

FLEXWAVE

*Nidec*

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DRIVE  
SOLUTIONS



FLEXWAVE



Flexwave



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## FLEXWAVE reducer

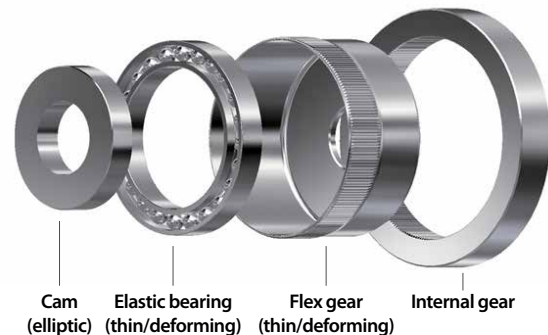
## Achieving new heights in compact, fine precision gear technology

## Description

The NIDEC-SHIMPO FLEXWAVE is a very compact reduction mechanism that achieves zero backlash, as well as exceptional accuracy and repeatability. The FLEXWAVE consists of three major internal elements – the elliptical wave generator

- Near Zero backlash
- High efficiency ratings
- High reduction ratios in a compact footprint
- Exceptional repeatability and torsional stiffness
- Extremely light weight with superior torque density

subassembly, the flexible cup gear, and the inner ring gear. The elasticity properties of the cup gear and the teeth differential between the cup gear and the inner ring gear result in the unique reduction characteristics.



## An Exposé on Strain Wave Gear Technology Reduction Mechanism

Strain wave gear technology centers on the elasticity and flexibility properties of a uniquely shaped metal structure. The strain wave gear set has three key elements; the elliptical wave generator subassembly, the flexible cup gear, and the inner ring gear.

- The elliptical wave generator subassembly is comprised of two components: an elliptical shaped disk and an outer ball bearing. The disk is inserted into the bearing, giving the bearing an elliptical shape as well. The wave generator assembly is the input section of the gear set.
- The flexible cup gear is the internal component that relies on unique elasticity properties to accommodate an elliptical deformation pattern. The sides of the cup gear are very thin, but the bottom of the cup gear is thick and rigid. This results in significant flexibility of the walls at the open end of the cup; but then the cup gear exhibits high rigidity at the closed end of the cup. Teeth are positioned radially around the perimeter of the open end of this cup gear.
- The flexible cup gear fits very tightly over the wave generator subassembly. When the wave generator is rotated, the cup gear deforms to the shape of a rotating ellipse but does not rotate with the wave generator.
- The inner ring gear is a rigid circular ring with teeth located on the interior perimeter. The wave generator and cup gear are placed inside this inner ring gear, meshing the teeth together. Because the cup gear has a deformed elliptical shape, the teeth will only mesh in two regions 180 degrees from each other, along the axis of the ellipse.
- As the wave generator subassembly rotates, the group of teeth of the cup gear that are engaged with those of the inner ring gear changes. The major axis of the cup gear actually rotates with the wave generator therefore; the points where the teeth mesh revolve around the center point at the same rate as the wave generator.

- The reduction is accomplished through a tooth count differential between the cup gear and the inner ring gear. For every full rotation of the wave generator subassembly, the cup gear rotates a minor amount backward because it has less teeth than the inner ring gear.

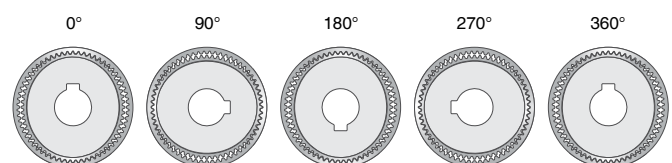
## Reduction Ratio

The rotation the wave generator subassembly results in a much slower rotation of the cup gear in the opposite direction. For a strain wave gearing mechanism, the gearing reduction ratio can be calculated from the number of teeth on each gear:

As an example, if there are 202 teeth on the inner ring gear and 200 on the cup gear, the reduction ratio is

$$(200 - 202)/200 = -0.01$$

Therefore the cup rotates at 1/100 of the speed of the wave generator assembly and in the opposite direction. This method of reduction permits a variety of ratios to be set without changing overall gear set shape, increasing its weight, or adding reduction stages. The variety of reduction ratios possible is restricted by the structural tooth size limitation for any given configuration.



## Applications

Robotics, medical devices, semiconductor and circuit manufacturing, machine tools - and in all industrial automation applications that require precision positioning.

## Product Overview

### CLOSED TYPE

#### Features

- Compact body diameter, but longer length
- Flange output can install application easily

**WPC-CN / WPC-CF**  
Component



**WPU-CN / WPC-CF**  
Unit



### OPEN TYPE

#### Features

- Compact length, but wider body diameter
- Larger size cross roller bearing is installed for higher radial/axial force capability

**WPU-SNH**  
Hollow unit



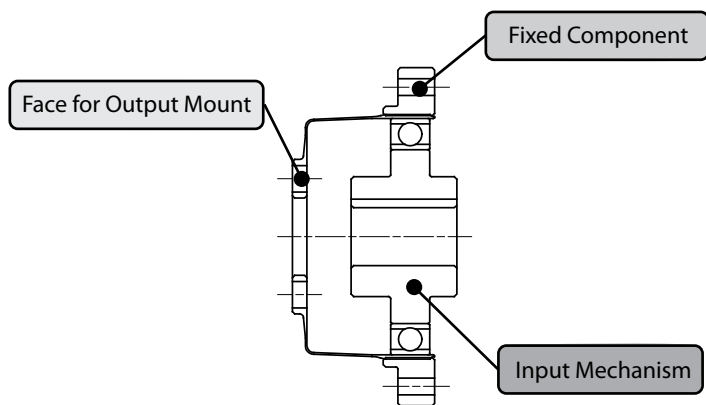
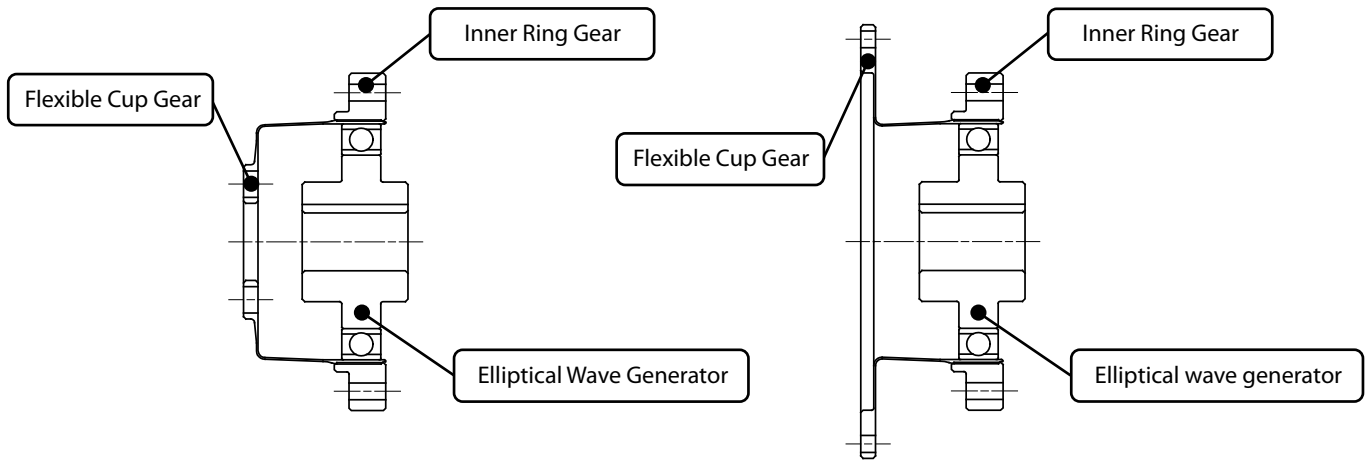
**WPU-SNJ**  
Input shaft unit



**WPS-SN**  
Simple unit

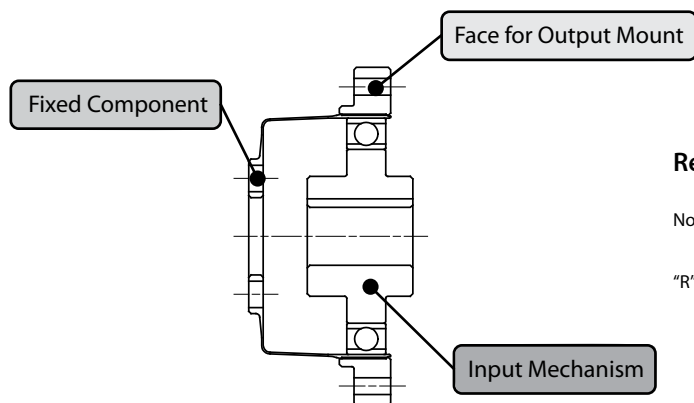


## Component level detail and reduction ratio



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

Note: The input and output rotation directions are opposite



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

Note: The input and output rotation directions are same

"R" is the ratio. Please refer to "Reducer Specifications" in the next page

# Standard type A

<b>Part Number</b>	<b>WP</b>	<b>C</b>	<b>-35</b>	<b>-50</b>	<b>-CN</b>	<b>-**</b>
Model name: WP series						Specifications: input shaft diameter, etc.
Type: C = component type - S = simple unit type U = unit type						Code: CN, CF, SN, SNH, SNJ
Size: 35, 42, 50, 63, 80						Ratio: 50, 80, 100, 120

Frame size				
Size/Ratio	50	80	100	120
35				
42				
50				
63				
80				

## Reducer Specifications

Size	Ratio <i>Reduction ratio is to be calculated by the formula in the previous page, using R value in this table</i>	Nominal output torque <i>The maximum allowable value at the input rotation speed of 2000 r/min</i>	Maximum output torque <i>The maximum torque when starting and stopping</i>	Emergency stop torque <i>The maximum torque when it receives shock</i>	Nominal input speed <i>The maximum average input speed</i>	Maximum input speed <i>The maximum input speed</i>	Permitted Axial Load <i>Values depend on the input shaft diameter, etc</i>
		[Nm]	[Nm]	[Nm]	[r/min]	[r/min]	[x 10 <sup>-4</sup> kgm <sup>2</sup> ]
35	50	7	23	46	3000	8500	0.027
	80	9	27	55			
	100	9	32	63			
42	50	21	44	91	3000	7300	0.055
	80	26	50	102			
	100	28	63	129			
	120	28	63	129			
50	50	33	73	127	3000	6500	0.158
	80	40	86	149			
	100	47	96	172			
	120	47	96	172			
63	50	51	127	242	3000	5600	0.385
	80	66	142	266			
	100	70	163	295			
	120	70	163	295			
80	50	89	253	447	3000	4800	1.03
	80	122	316	590			
	100	142	346	673			
	120	142	346	673			

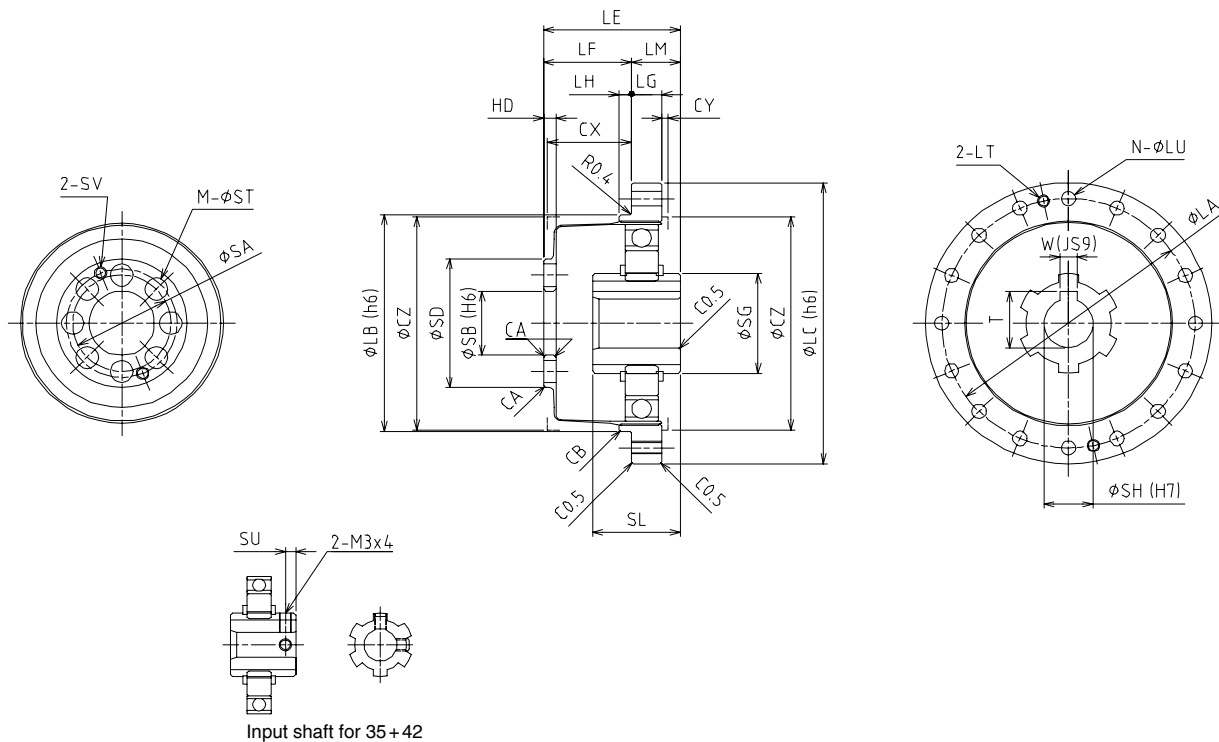


# Closed Type - Component

WPC-CN / WPC-CF



STANDARD TYPE A



Size	Weight [Kg]	Moment of inertia [ $\times 10^{-4}$ kgm <sup>2</sup> ]
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

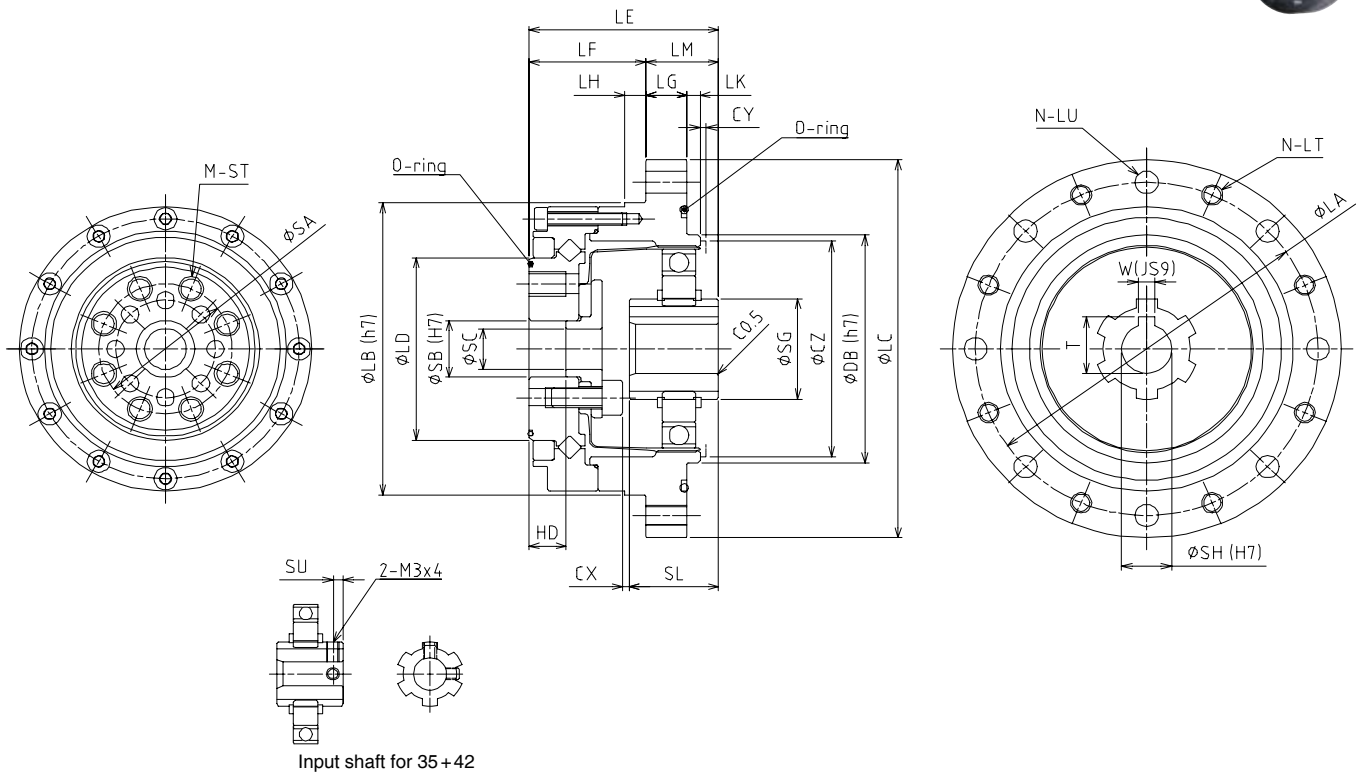
Size	LA [mm]	LB [mm]	LC [mm]	N <sup>1</sup> [mm]	LU [mm]	LT [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LM [mm]	SG [mm]	SH [mm]	SL [mm]	W [mm]
35	44	38	50	8 (6)	3,5	M3	28,5	17,5	6	2	11	15,8	6	18,5	-
42	54	48	60	16 (12)	3,5	M3	32,5	20	6,5	2,5	12,5	15,8	8	20,7	-
50	62	54	70	16 (12)	3,5	M3	33,5	21,5	7,5	3	12	24,8	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

Size	T [mm]	SU [mm]	SA [mm]	SB [mm]	SD [mm]	M [mm]	ST [mm]	SV [mm]	HD [mm]	CA [mm]	CB [mm]	CX [mm]	CY [mm]	CZ [mm]
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 and -CF are different in dimensions. The -CF value is shown in ( ).  
For details in the input section, please check the drawings.

