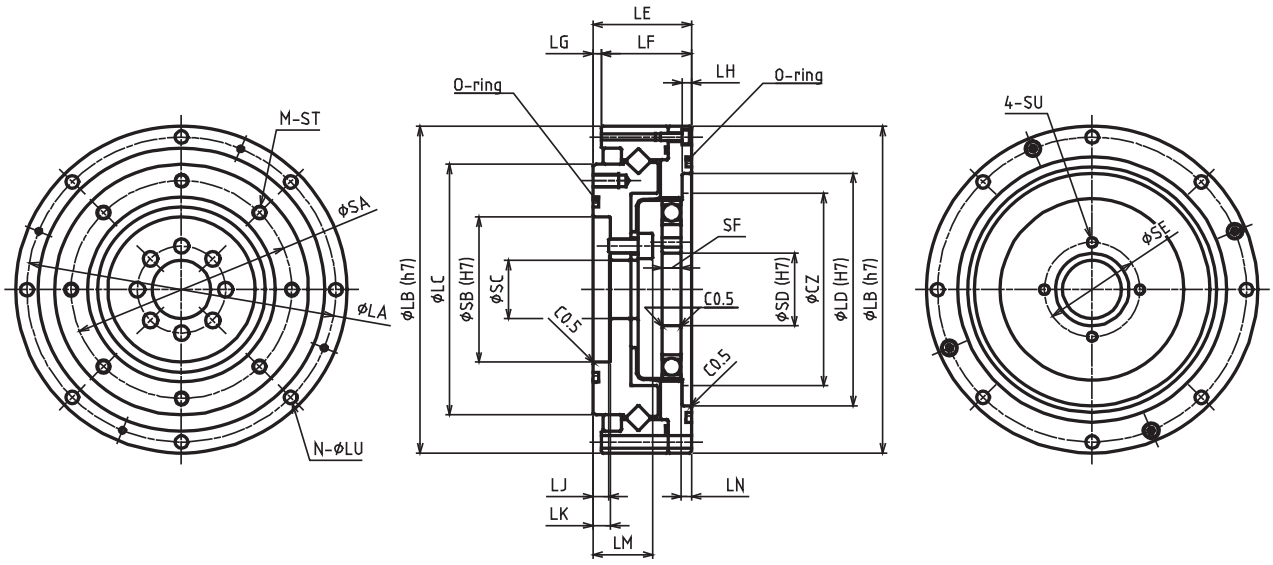
[mm]

尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LM	N	LU
35	49	55	31	42.5	25	23	0.5	2	5	14.7	1.7	6	3.5
42	56	62	38	49.5	26.5	24.5	0.5	2	5	16.2	1.7	10	3.5
50	64	70	45	58	29.7	27.7	0.5	2	5	18.7	1.7	12	3.5
63	79	85	58	73	37.1	34.1	0.5	3	5.5	23.6	2.6	18	3.5
80	104	112	78	96	43	40	1	3	5.5	30.5	2.5	18	4.5

尺寸 Size	SA	SB	SC	SD	SE	SF	CY	CZ	M	ST	SU
35	25	12	11	11	17	4	1	38	10	M3 × 6	M3
42	27	14	11	15	21	5	1	45	8	M5 × 8	M3
50	34	18	16	20	26	5.2	1.5	53	8	M6 × 9	M3
63	42	24	20	24	30	6.3	1.5	66	8	M8 × 12	M3
80	57	32	30	32	40	8.6	2	86	10	M8 × 12	M4

封闭型 组合型
Closed Type, Unit

WPU- □ - □ -CDH



[mm]