# Closed Type - Unit

WPU-CN / WPU-CF



Size	Weight [Kg]	Moment of inertia [ $\times 10^{-4} \text{ kgm}^2$ ]
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

Size	LA [mm]	LB [mm]	LC [mm]	LD [mm]	N <sup>1</sup> [mm]	LT [mm]	LU [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LK [mm]	LM [mm]	DB [mm]	SG [mm]
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

Size	SH [mm]	SL [mm]	W [mm]	T [mm]	SU [mm]	SA [mm]	SB [mm]	SC [mm]	M [mm]	ST [mm]	HD [mm]	CX [mm]	CY [mm]	CZ [mm]
35	6	18,5	-	-	2,5	23	11	8	6	M4x8	9,5	1,6	1	38
42	8	20,7	-	-	3	27	10	7	6	M5x8	9,5	1,3	1	45
50	12	21,5	4	13,8	-	32	14	10	8	M6x9	9	1,5	1,5	53
63	14	21,6	5	16,3	-	42	20	15	8	M8x10	12	3,4	1,5	66
80	14	23,6	5	16,3	-	55	26	20	8	M10x12	15	5,2	1,5	86

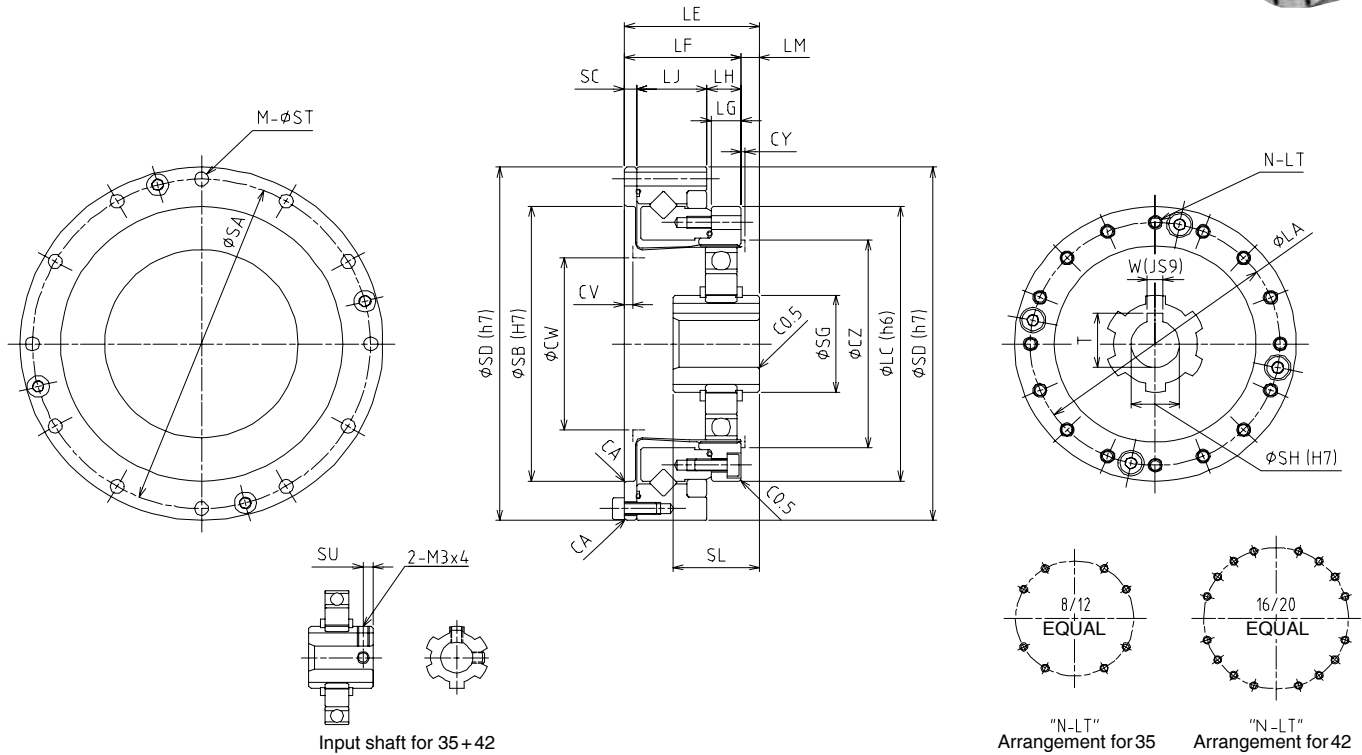
\*1) -CN and -CF are different in dimensions. The -CF value is shown in ( ).  
For details in the input section, please check the drawings.

# Open type - Simple unit

WPS-SN



STANDARD TYPE A



Size	Weight [Kg]	Moment of inertia [ $\times 10^{-4}$ kgm <sup>2</sup> ]
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

Size	LA [mm]	LC [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LJ [mm]	LM [mm]	SG [mm]	SH [mm]	SL [mm]	W [mm]	T [mm]	SU [mm]	SA [mm]	SB [mm]
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

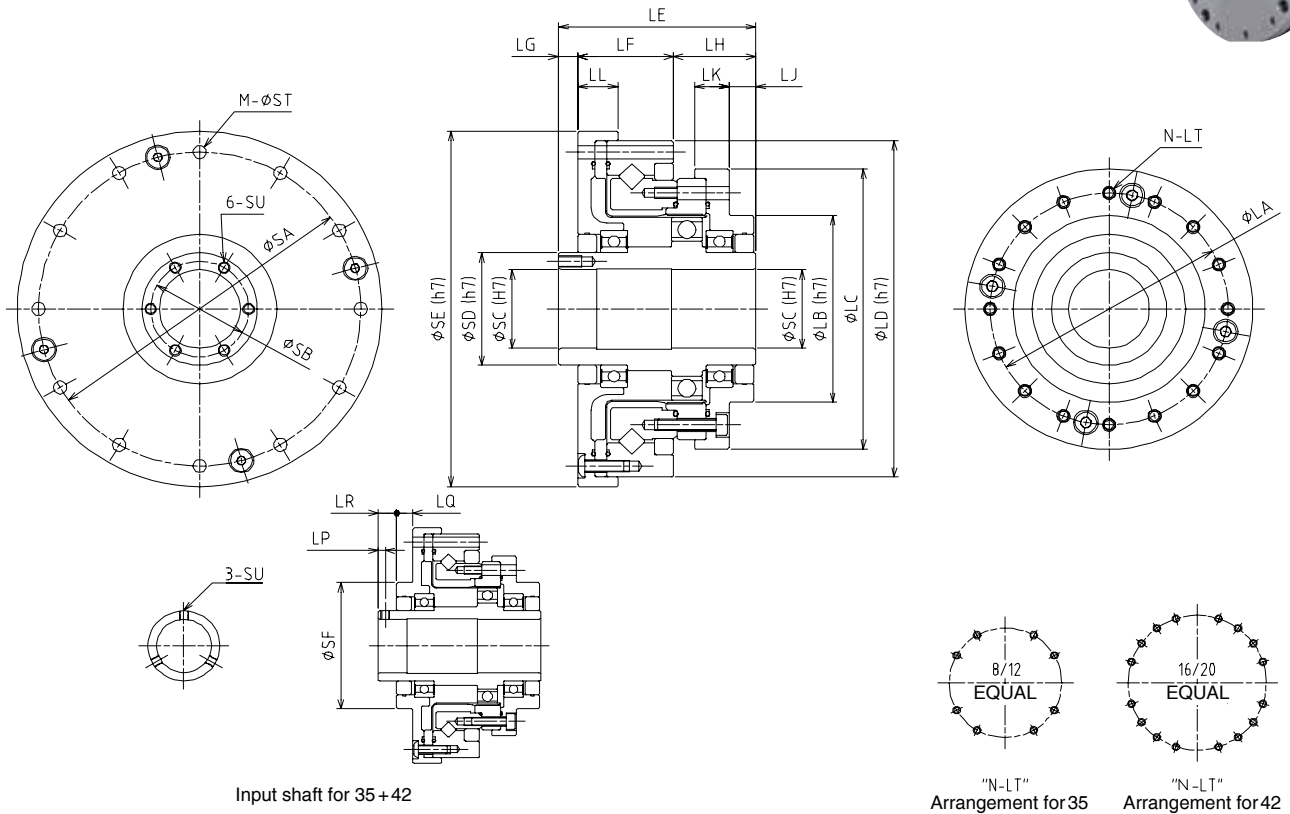
Size	SC [mm]	SD [mm]	M [mm]	ST [mm]	CA [mm]	CY [mm]	CZ [mm]	CV [mm]	CW [mm]	N [mm]	LT [mm]
35	2,4	70	8	3,5	C0.3	1	38	1,6	31	8	M3 x 5, $\phi$ 3,5x6
42	3	80	12	3,5	C0.3	1	45	2	37	16	M3x6, $\phi$ 3,5x6,5
50	3	90	12	3,5	C0.3	1,5	53	2	44	16	M3x6, $\phi$ 3,5x7,5
63	3,3	110	12	4,5	C0.3	1,5	66	2	56	16	M4x7, $\phi$ 4,5x10
80	3,6	142	12	5,5	C0.5	1,5	86	2	72	16	M5x8, $\phi$ 5,5x14

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

# Open Type - hollow shaft Unit



WPU-SNH



Size	Weight [Kg]	Moment of inertia [ $\times 10^{-4} \text{ kgm}^2$ ]
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

Size	LA [mm]	LB [mm]	LC [mm]	LD [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LJ [mm]	LK [mm]	LL [mm]	LP [mm]	LQ [mm]	LR [mm]
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	-	-	-

Size	SA [mm]	SB [mm]	SC [mm]	SD [mm]	SE [mm]	SF [mm]	M [mm]	ST [mm]	SU [mm]	N [mm]	LT [mm]
35	64	-	14	20	74	36	8	3,5	M3	8	M3 $\times$ 5, $\phi$ 3,5 $\times$ 11,5
42	74	-	19	25	84	45	12	3,5	M3	16	M3 $\times$ 6, $\phi$ 3,5 $\times$ 12
50	84	25,5	21	30	95	-	12	3,5	M3 $\times$ 6	16	M3 $\times$ 6, $\phi$ 3,5 $\times$ 13,5
63	102	33,5	29	38	115	-	12	4,5	M3 $\times$ 6	16	M4 $\times$ 7, $\phi$ 4,5 $\times$ 15,5
80	132	40,5	36	45	147	-	12	5,5	M3 $\times$ 6	16	M5 $\times$ 8, $\phi$ 5,5 $\times$ 20,5

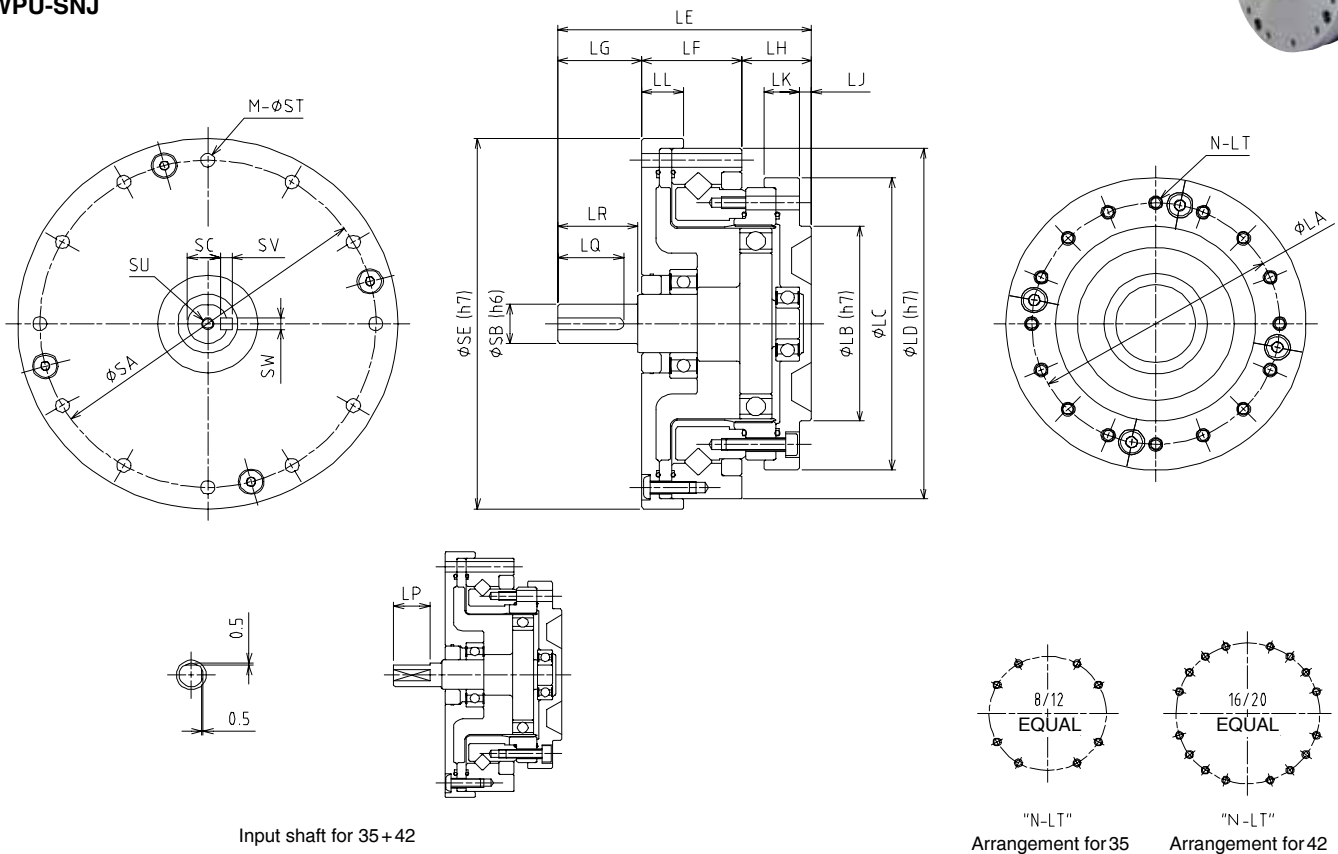
\*1) For details in the input section, please check the drawings.

# Open type - input shaft Unit

WPU-SNJ



STANDARD TYPE A



Input shaft for 35+42

"N-LT" Arrangement for 35      "N-LT" Arrangement for 42

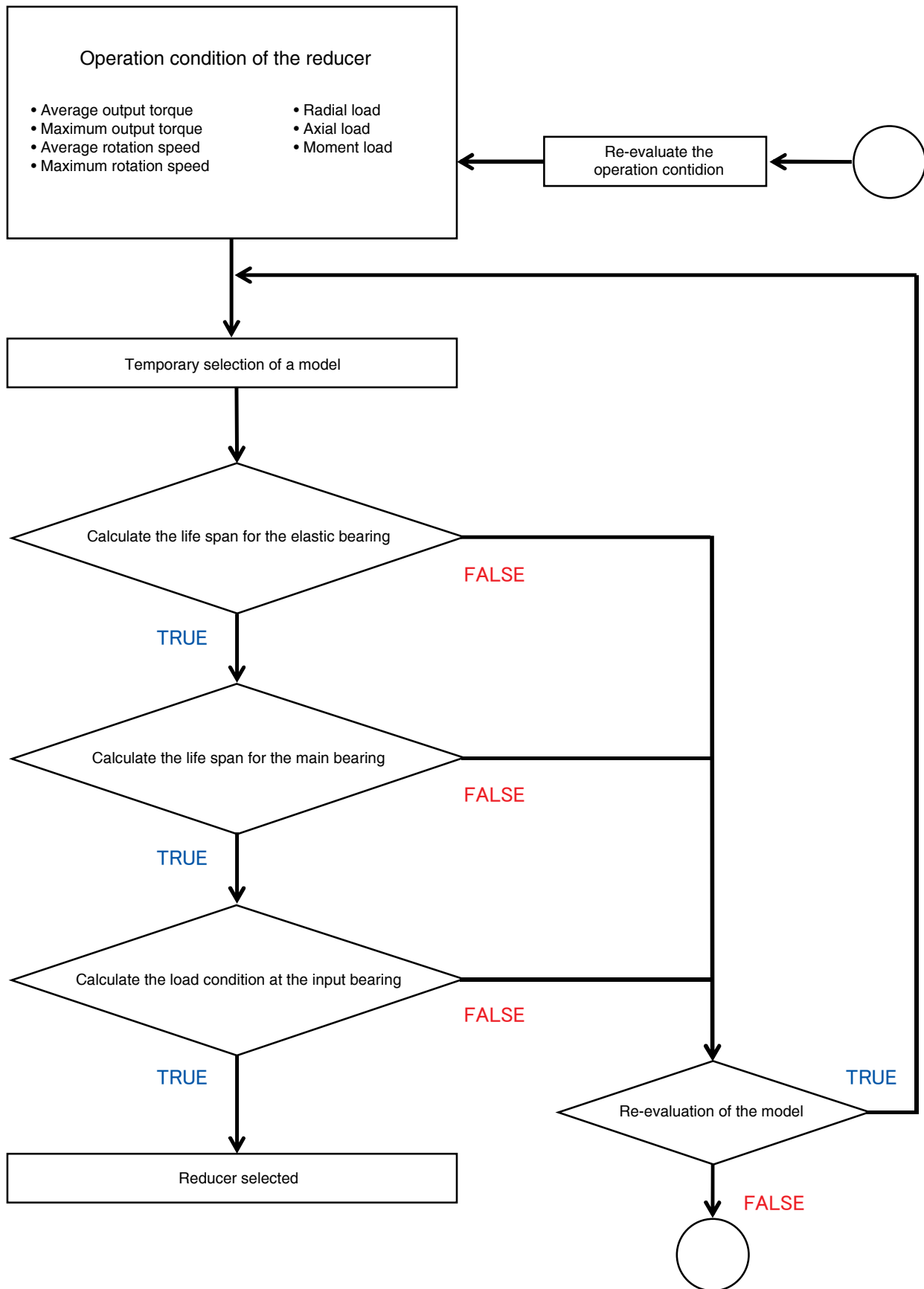
Size	Weight [Kg]	Moment of inertia [ $\times 10^{-4} \text{ kgm}^2$ ]
35	0,48	0,0376
42	0,69	0,0897
50	1,0	0,208
63	1,6	0,554
80	3,2	1,74

Size	LA [mm]	LB [mm]	LC [mm]	LD [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LJ [mm]	LK [mm]	LL [mm]	LP [mm]	LQ [mm]	LR [mm]
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

Size	SA	SB	SC	SE	SV	SW	M	ST	SU	N	LT
35	64	6	-	74	-	-	8	3,5	-	8	M3×5, ø 3,5×11,5
42	74	8	-	84	-	-	12	3,5	-	16	M3×6, ø 3,5×12
50	84	10	8,2	95	3	3	12	3,5	M3×6	16	M3×6, ø 3,5×13,5
63	102	14	11	115	5	5	12	4,5	M3×6	16	M4×7, ø 4,5×15,5
80	132	14	11	147	5	5	12	5,5	M3×6	16	M5×8, ø 5,5×20,5

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

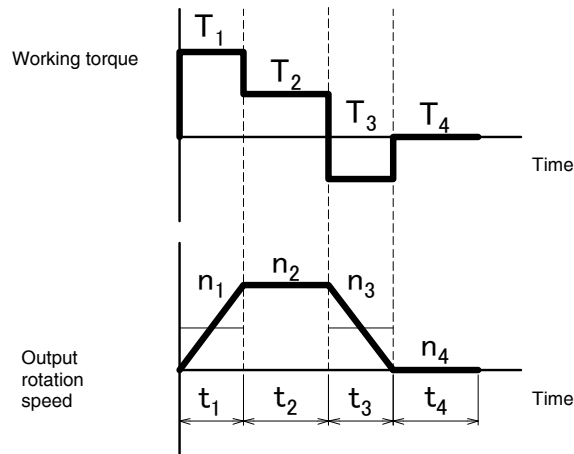
# Model selection



# Life estimation (Elastic bearing)

STANDARD TYPE A

## Operation cycle example



### Calculation formula for output torque

<b>Average output torque</b>	<b>Tao</b>	<b>[Nm]</b>	$T_{ao} = \sqrt[3]{\frac{n_1 \cdot t_1 \cdot  T_1 ^3 + n_2 \cdot t_2 \cdot  T_2 ^3 + \dots + n_n \cdot t_n \cdot  T_n ^3}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}}$
<b>Peak output torque value</b>	<b>Tmo</b>	<b>[Nm]</b>	Tmo = Largest among $T_1, T_2, \dots, T_n$

Please make sure the peak output torque is below the maximum output torque in the specification table.

### Calculation formula for input speed

<b>Average output rotation speed</b>	<b>nao</b>	<b>[r/min]</b>	$n_{ao} = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + \dots + t_n}$
<b>Peak output rotation speed</b>	<b>nmo</b>	<b>[r/min]</b>	nmo = Largest among $n_1, n_2, \dots, n_n$
<b>Average input speed</b>	<b>nai</b>	<b>[r/min]</b>	nai = nao × R (R = ratio)
<b>Peak input speed value</b>	<b>nmi</b>	<b>[r/min]</b>	nmi = nmo × R (R = ratio)

Please make sure the peak input speed value is below the maximum input speed in the specification table

### Calculation formula for life span

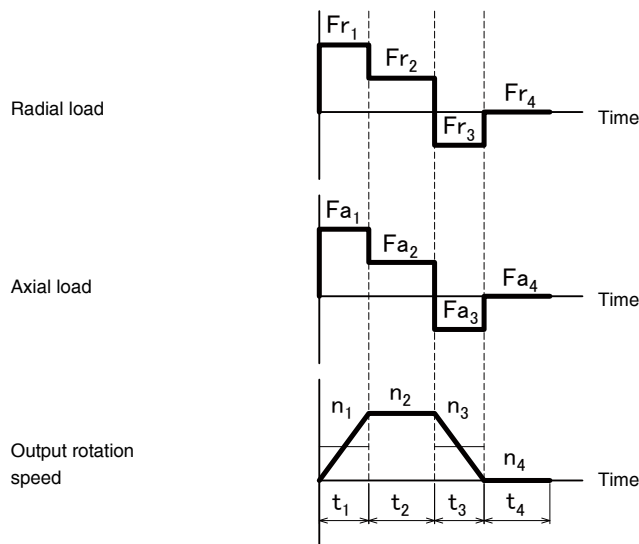
<b>Part life span for the elastic bearing</b>	<b>Lhe</b>	<b>[h]</b>	$L_{he} = 7000 \times \left(\frac{T_{ar}}{T_{ao}}\right)^3 \times \left(\frac{n_{ar}}{n_{ai}}\right)$
<b>Rating torque</b>	<b>Tar</b>	<b>[Nm]</b>	Nominal output torque in the specification table
<b>Rating input rotation speed</b>	<b>nar</b>	<b>[r/min]</b>	2000 r/min

# Life estimation specification (Main bearing)

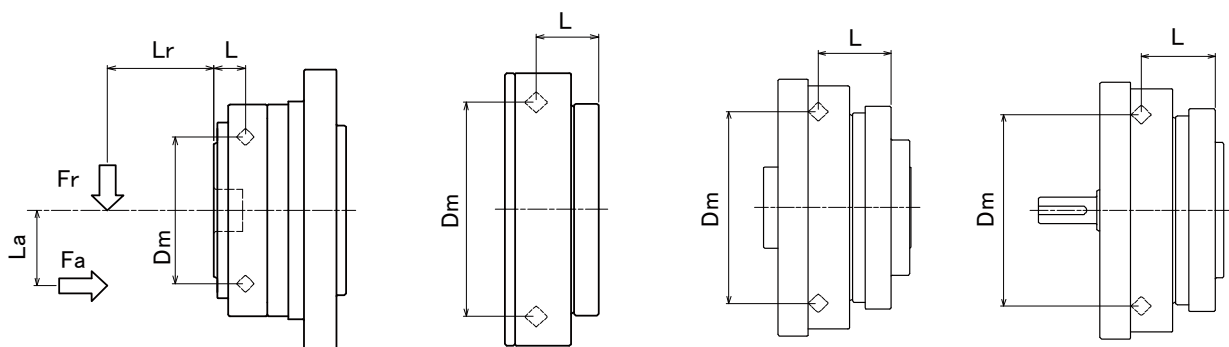
## Main bearing specification (Cross roller bearing)

Series	Size	Pitch circle diameter of the bearing rollers	Offset	Basic dynamic load rating	Basic static load rating	Allowable moment	Moment rigidity
		Dm [m]	L [m]	C [N]	Co [N]	Ma [Nm]	Km [10 <sup>4</sup> 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

## Operation cycle example



## External load





## Calculation formula for the largest working moment

### Operation cycle example

<b>Peak working moment</b>	<b>Mm</b>	<b>[Nm]</b>	$Mm = Frm(Lr + L) + FamLa$
<b>Peak radial load</b>	<b>Frm</b>	<b>[N]</b>	Frm = Largest among $Fr_1, Fr_2, \dots, Fr_n$
<b>Peak axial load</b>	<b>Fam</b>	<b>[N]</b>	Fam = Largest among $Fa_1, Fa_2, \dots, Fa_n$

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

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

<b>Average radial load</b>	<b>Fra</b>	<b>[N]</b>	$Fra = \sqrt[10]{\frac{n_1 \cdot t_1 \cdot  Fr_1 ^{10/3} + n_2 \cdot t_2 \cdot  Fr_2 ^{10/3} + \dots + n_n \cdot t_n \cdot  Fr_n ^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}}$
<b>Axial load</b>	<b>Faa</b>	<b>[N]</b>	$Faa = \sqrt[10]{\frac{n_1 \cdot t_1 \cdot  Fa_1 ^{10/3} + n_2 \cdot t_2 \cdot  Fa_2 ^{10/3} + \dots + n_n \cdot t_n \cdot  Fa_n ^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}}$
<b>Average output rotation speed</b>	<b>nao</b>	<b>[r/min]</b>	$nao = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}{t_1 + t_2 + \dots + t_n}$
<b>Average working moment</b>	<b>Ma</b>	<b>[Nm]</b>	$Ma = Fra(Lr + L) + FaaLa$

### Calculation formula for the Loading factor, Equivalent radial load

<b>Loading factor</b>	<b>Xc, Yc</b>	<b>-</b>	$\frac{Faa}{Fra + 2Ma / Dm} \leq 1.5$	Xc = 1,0 , Yc = 0,45
			$\frac{Faa}{Fra + 2Ma / Dm} > 1.5$	Xc = 0,67 , Yc = 0,67
<b>Equivalent radial load</b>	<b>Pc</b>	<b>[N]</b>	$Pc = Xc \cdot (Fra + 2Ma/Dm) Yc Faa$	

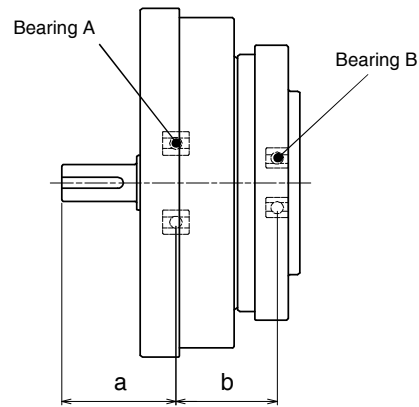
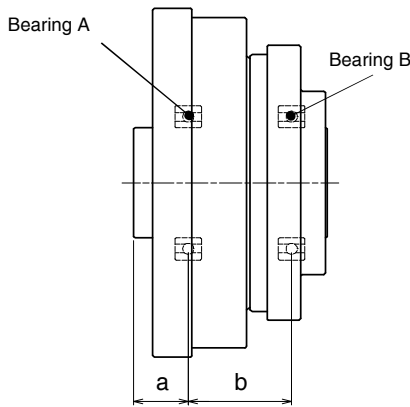
### Life span for the main bearing

<b>Life span for the main bearing</b>	<b>Lhc</b>	<b>[h]</b>	$Lhc = \frac{10^6}{60 \cdot nao} \cdot \left( \frac{C}{fw \cdot Pc} \right)^{\frac{10}{3}}$
<b>Impact factor</b>	<b>fw</b>	<b>-</b>	1,0: no shock
			1,2: with some shock
			1,5: with shock and vibration

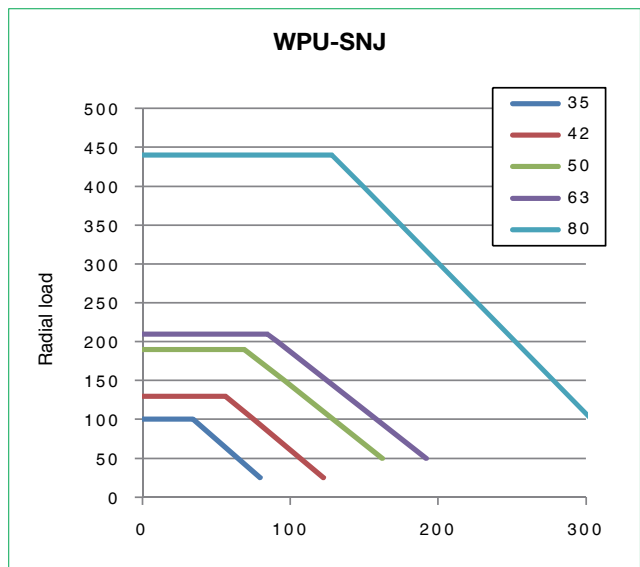
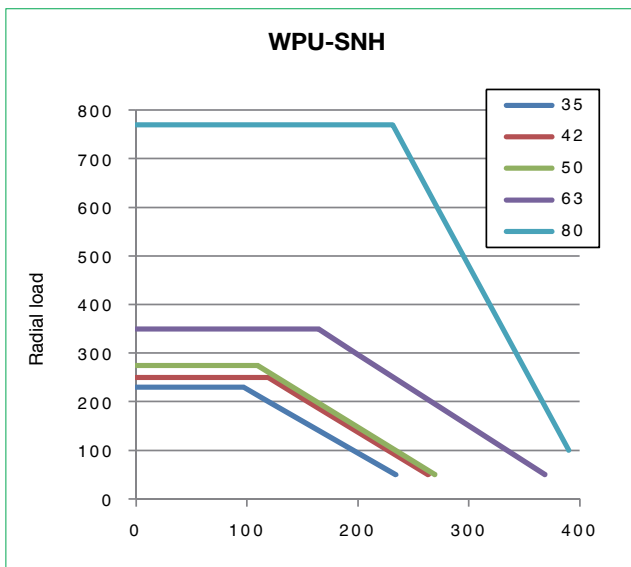
# Maximum load at input shaft

Bearing specification (Open type, Unit)

Series	Size	Bearing A		Bearing B		a [mm]	b [mm]
		Basic dynamic load rating	Basic static load rating	Basic dynamic load rating	Basic static load rating		
		C [N]	Co [N]	C [N]	Co [N]		
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



Maximum load (Average input rotation speed : 2000 r/min, Life span: 7000h)



# Lubricant information

## Grease

Sumiplex MP No.2 (SUMICO LUBRICANT CO., LTD.)  
 Operating temperature range: 0-40 °C (ambient temperature)

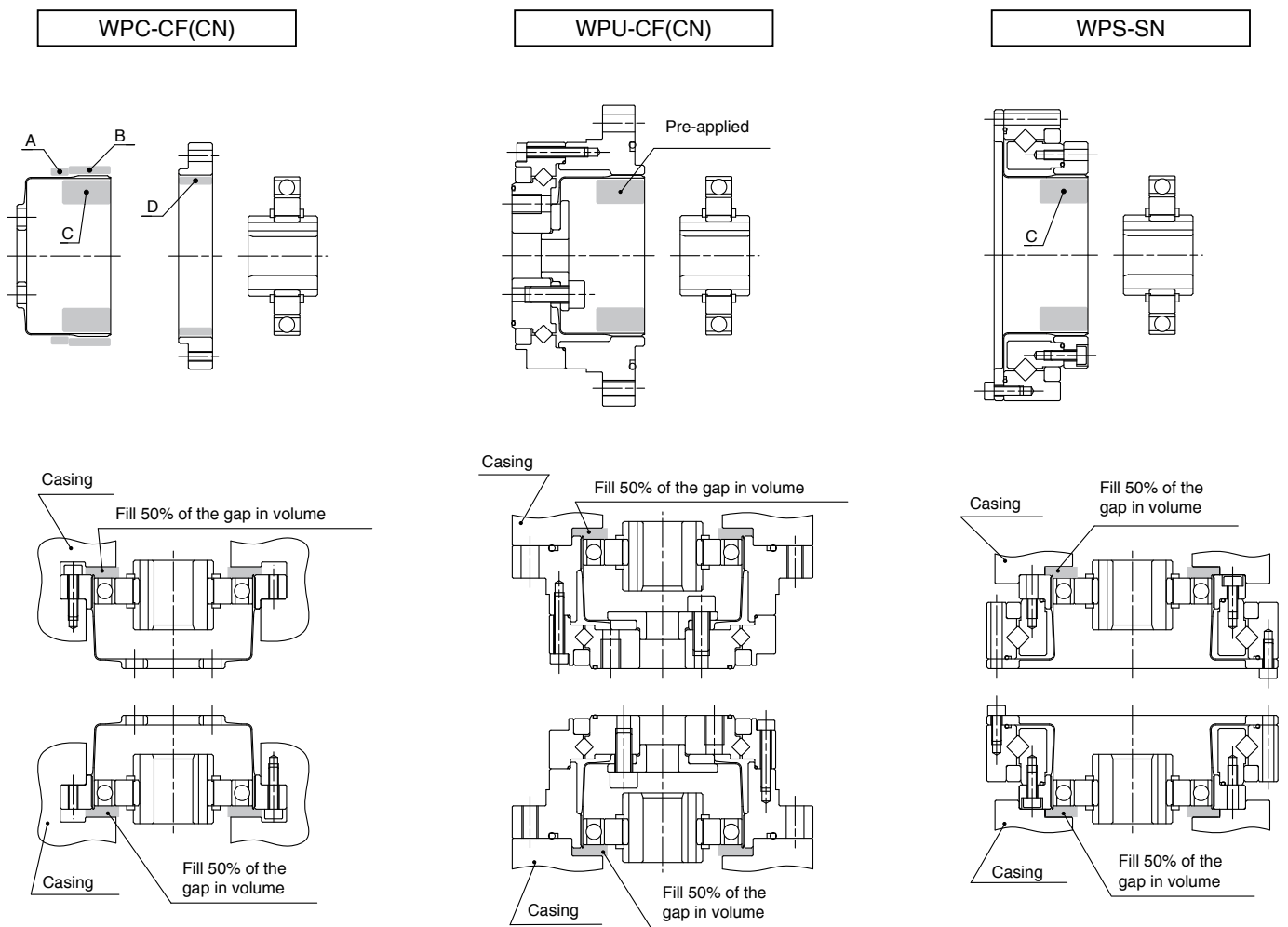
## Grease application

Please apply grease according to the table below.

Size	Applied part [g]					
	A	B	C Horizontal	C Vertical up	C Vertical down	D
35	0.3	0.3	6	8	9	0.3
42	0.5	0.5	10	12	14	0.5
50	0.8	0.8	16	18	21	0.8
63	1.5	1.5	30	35	40	1.5
80	3.0	3.0	60	70	80	3.0

- The quantity of grease applied to C should be adjusted depending on the mounting direction.
- C of the unit type product is already filled with the same quantity of grease as horizontal mounting.
- For vertical up/down, 50% of the space between input assy and casing inner wall should be filled with grease.

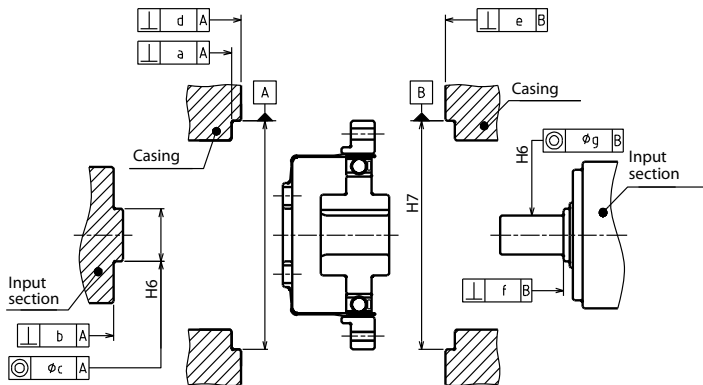
## Grease application location



STANDARD TYPE A

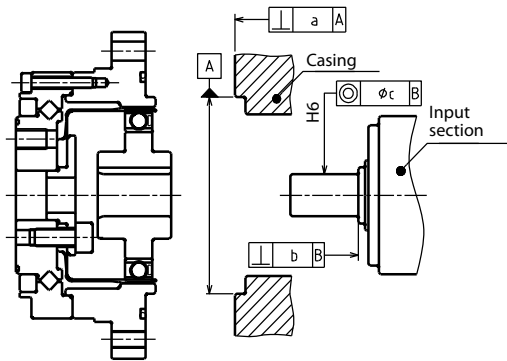
# Attachment fixture requirement

## WPC-CF(CN)



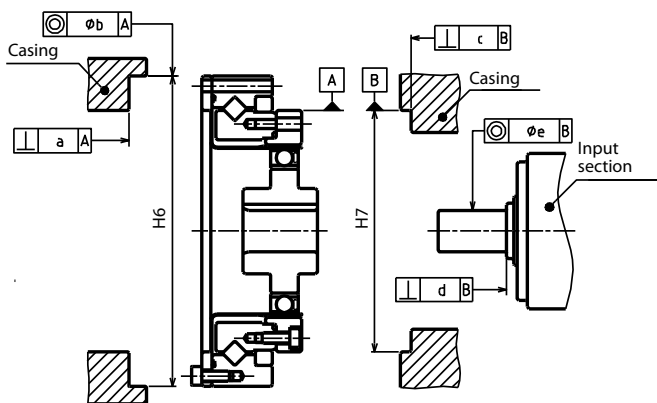
Mounting Tolerance [mm]					
Size	35	42	50	63	80
a	0,015	0,015	0,018	0,018	0,023
b	0,010	0,012	0,014	0,016	0,020
c	0,013	0,013	0,015	0,018	0,020
d	0,015	0,015	0,018	0,018	0,023
e	0,015	0,015	0,018	0,018	0,023
f	0,012	0,012	0,014	0,016	0,016
g	0,016	0,020	0,024	0,024	0,024

## WPU-CF(CN)



Mounting Tolerance [mm]					
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-SN



Mounting Tolerance [mm]					
Size	35	42	50	63	80
a	0,025	0,025	0,025	0,030	0,030
b	0,020	0,020	0,020	0,025	0,025
c	0,020	0,020	0,020	0,025	0,025
d	0,012	0,012	0,014	0,016	0,016
e	0,016	0,020	0,024	0,024	0,024

# Transmitting Torque

## Assembly

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.