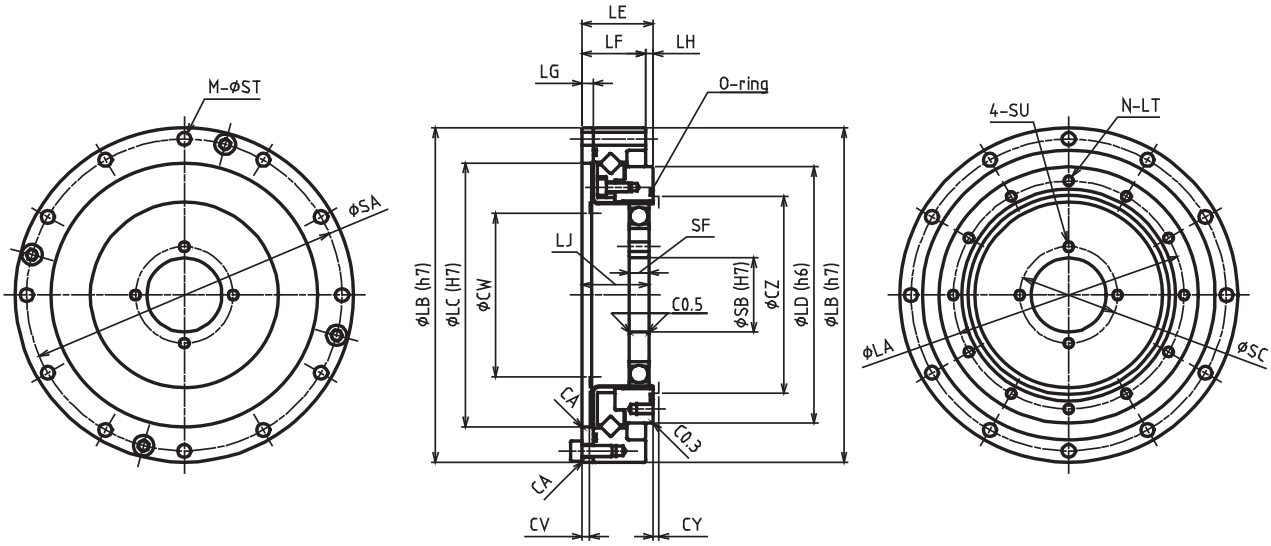
尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LM	LN	N	LU
35	64	70	49	48	22	21.5	0.5	2.5	3.9	4.9	12.9	2.8	6	3.5
42	74	80	59	56	22.7	22.2	0.5	2.5	1.4	3.7	13.4	2.8	8	3.5
50	84	90	69	64	26.8	24.5	2.3	2.5	4.3	4.8	16.3	2.8	8	3.5
63	102	110	84	80	31.5	29.4	2.1	3	3.5	5.5	18.5	3.4	10	4.5
80	132	142	110	106	37	34.2	2.8	3	2.5	6	20.5	3.5	10	5.5

尺寸 Size	SA	SB	SC	SD	SE	SF	CZ	M	ST	SU
35	42	30	11	11	17	4	38	8	M3 × 5	M3
42	50	34	11	15	21	5	45	10	M3 × 6	M3
50	60	40	16	20	26	5.2	53	8	M4 × 7	M3
63	73	52	20	24	30	6.3	66	8	M5 × 8	M3
80	96	70	30	32	40	8.6	86	8	M6 × 10	M4

开放型 简易组合型

Open type, Simple unit

WPS- □ - □ -SD



[mm]