### Tightening torque for bolts

Bolt size	M3	M4	M5	M6	M8	M10
Tightening torque	1,9	4,3	8,7	15	36	71

Recommended bolt: Strength rating above 12.9

### Bolt specifications and Transmitting torque (Closed type, Unit)

#### Output flange attachment

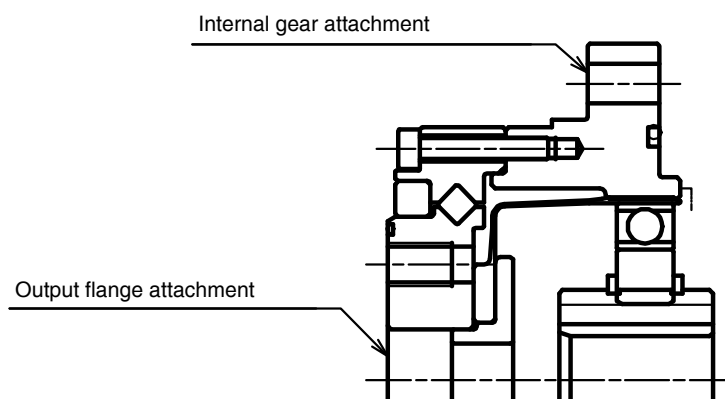
Size	35	42	50	63	80
Bolt size	M4	M5	M6	M8	M10
Bolt count	6	6	8	8	8
Bolt PCD	23	27	32	42	55
Tightening torque	4,3	8,7	15	36	71
Transmitting torque	56	106	238	566	1177

#### Internal gear attachment

Size	35	42	50	63	80
Bolt size	M4	M4	M5	M5	M6
Bolt count	8	8	8	10	12
Bolt PCD	65	71	82	96	125
Tightening torque	4,3	4,3	8,7	8,7	15
Transmitting torque	210	230	430	629	1392

#### Internal gear attachment

Size	35	42	50	63	80
Bolt size	M4	M4	M5	M5	-
Bolt count	6	6	6	8	-
Bolt PCD	65	71	82	96	-
Tightening torque	4,3	4,3	8,7	8,7	-
Transmitting torque	158	172	322	503	-



**Bolt specifications and Transmitting torque (Closed type, Component)**

**Flex Gear Attachment**

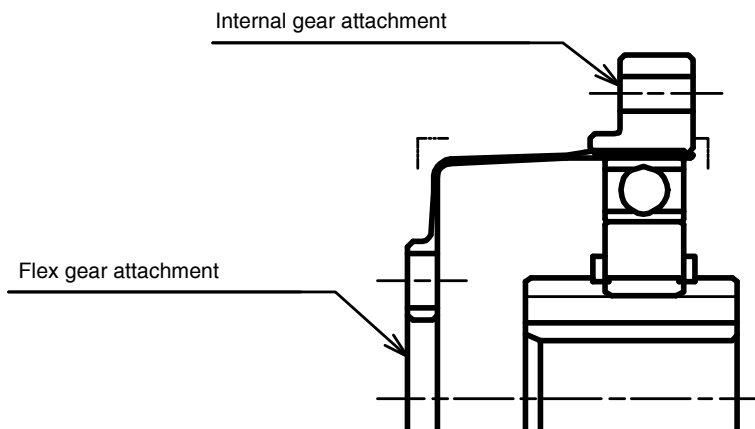
Size	35	42	50	63	80
Bolt size	M4	M5	M5	M6	M8
Bolt count	6	6	8	8	8
Bolt PCD	17	19	24	30	40
Tightening torque	4.3	8.7	8.7	15	36
Transmitting torque	41	75	126	223	539

**Internal Gear Attachment**

Size	35	42	50	63	80
Bolt size	M3	M3	M3	M4	M5
Bolt count	8	16	16	16	16
Bolt PCD	44	54	62	75	100
Tightening torque	1.9	1.9	1.9	4.3	8.7
Transmitting torque	82	200	230	485	1048

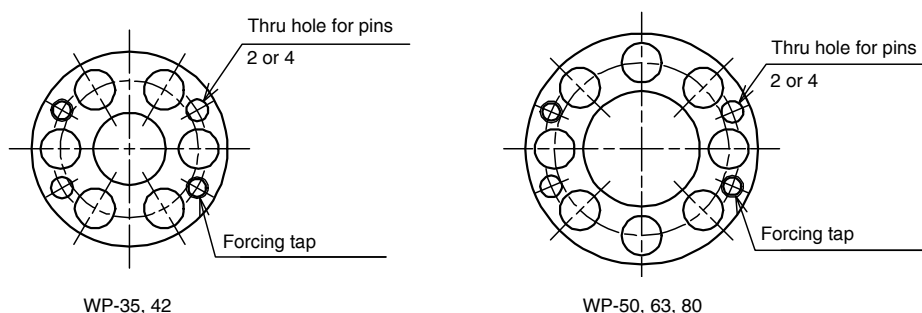
**Internal Gear Attachment**

Size	35	42	50	63	80
Bolt size	M3	M3	M3	M4	M5
Bolt count	6	12	12	12	12
Bolt PCD	44	54	62	75	100
Tightening torque	1.9	1.9	1.9	4.3	8.7
Transmitting torque	61	150	172	364	786



**Reinforcement**

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



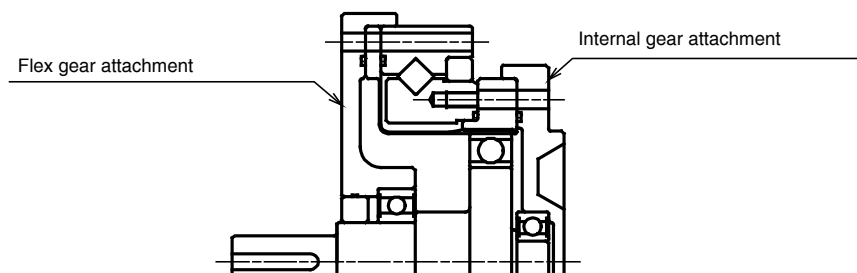
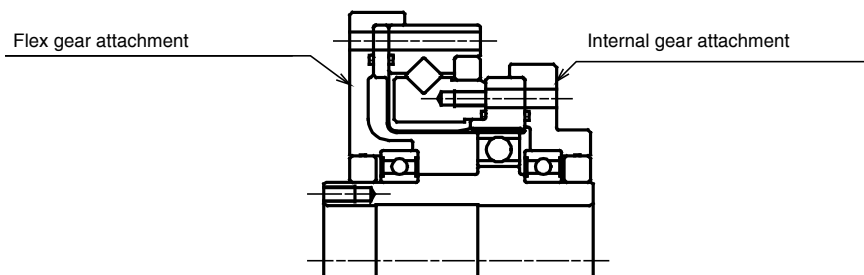
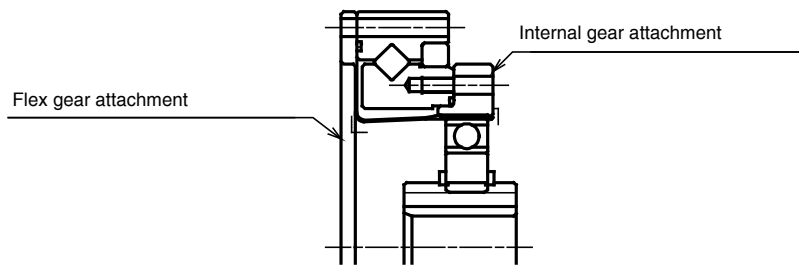
## Bolt specifications and Transmitting torque (Open type)

### Flex Gear Attachment

Size	35	42	50	63	80
Bolt size	M3	M3	M3	M4	M5
Bolt count	8	12	12	12	12
Bolt PCD	64	74	84	102	132
Tightening torque	1.9	1.9	1.9	4.3	8.7
Transmitting torque	119	206	234	495	1037

### Internal Gear Attachment

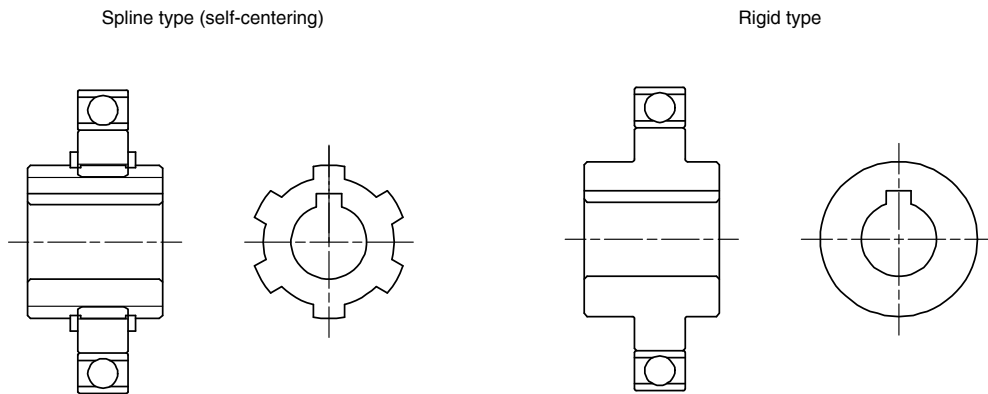
Size	35	42	50	63	80
Bolt size	M3	M3	M3	M4	M5
Bolt count	8	16	16	16	16
Bolt PCD	44	54	62	77	100
Tightening torque	1.9	1.9	1.9	4.3	8.7
Transmitting torque	82	200	230	498	1048



STANDARD TYPE A

## Input section structure

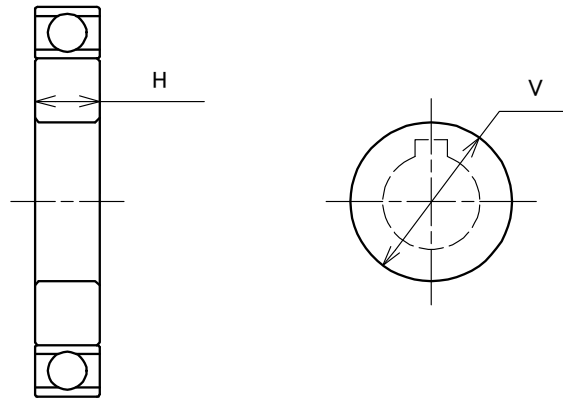
There are two types of input section structure, spline type (self-centering feature) and rigid type.



### 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.



### Cam dimension

Size	35	42	50	63	80
Standard bore size [mm]	6	8	12	14	14
Maximum bore size [mm]	17	20	23	28	36
Minimum thickness [mm]	6	7	8	9	11

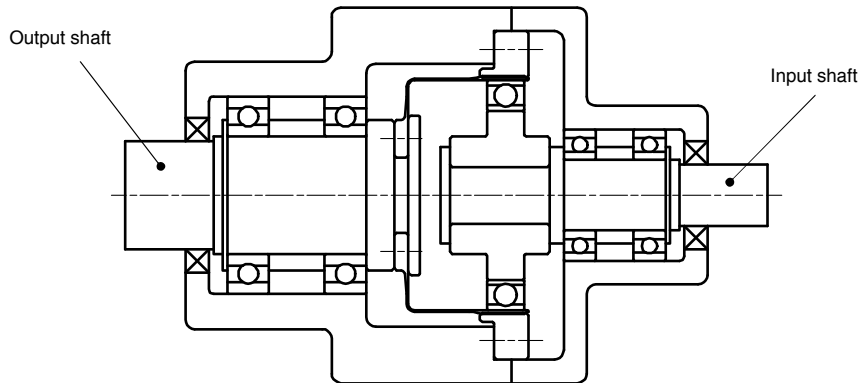


# Installation and assembly instructions

STANDARD TYPE A

## Shaft installation instruction (WPC-C)

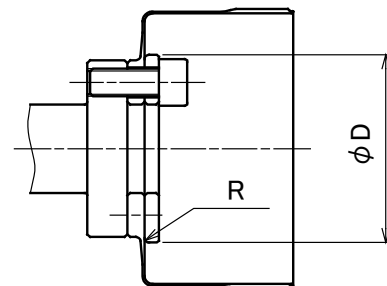
Please design the support structure for input shaft and output shaft so that both radial and axial loads are supported. (Diagram below shows an example)



## Attachment flange requirement

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.

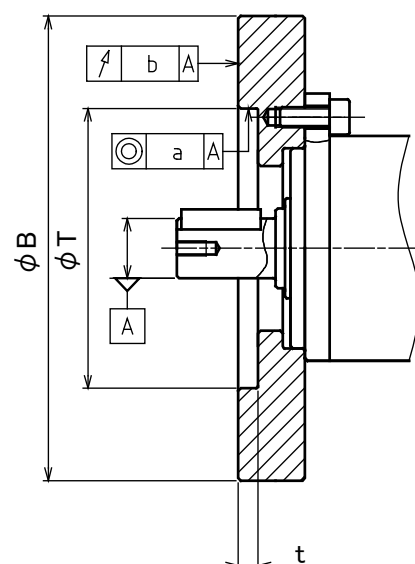
Item	35	42	50	63	80
D [mm]	24.5	29	34	42	55
R [mm]	1.2	1.2	1.4	1.5	2



## Size requirement of the flange for motor attachment

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.

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

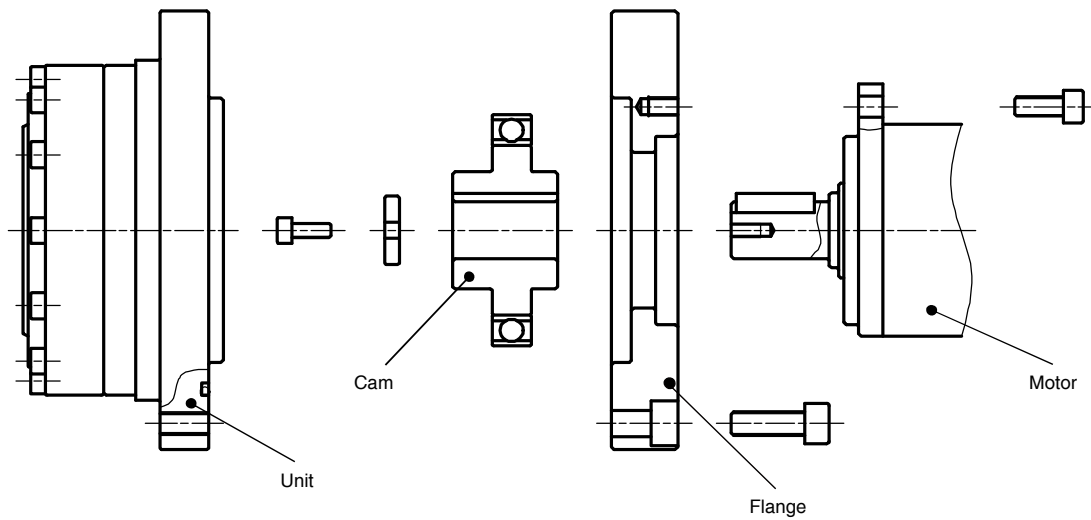


## Motor installation procedure

### Motor installation procedure (WPU-C)

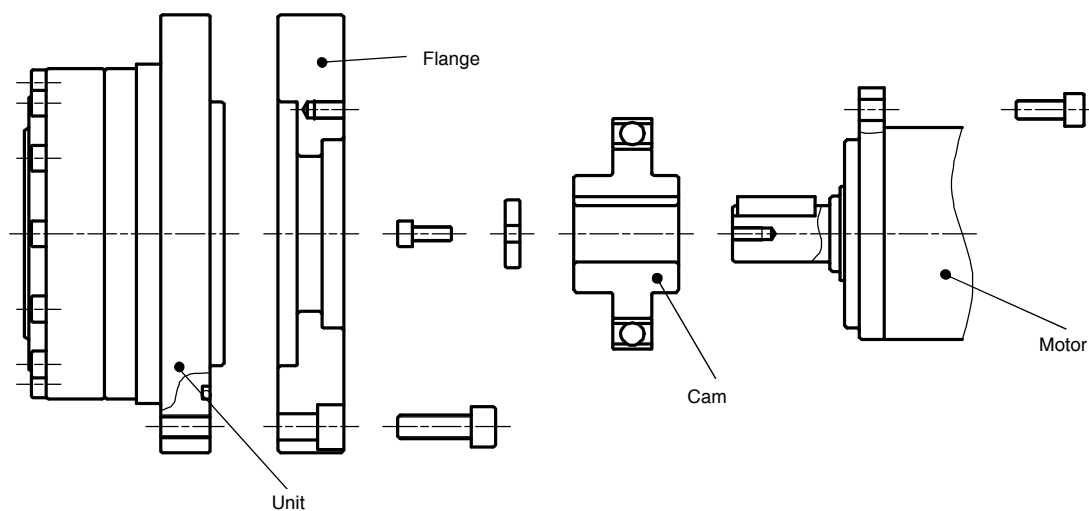
#### Procedure 1

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



#### Procedure 2

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



#### Caution during installation

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

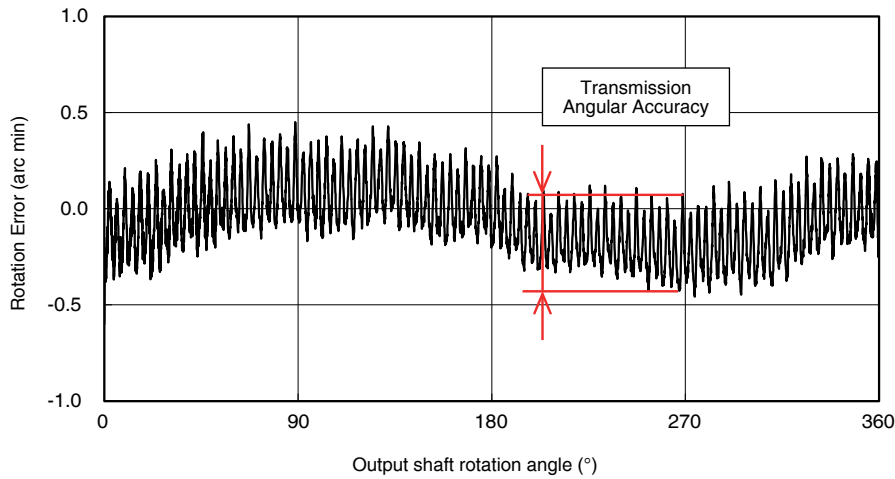
# Characteristics Data

STANDARD TYPE A

## Transmission Angular Accuracy

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.



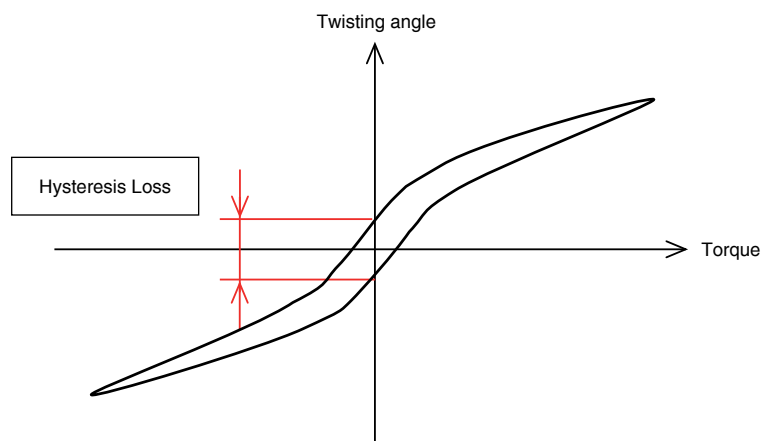
Ratio	Size				
	35 [arc-min]	42 [arc-min]	50 [arc-min]	63 [arc-min]	80 [arc-min]
50	2.0	2.0	1.5	1.0	1.0
80	1.5	1.5	1.0	1.0	1.0
100	1.5	1.5	1.0	1.0	1.0
120	-	1.5	1.0	1.0	1.0

## Hysteresis Loss

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.



Ratio	Size				
	35 [arc-min]	42 [arc-min]	50 [arc-min]	63 [arc-min]	80 [arc-min]
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

### Maximum Backlash

What is Maximum Backlash?

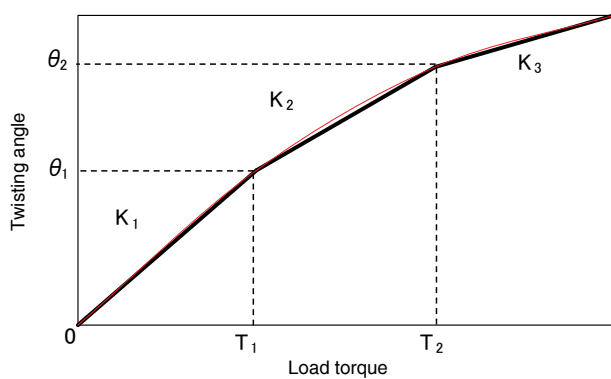
In this context, maximum backlash is the output backlash for spline type input shaft. (Backlash is zero for rigid type input, because gear engagement backlash is zero.)

Ratio	Size				
	35 [arc-sec]	42 [arc-sec]	50 [arc-sec]	63 [arc-sec]	80 [arc-sec]
50	27	27	18	16	16
80	17	17	11	10	10
100	13	13	9	8	8
120	-	11	7	7	7

### Stiffness (Closed type, Unit)

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.



Spring coefficient at 0 ~  $T_1$  torque

Spring coefficient at  $T_1$  ~  $T_2$  torque

Spring coefficient at  $T_2$  ~ torque

Ratio	Item	Unit	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	$K_1$	[ $\times 10^4$ Nm/rad]	0.28	0.69	1.1	2.7	5.6
	$K_2$	[ $\times 10^4$ Nm/rad]	0.45	0.85	1.7	3.3	7.1
	$K_3$	[ $\times 10^4$ Nm/rad]	0.55	1.1	2.5	4.0	8.3
	$\theta_1$	[arc-min]	2.3	2.2	2.0	1.8	2.0
	$\theta_2$	[arc-min]	5.7	4.5	5.3	5.5	6.5
80 100 120	$K_1$	[ $\times 10^4$ Nm/rad]	0.45	0.92	1.2	3.3	6.9
	$K_2$	[ $\times 10^4$ Nm/rad]	0.63	1.1	1.8	3.7	8.1
	$K_3$	[ $\times 10^4$ Nm/rad]	0.70	1.3	2.2	4.5	10
	$\theta_1$	[arc-min]	1.8	1.3	1.8	1.6	1.7
	$\theta_2$	[arc-min]	4.7	3.5	4.8	4.4	4.9

Average value shown in the table

### Starting Torque

What is Starting Torque?

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

Ratio	Size				
	35 [cNm]	42 [cNm]	50 [cNm]	63 [cNm]	80 [cNm]
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

For reference only. Torque value may vary depending on the condition.

### Output Starting Torque

What is Output Starting Torque?

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

Ratio	Size				
	35 [Nm]	42 [Nm]	50 [Nm]	63 [Nm]	80 [Nm]
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

For reference only. Torque value may vary depending on the condition.

### No-load Running Torque (Closed type, Unit)

What is No-load Running Torque?

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

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

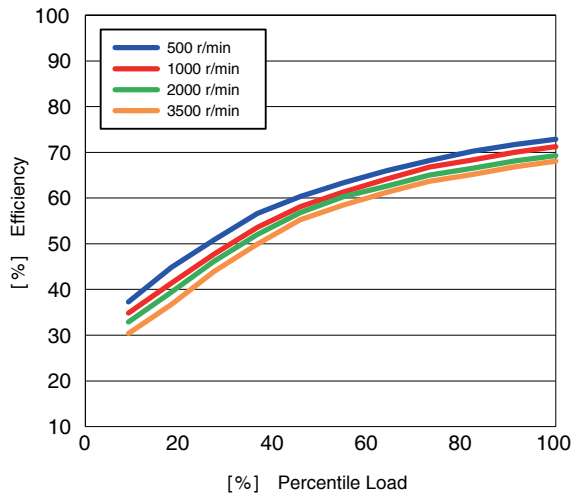
For reference only. Torque value may vary depending on the condition.

**Efficiency (Closed type, Unit)**

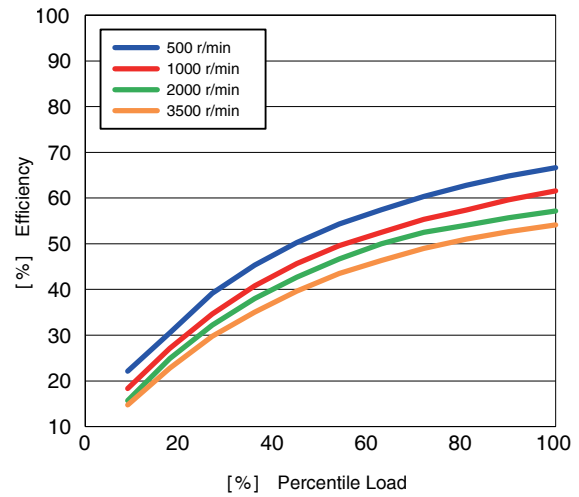
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25 °C

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

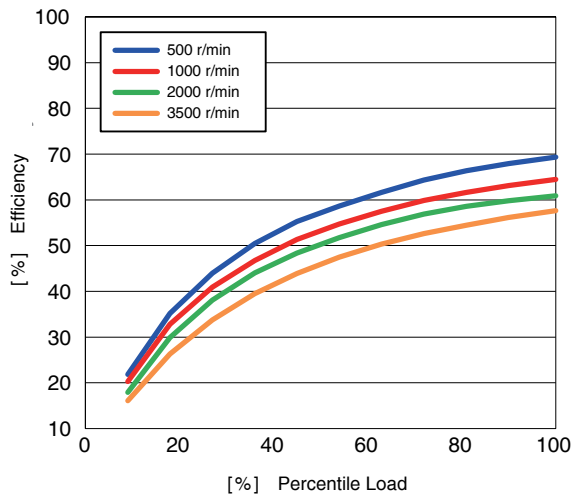
WPU-35-50



WPU-35-80



WPU-35-100

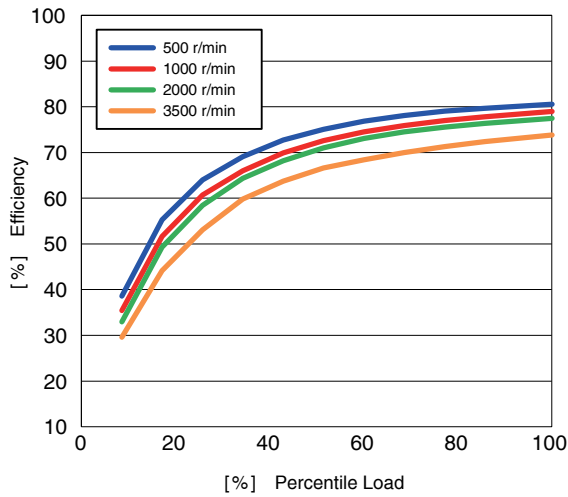


**Efficiency (Closed type, Unit)**

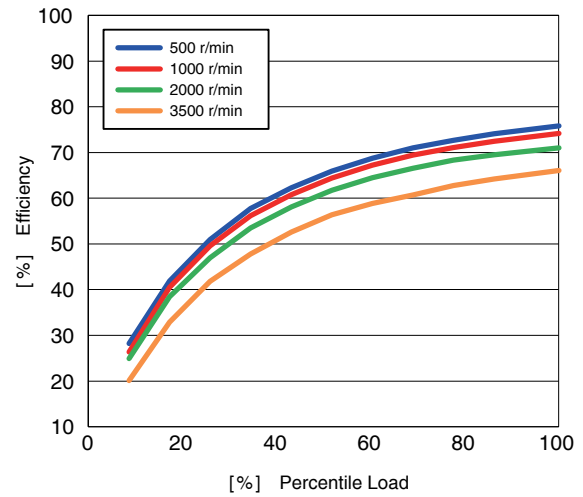
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25 °C

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

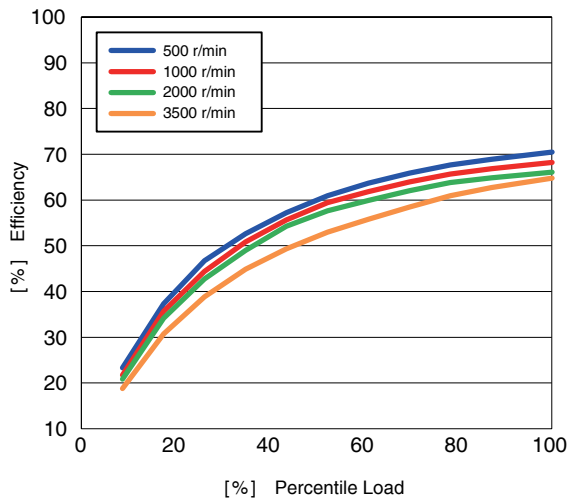
WPU-42-50



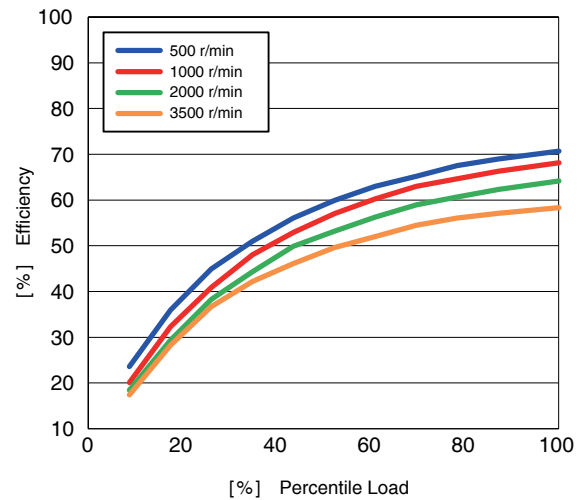
WPU-42-80



WPU-42-100



WPU-42-120

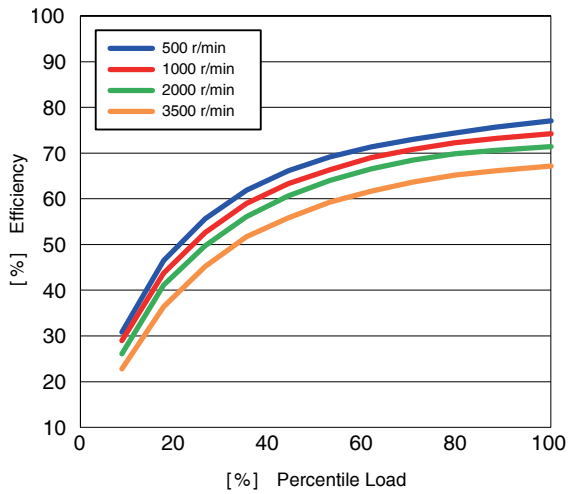


**Efficiency (Closed type, Unit)**

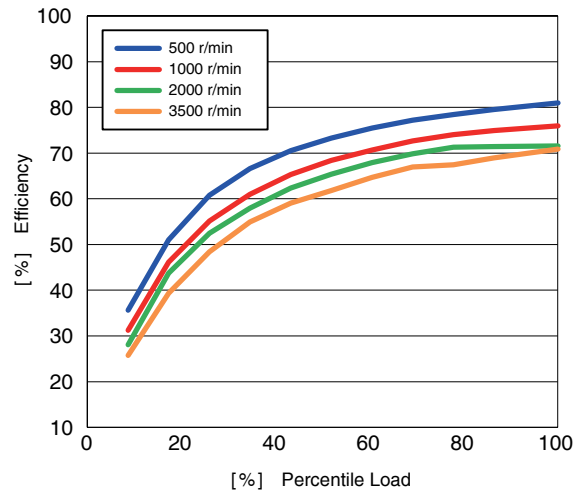
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25 °C

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

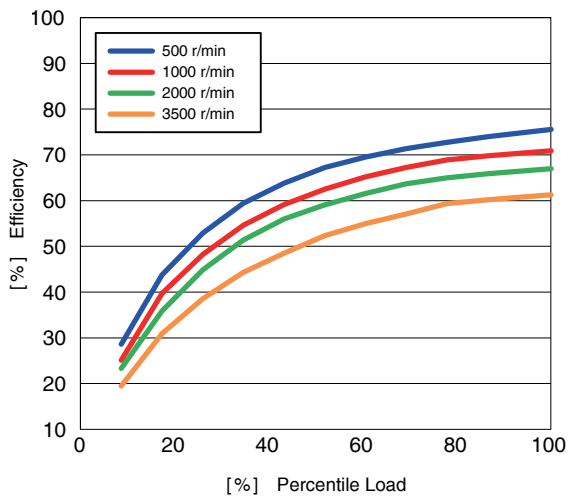
WPU-50-50



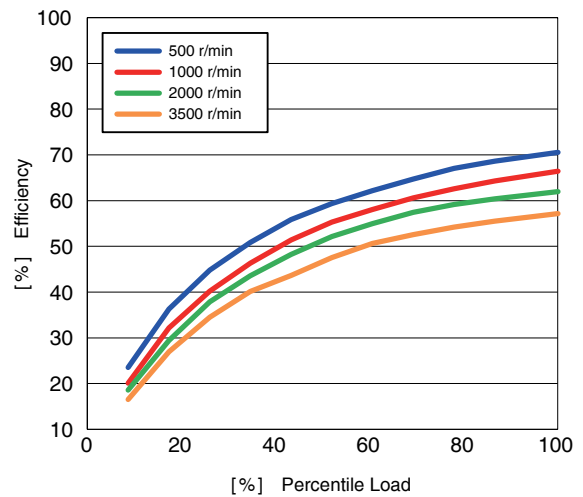
WPU-50-80



WPU-50-100



WPU-50-120



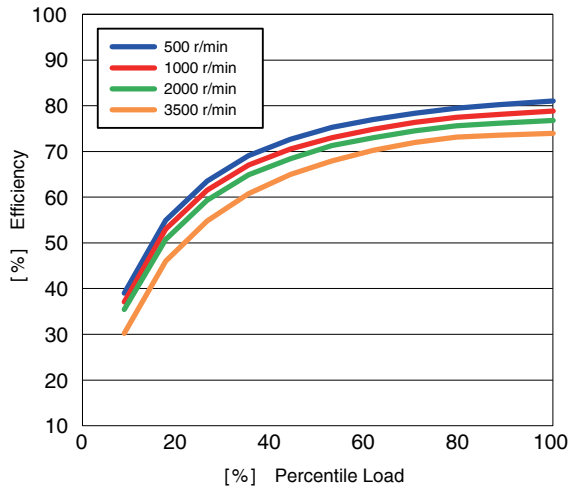


**Efficiency (Closed type, Unit)**

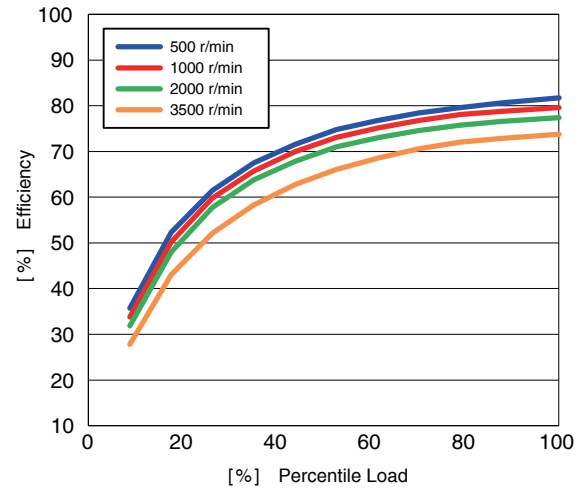
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25 °C