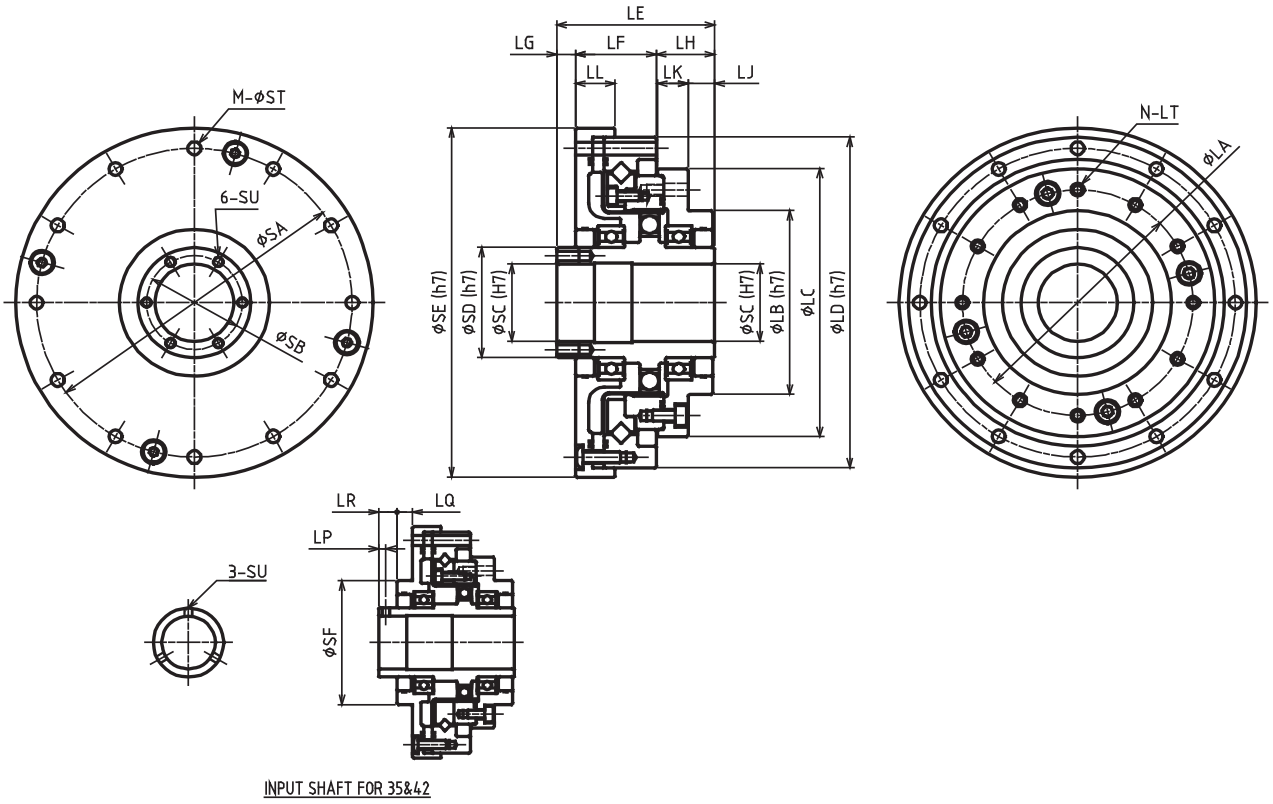
尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	N	LT
35	43	70	50	49	17.5	15.5	2.4	2	15.7	8	M3 × 4.5
42	52	80	61	59	18.5	16.5	3	2	16.9	12	M3 × 4.5
50	61.4	90	71	69	19	17	3	2	17.8	12	M3 × 4.5
63	76	110	88	84	22	20	3.3	2	21.6	12	M4 × 6
80	99	142	114	110	27.9	23.6	3.6	4.3	27.3	12	M5 × 8

尺寸 Size	SA	SB	SC	SF	CA	CY	CZ	CV	CW	M	ST	SU
35	64	11	17	4	0.3	1	36.5	1.6	31	8	3.5	M3
42	74	15	21	5	0.3	1	43.5	2	37	12	3.5	M3
50	84	20	26	5.2	0.3	1.5	53	2	44	12	3.5	M3
63	102	24	30	6.3	0.3	1.5	66	2	56	12	4.5	M3
80	132	32	40	8.6	0.5	2	84	2	72	12	5.5	M4

开放型 组合型（中空轴）

Open type, Unit (hollow shaft)

WPU- □ - □ -SDH



[mm]

尺寸 Size	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LK	LL	LP	LQ	LR
35	43	36	52	70	45.5	19.5	12	14	6.5	7.5	9	2.5	5.5	6.5
42	52	45	62	80	48	20.5	12	15.5	7	8.5	10	2.5	5.5	6.5
50	61.4	50	73	90	42	21.5	5	15.5	7	8.5	10.5	–	–	–
63	76	60	87	110	46.5	24	6	16.5	6	10.5	10.5	–	–	–
80	99	75	114	142	55	28.6	7	19.4	7.5	11.9	12	–	–	–

尺寸 Size	SA	SB	SC	SD	SE	SF	M	ST	SU	N	LT
35	64	–	14	20	74	36	8	3.5	M3	8	M3 × 4.5, ϕ 3.5 × 5.5
42	74	–	19	25	84	45	12	3.5	M3	12	M3 × 4.5, ϕ 3.5 × 6.5
50	84	25.5	21	30	95	–	12	3.5	M3 × 6	12	M3 × 4.5, ϕ 3.5 × 6.5
63	102	33.5	29	38	115	–	12	4.5	M3 × 6	12	M4 × 6, ϕ 4.5 × 8.5
80	132	48	41	45	147	–	12	5.5	M3 × 6	12	M5 × 8, ϕ 5.5 × 7.6

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日本电产新宝(浙江)有限公司
NIDEC-SHIMPO (ZHEJIANG) CORPORATION

地址 : 平湖经济开发区平成路 288 号
电话号码 :0573-8507-9561(代表)
传真号码 :0573-8509-3543　邮编 :314200
www.nidec-shimpo.co.jp/