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

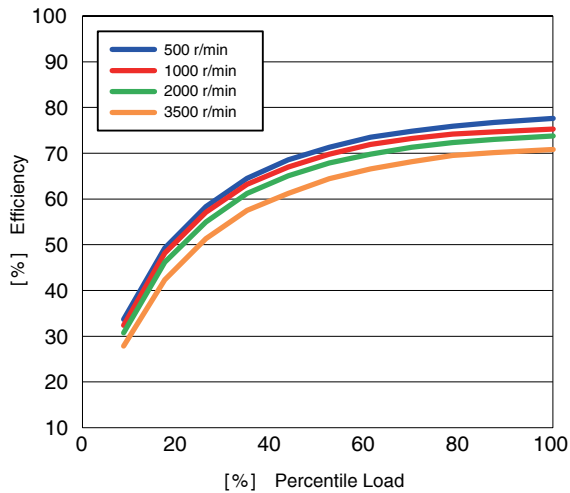
WPU-63-50



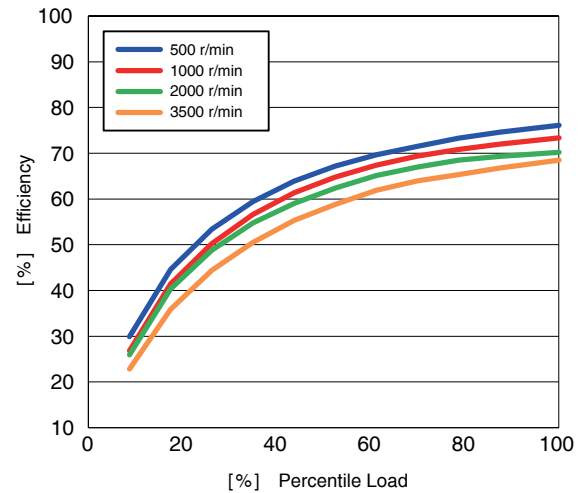
WPU-63-80



WPU-63-100



WPU-63-120

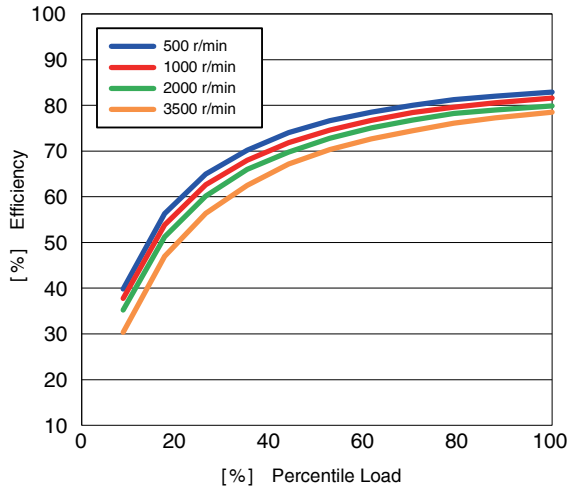


**Efficiency (Closed type, Unit)**

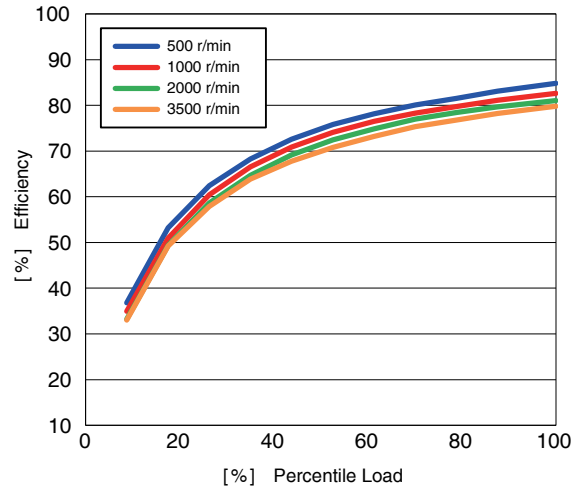
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25 °C

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

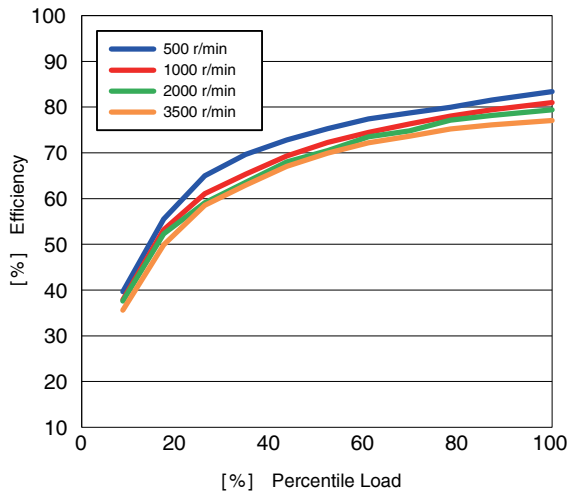
WPU-80-50



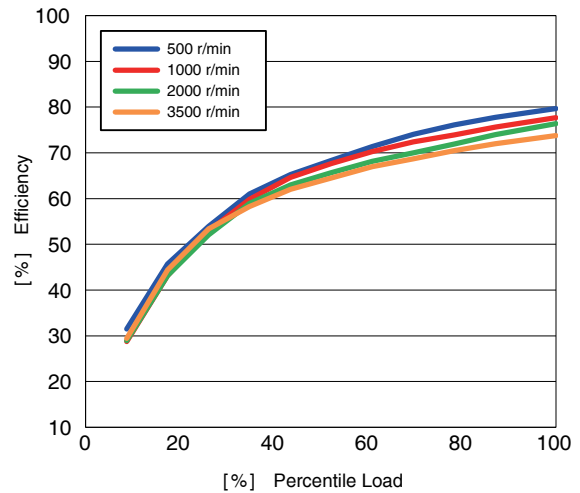
WPU-80-80



WPU-80-100



WPU-80-120



# Standard type D - slim version

<b>Part Number</b>	<b>WP</b>	<b>U</b>	<b>-35</b>	<b>-50</b>	<b>-CD</b>
Model name: WP series					
Type: S = simple unit type U = unit type					Code: CD, CDH, SD, SDH
Size: 35, 42, 50, 63, 80					Ratio: 50, 80, 100, 120

For the code details, please check the Dimensions Table.

Frame size				
Size/Ratio	50	80	100	120
35				
42				
50				
63				
80				



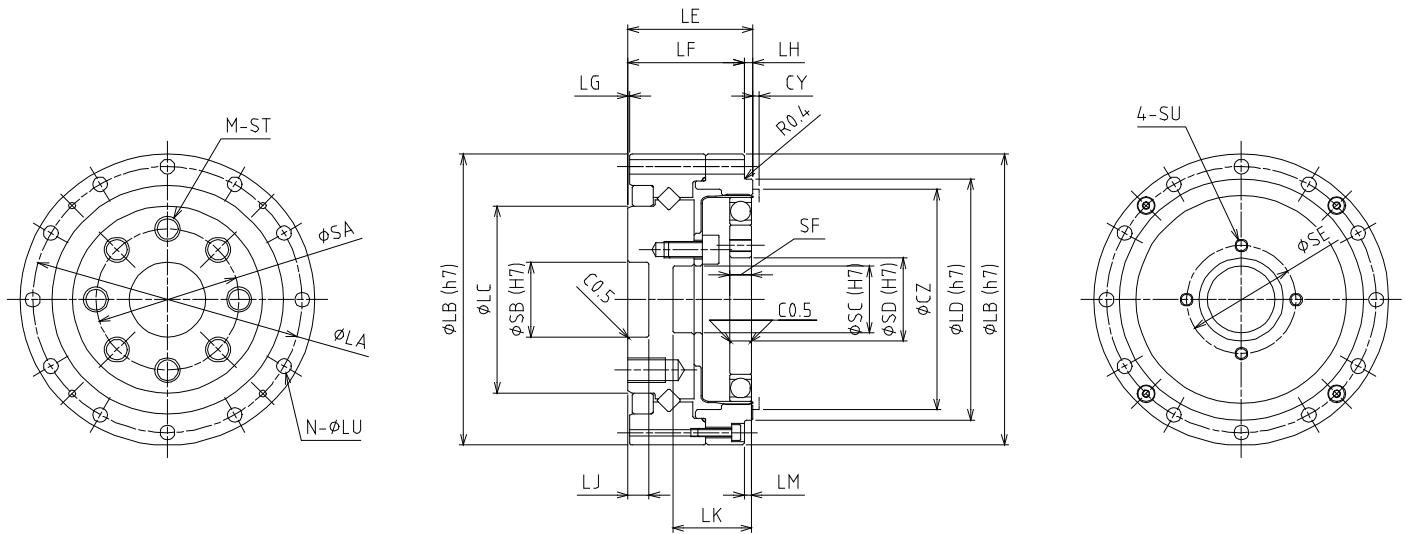
**STANDARD TYPE D**

## Reducer Specifications

Size	Ratio R	Nominal output torque <i>The maximum allowable value at the input rotation speed of 2000 r/min</i>	Maximum output torque <i>The maximum torque when starting and stopping</i>	Emergency stop torque <i>The maximum torque when it receives shock</i>	Nominal input speed <i>The maximum average input speed</i>	Maximum input speed <i>The maximum input speed</i>
		[Nm]	[Nm]	[Nm]	[r/min]	[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		

# Closed Type, Unit

## WPU-CD

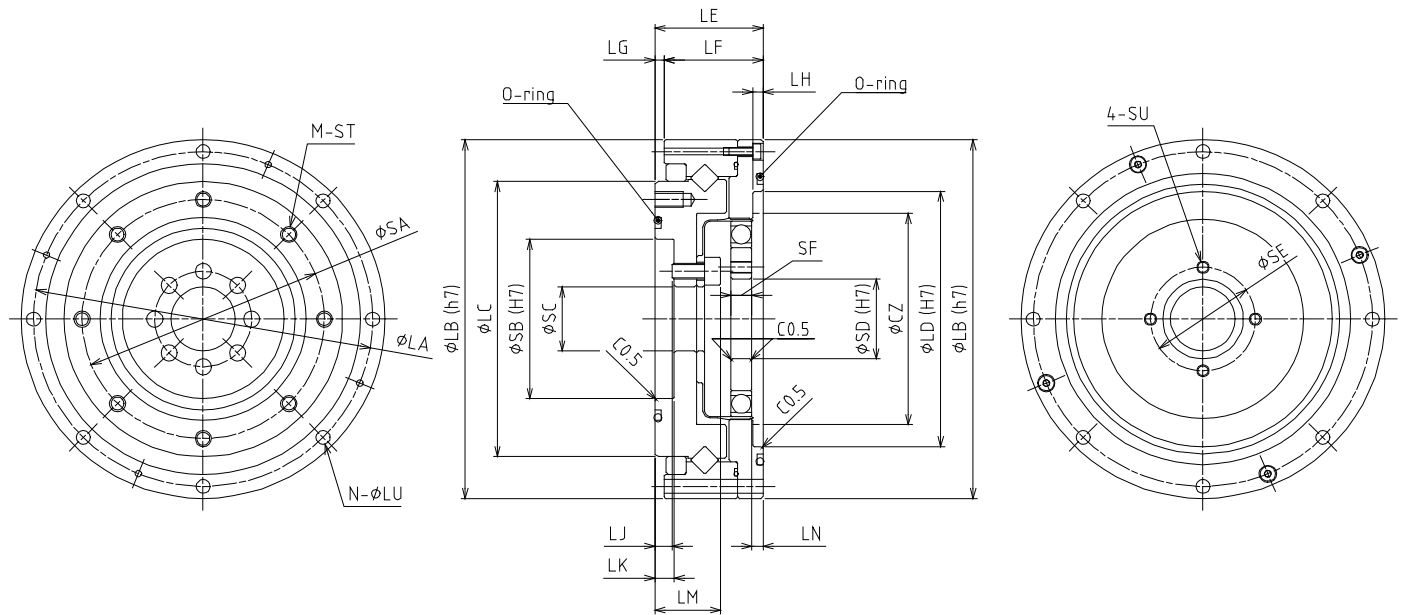


Size	LA [mm]	LB [mm]	LC [mm]	LD [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LJ [mm]	LK [mm]	LM [mm]	N [mm]	LU [mm]
35	49	55	31	42.5	25	23	0.5	2	5	14.7	1.7	6	3.5
42	56	62	38	49.5	26.5	24.5	0.5	2	5	16.2	1.7	10	3.5
50	64	70	45	58	29.7	27.7	0.5	2	5	18.7	1.7	12	3.5
63	79	85	58	73	37.1	34.1	0.5	3	5.5	23.6	2.6	18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

Size	SA [mm]	SB [mm]	SC [mm]	SD [mm]	SE [mm]	SF [mm]	CY [mm]	CZ [mm]	M [mm]	ST [mm]	SU [mm]
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

# Closed Type, Unit

## WPU-CDH



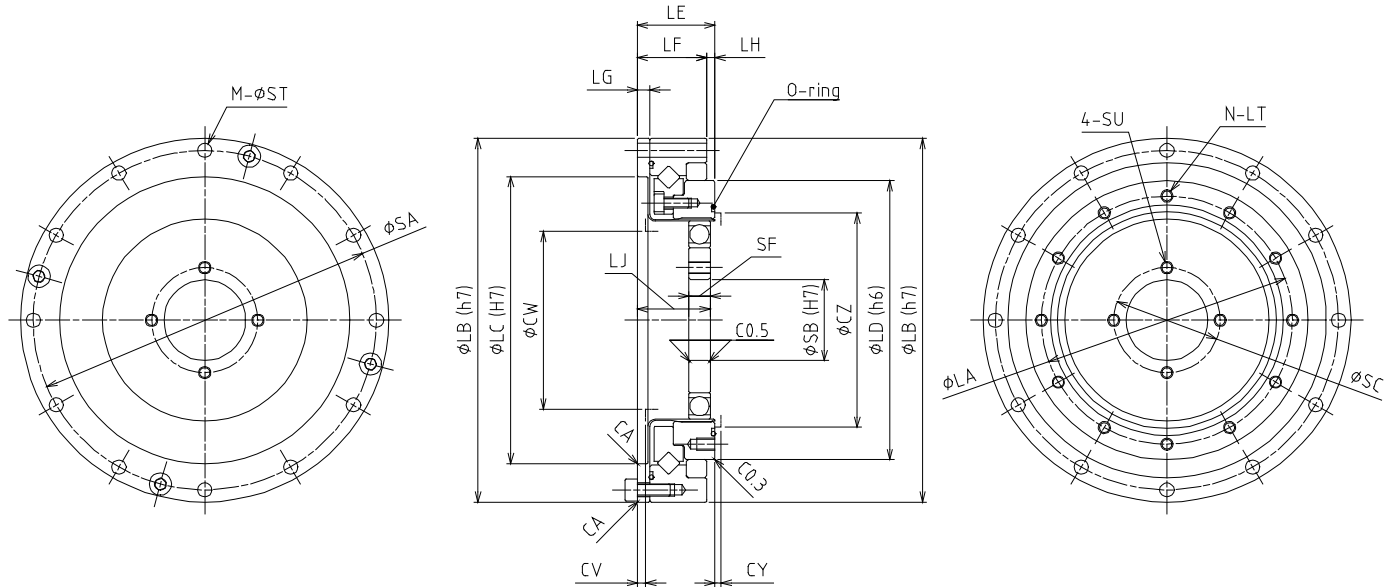
STANDARD TYPE D

Size	LA [mm]	LB [mm]	LC [mm]	LD [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LJ [mm]	LK [mm]	LM [mm]	LN [mm]	N [mm]	LU [mm]
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

Size	SA [mm]	SB [mm]	SC [mm]	SD [mm]	SE [mm]	SF [mm]	CZ [mm]	M [mm]	ST [mm]	SU [mm]
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

# Open type, Simple unit

## WPS-SD

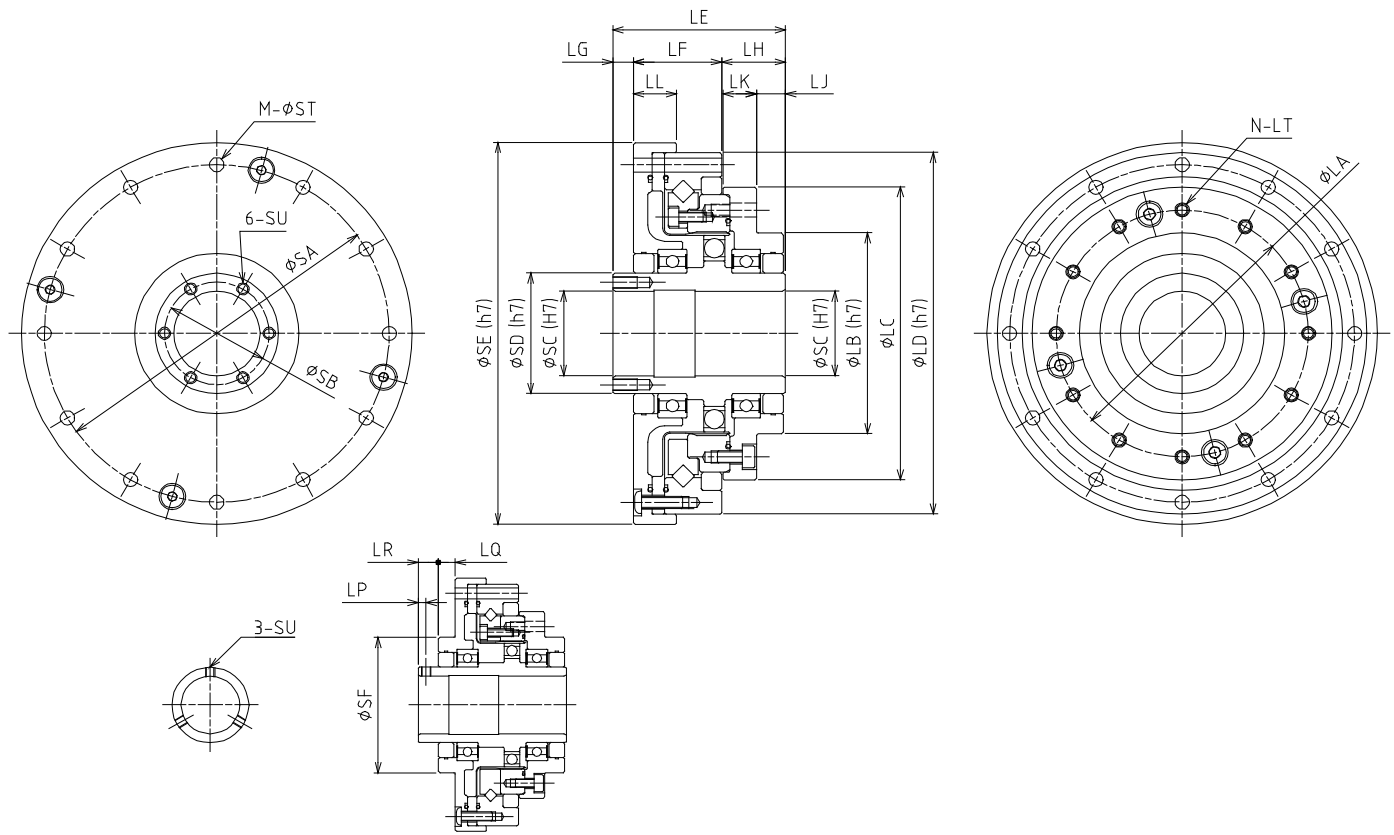


Size	LA [mm]	LB [mm]	LC [mm]	LD [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LJ [mm]	N [mm]	LT [mm]
35	43	70	50	49	17.5	15.5	2.4	2	15.7	8	M3×4.5
42	52	80	61	59	18.5	16.5	3	2	16.9	12	M3×4.5
50	61.4	90	71	69	19	17	3	2	17.8	12	M3×4.5
63	76	110	88	84	22	20	3.3	2	21.6	12	M4×6
80	99	142	114	110	27.9	23.6	3.6	4.3	27.3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

Size	SA [mm]	SB [mm]	SC [mm]	SF [mm]	CA [mm]	CY [mm]	CZ [mm]	CV [mm]	CW [mm]	M [mm]	ST [mm]	SU [mm]
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

# Open type, Unit (hollow shaft)

WPU-SDH



Input shaft for 35+42

STANDARD TYPE D

Size	LA [mm]	LB [mm]	LC [mm]	LD [mm]	LE [mm]	LF [mm]	LG [mm]	LH [mm]	LJ [mm]	LK [mm]	LL [mm]	LP [mm]	LQ [mm]	LR [mm]
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	-	-	-

Size	SA [mm]	SB [mm]	SC [mm]	SD [mm]	SE [mm]	SF [mm]	M [mm]	ST [mm]	SU [mm]	N [mm]	LT [mm]
35	64	-	14	20	74	36	8	3.5	M3	8	M3×4.5 Ø3.5×5.5
42	74	-	19	25	84	45	12	3.5	M3	12	M3×4.5 Ø3.5×6.5
50	84	25.5	21	30	95	-	12	3.5	M3×6	12	M3×4.5 Ø3.5×6.5
63	102	33.5	29	38	115	-	12	4.5	M3×6	12	M4×6 Ø4.5×8.5
80	132	48	41	45	147	-	12	5.5	M3×6	12	M5×8 Ø5.5×7.6

# Life estimation

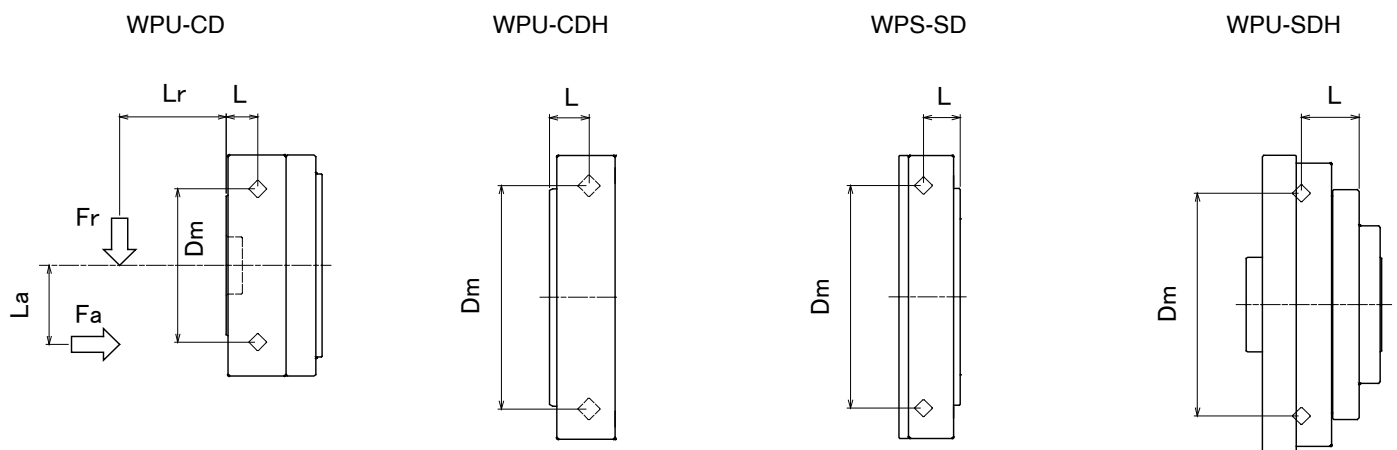
## Model selection / Life estimation

For the flow of model selection and life estimation, please refer to Standard type A.  
For the bearing specification, please refer to the table below.

### Main bearing specification (Cross roller bearing)

Series	Size	Pitch circle diameter of the bearing rollers	Offset	Basic dynamic load rating	Basic static load rating	Allowable moment	Moment rigidity
		Dm [m]	L [m]	C [N]	Co [N]	Mal [Nm]	Km [10 <sup>4</sup> Nm/rad]
WPU-CD	35	0.0335	0.0090	5620	6540	36.5	7.35
	42	0.0410	0.0095	6340	8170	55.8	8.02
	50	0.0493	0.0105	10400	13300	91.0	13.5
	63	0.0615	0.0128	15800	21100	156	27.7
	80	0.0815	0.0130	24400	35600	313	66.0
WPU-CDH	35	0.0505	0.0062	7110	10200	74.0	14.4
	42	0.0598	0.0066	10900	15200	124	19.7
	50	0.0708	0.0077	17200	24700	187	40.1
	63	0.0856	0.0092	25100	37400	258	71.5
	80	0.114	0.0106	43300	67600	580	188
WPS-SD	35	0.0512	0.0111	8010	11400	37.0	8.86
	42	0.0614	0.0112	7370	10900	62	20.8
	50	0.0715	0.0114	8030	12800	93	22.5
	63	0.0869	0.0128	14300	24500	129	33.3
	80	0.113	0.0181	23700	42500	290	84.5
WPU-SDH	35	0.0512	0.0166	8010	11400	37.0	8.86
	42	0.0614	0.0177	7370	10900	62	20.8
	50	0.0715	0.0179	8030	12800	93	22.5
	63	0.0869	0.0213	14300	24500	129	33.3
	80	0.113	0.0257	23700	42500	290	84.5

### External load

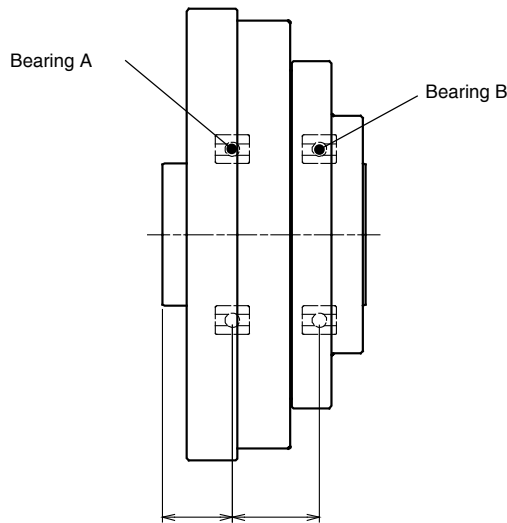




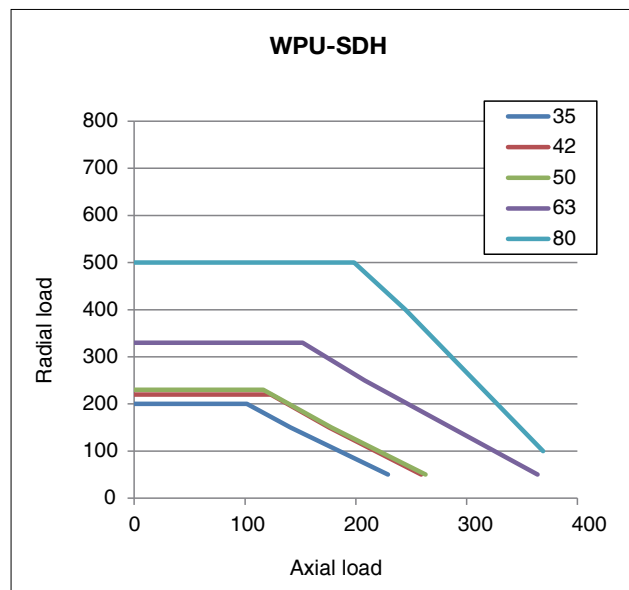
# Maximum load at input shaft

Bearing specification (Open type, Unit)

Series	Size	Bearing A		Bearing B		a [mm]	b [mm]
		Basic dynamic load rating	Basic static load rating	Basic dynamic load rating	Basic static load rating		
		C [N]	Co [N]	C [N]	Co [N]		
WPU-SDH	35	4000	2470	4000	2470	16.0	20.0
	42	4300	2950	4300	2950	16.0	22.5
	50	4500	3450	4500	3450	14.5	18.0
	63	4900	4350	4900	4350	15.5	21.8
	80	8800	8500	6400	6200	17.0	28.5



Maximum load (Average input rotation speed: 2000r/min, Life span: 7000h)



STANDARD TYPE D

## Lubricant information

### Grease

Sumiplex MP No.2 (SUMICO LUBRICANT CO., LTD.)  
 Operating temperature range: 0-40 °C (ambient temperature)

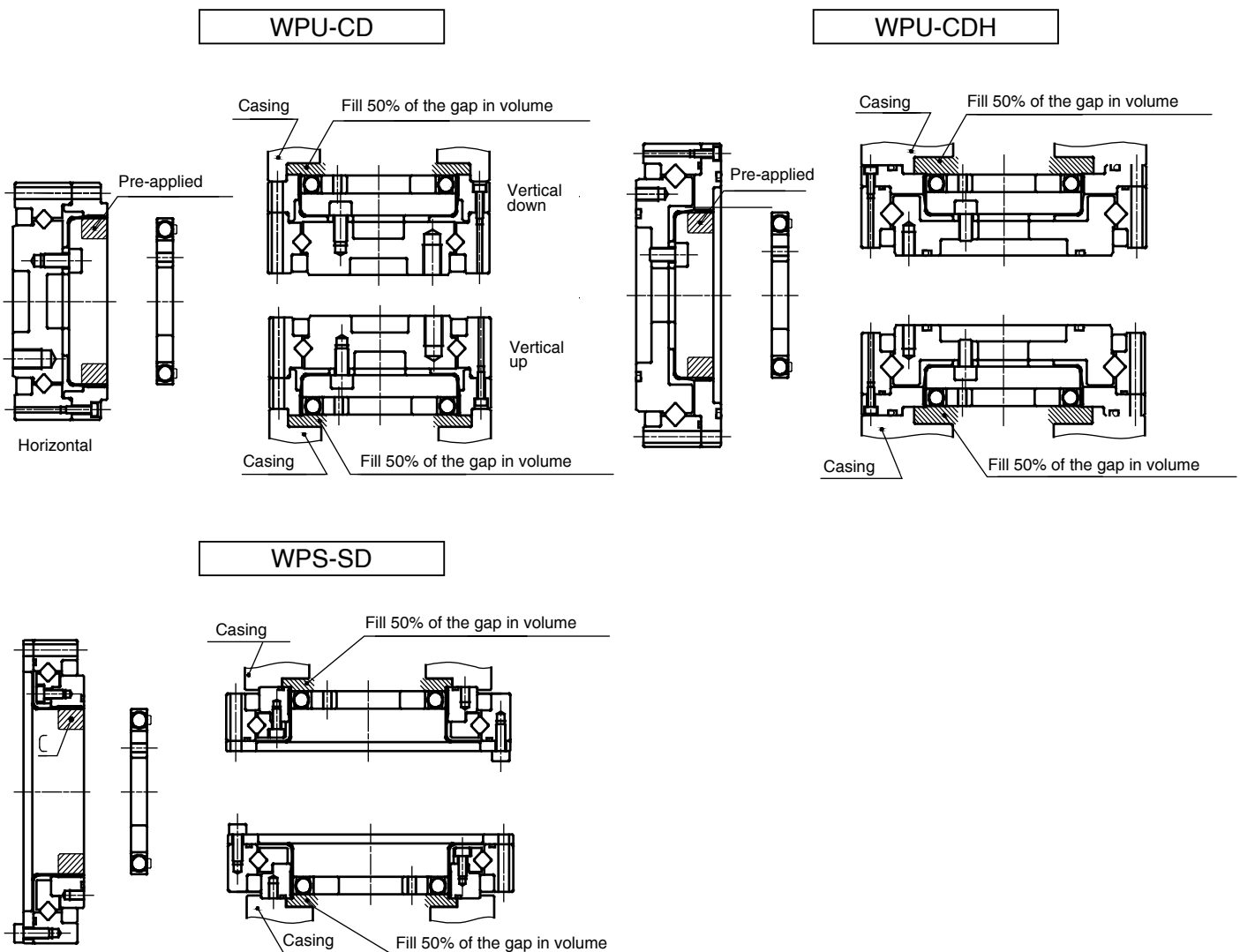
### Grease application

Please apply grease according to the table below.

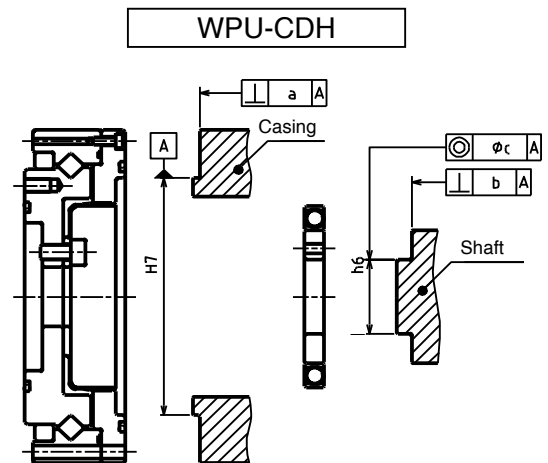
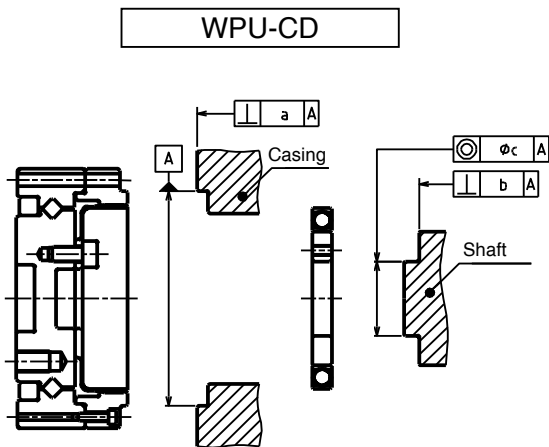
Size	Applied part [g]		
	C Horizontal	C Vertical up	C Vertical down
35	3	4	5
42	5	6	7
50	8	9	11
63	16	19	21
80	36	42	48

- The quantity of grease applied to C should be adjusted depending on the mounting direction. C of the unit type product is already filled with the same quantity of grease as horizontal mounting.
- For vertical up/down, 50% of the space between input assy and casing inner wall should be filled with grease.

### Position of application of the grease

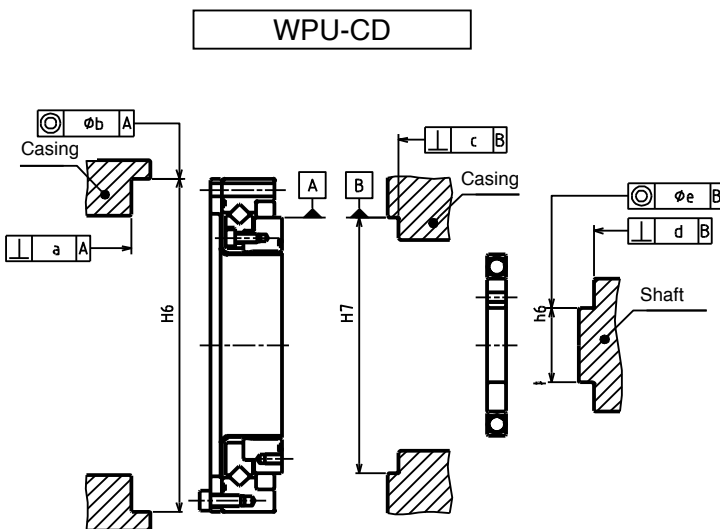


# Attachment fixture requirement



Mounting Tolerance [mm]					
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

Mounting Tolerance [mm]					
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



Mounting Tolerance [mm]					
Size	35	42	50	63	80
a	0.020	0.020	0.020	0.025	0.025
b	0.020	0.020	0.020	0.025	0.025
c	0.020	0.020	0.020	0.025	0.025
d	0.012	0.012	0.014	0.016	0.016
e	0.016	0.020	0.024	0.024	0.024

STANDARD TYPE D

# Transmitting Torque

## Bolting

Please refer to the table below for the bolt tightening torque.

### Tightening torque for bolts

<b>Bolt size</b>	M3	M4	M5	M6	M8	M10
<b>Tightening torque</b>	1.9	4.3	8.7	15	36	71

Recommended bolt: Strength rating above 12.9

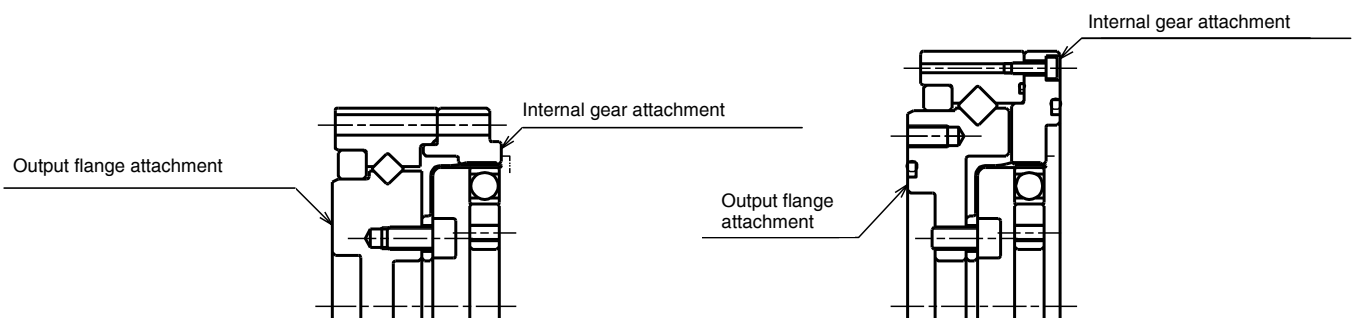
### Bolt specifications and Transmitting torque (Closed type, Unit)

Output flange attachment (WPU-CD)					
Size	35	42	50	63	80
<b>Bolt size</b>	M3	M5	M6	M8	M8
<b>Bolt count</b>	10	8	8	8	10
<b>Bolt PCD</b>	25	27	34	42	57
<b>Tightening torque</b>	1.9	8.7	15	36	36
<b>Transmitting torque</b>	58	141	252	566	960

Internal gear attachment (WPU-CD)					
Size	35	42	50	63	80
<b>Bolt size</b>	M3	M3	M3	M3	M4
<b>Bolt count</b>	6	10	12	18	18
<b>Bolt PCD</b>	49	56	64	79	104
<b>Tightening torque</b>	1.9	1.9	1.9	1.9	4.3
<b>Transmitting torque</b>	68	130	178	330	757

Output flange attachment (WPU-CDH)					
Size	35	42	50	63	80
<b>Bolt size</b>	M3	M3	M4	M5	M6
<b>Bolt count</b>	8	10	8	8	8
<b>Bolt PCD</b>	42	50	60	73	96
<b>Tightening torque</b>	1.9	1.9	4.3	8.7	15
<b>Transmitting torque</b>	78	116	194	382	713

Internal gear attachment (WPU-CDH)					
Size	35	42	50	63	80
<b>Bolt size</b>	M3	M3	M3	M4	M5
<b>Bolt count</b>	6	8	8	10	10
<b>Bolt PCD</b>	64	74	84	102	132
<b>Tightening torque</b>	1.9	1.9	1.9	4.3	8.7
<b>Transmitting torque</b>	89	137	156	412	864

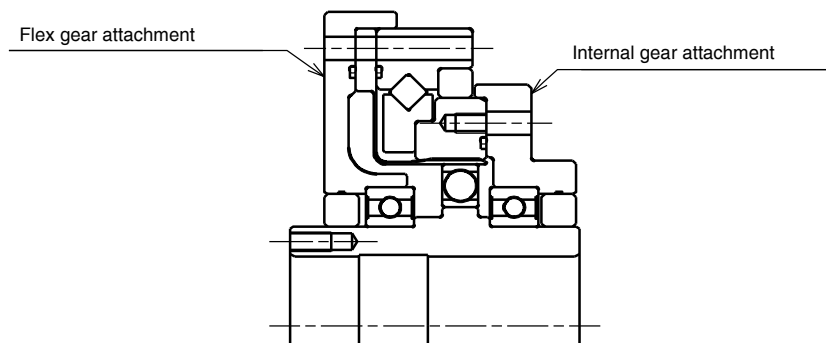
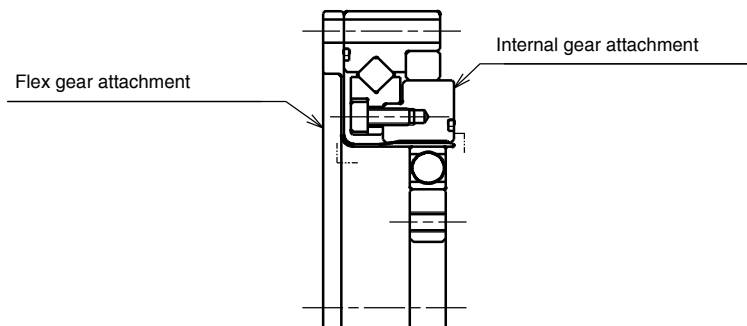


**Bolt specifications and Transmitting torque (Open type)**

Flex gear attachment					
Size	35	42	50	63	80
Bolt size	M3	M3	M3	M4	M5
Bolt count	8	12	12	12	12
Bolt PCD	64	74	84	102	132
Tightening torque	1.9	1.9	1.9	4.3	8.7
Transmitting torque	119	206	234	495	1037

Internal gear attachment					
Size	35	42	50	63	80
Bolt size	M3	M3	M3	M4	M5
Bolt count	8	12	12	12	12
Bolt PCD	43	52	61.4	76	99
Tightening torque	1.9	1.9	1.9	4.3	8.7
Transmitting torque	80	145	171	369	778

STANDARD TYPE D

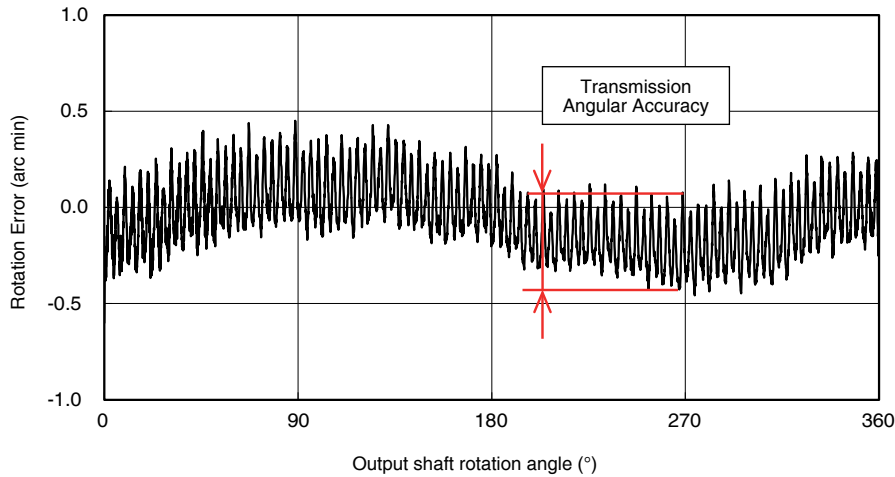


# Characteristics Data

## Transmission Angular Accuracy

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.



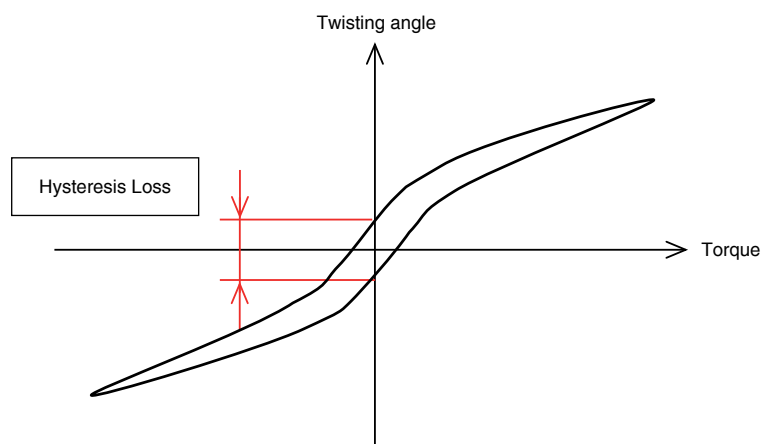
Ratio	Size				
	35 [arc-min]	42 [arc-min]	50 [arc-min]	63 [arc-min]	80 [arc-min]
50	2.0	2.0	1.5	1.0	1.0
80	1.5	1.5	1.0	1.0	1.0
100	1.5	1.5	1.0	1.0	1.0
120	-	1.5	1.0	1.0	1.0

## Hysteresis Loss

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.



Ratio	Size				
	35 [arc-min]	42 [arc-min]	50 [arc-min]	63 [arc-min]	80 [arc-min]
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

**Maximum Backlash**

What is Maximum Backlash?

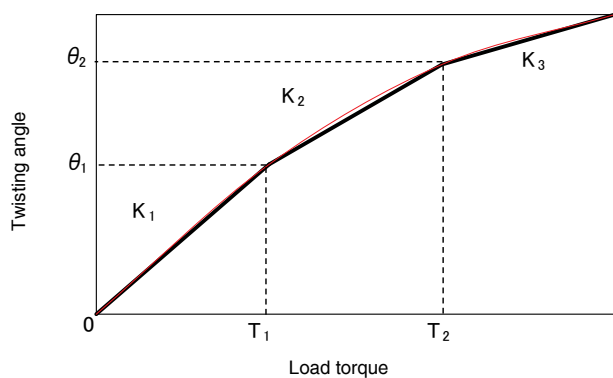
In this context, maximum backlash is the output backlash for spline type input shaft. (Backlash is zero for rigid type input, because gear engagement backlash is zero.)

Ratio	Size				
	35 [arc-sec]	42 [arc-sec]	50 [arc-sec]	63 [arc-sec]	80 [arc-sec]
50	27	27	18	16	16
80	17	17	11	10	10
100	13	13	9	8	8
120	-	11	7	7	7

**Stiffness (Closed type, Unit)**

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.



Spring coefficient at 0 ~ T<sub>1</sub> torque

Spring coefficient at T<sub>1</sub> ~ T<sub>2</sub> torque

Spring coefficient at T<sub>2</sub> ~ torque

Ratio	Item	Unit	Size				
			35	42	50	63	80
-	T <sub>1</sub>	[Nm]	2	3.9	7	14	29
-	T <sub>2</sub>	[Nm]	6.9	12	25	48	108
50	K <sub>1</sub>	[× 10 <sup>4</sup> Nm/rad]	0.39	0.66	1.1	2.2	4.6
	K <sub>2</sub>	[× 10 <sup>4</sup> Nm/rad]	0.47	0.75	1.4	2.6	5.1
	K <sub>3</sub>	[× 10 <sup>4</sup> Nm/rad]	0.52	0.82	1.4	2.7	5.6
	θ <sub>1</sub>	[arc-min]	1.7	2.0	2.2	2.2	2.2
	θ <sub>2</sub>	[arc-min]	5.0	5.5	6.3	6.4	7.2
80 100 120	K <sub>1</sub>	[× 10 <sup>4</sup> Nm/rad]	0.44	0.86	1.6	2.9	6.2
	K <sub>2</sub>	[× 10 <sup>4</sup> Nm/rad]	0.60	1.0	1.9	3.2	6.5
	K <sub>3</sub>	[× 10 <sup>4</sup> Nm/rad]	0.72	1.0	1.9	3.1	6.5
	θ <sub>1</sub>	[arc-min]	1.6	1.6	1.5	1.7	1.6
	θ <sub>2</sub>	[arc-min]	4.0	4.1	4.6	5.2	5.7

Average value shown in the table

STANDARD TYPE D

### Starting Torque (Closed type, Unit)

What is Starting Torque?

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

Ratio	Size				
	35 [cNm]	42 [cNm]	50 [cNm]	63 [cNm]	80 [cNm]
50	7.0	11	14	17	26
80	6.8	9.5	13	24	26
100	6.4	9.4	11	14	20
120	-	8.1	9.3	14	20

For reference only. Torque value may vary depending on the condition.

### Output Starting Torque (Closed type, Unit)

What is Output Starting Torque?

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

Ratio	Size				
	35 [Nm]	42 [Nm]	50 [Nm]	63 [Nm]	80 [Nm]
50	1.2	3.6	4.4	5.8	13
80	1.6	3.9	7.2	13	26
100	1.7	5.7	8.6	9.4	23
120	-	4.2	8.1	10	30

For reference only. Torque value may vary depending on the condition.

### No-load Running Torque (Closed type, Unit)

What is No-load Running Torque?

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

Ratio	Input speed	Size				
		35 [cNm]	42 [cNm]	50 [cNm]	63 [cNm]	80 [cNm]
50	500 r/min	3.4	7.5	9.2	17	35
	1000 r/min	4.3	8.2	11	18	37
	2000 r/min	5.0	8.5	13	18	39
	3500 r/min	5.4	11	14	22	38
80	500 r/min	3.2	7.6	10	20	35
	1000 r/min	4.0	8.7	12	21	38
	2000 r/min	4.8	8.9	14	22	39
	3500 r/min	5.2	11	14	24	38
100	500 r/min	3.2	7.1	11	21	36
	1000 r/min	4.0	8.2	13	23	39
	2000 r/min	4.7	8.4	14	24	39
	3500 r/min	5.1	9.7	14	25	38
120	500 r/min	-	6.7	9.8	23	40
	1000 r/min	-	8.1	12	24	41
	2000 r/min	-	8.4	13	26	41
	3500 r/min	-	8.4	13	26	39

For reference only. Torque value may vary depending on the condition.

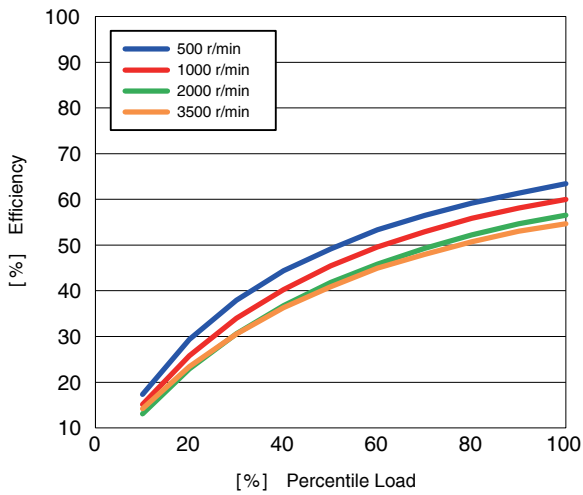


**Efficiency (Closed type, Unit)**

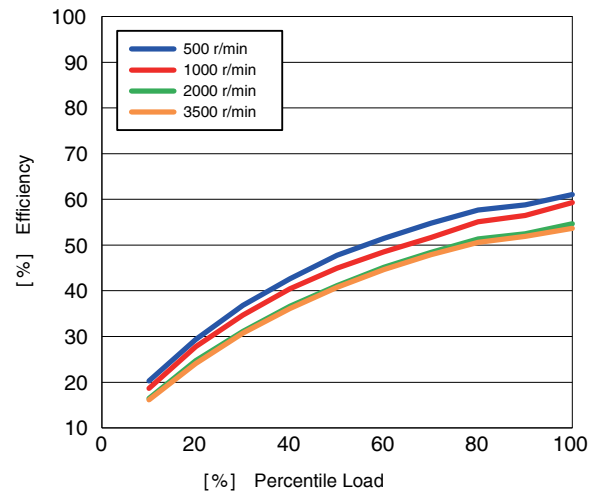
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25°C

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

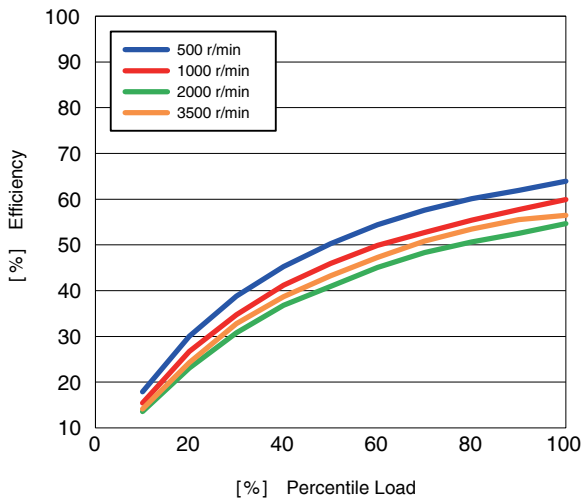
WPU-35-50



WPU-35-80



WPU-35-100



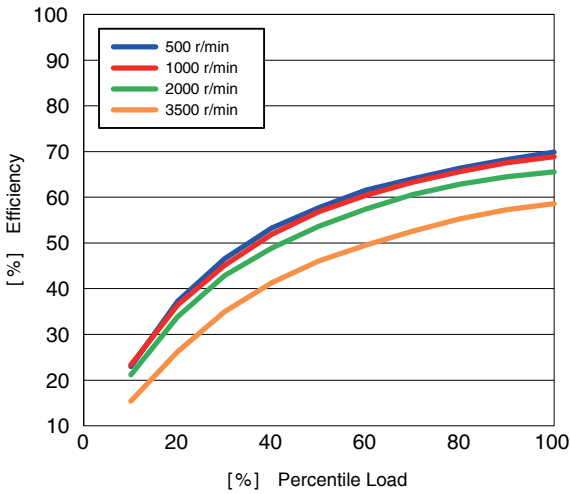
STANDARD TYPE D

**Efficiency (Closed type, Unit)**

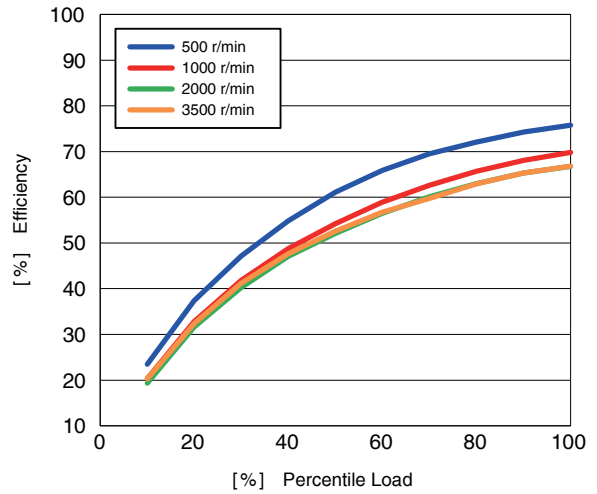
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25 °C

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

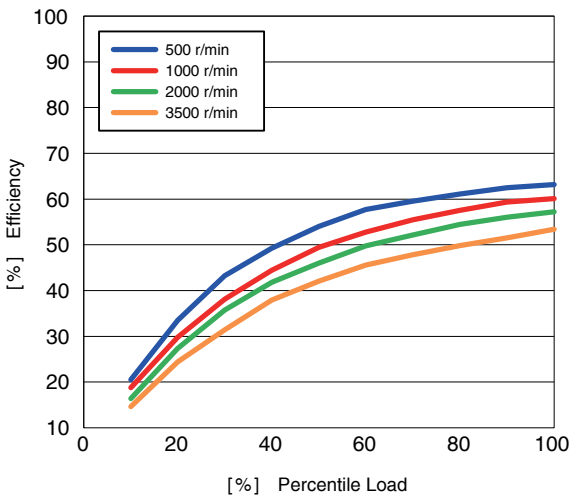
WPU-42-50



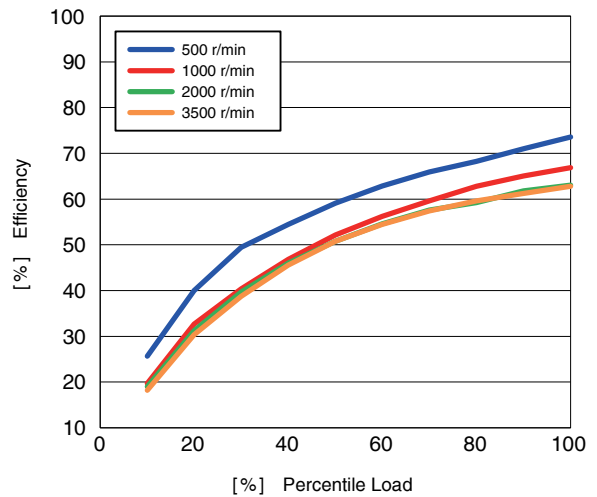
WPU-42-80



WPU-42-100



WPU-42-120



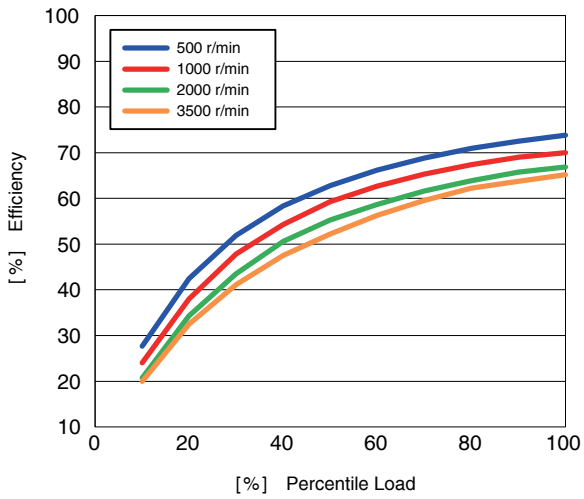
**Efficiency (Closed type, Unit)**

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

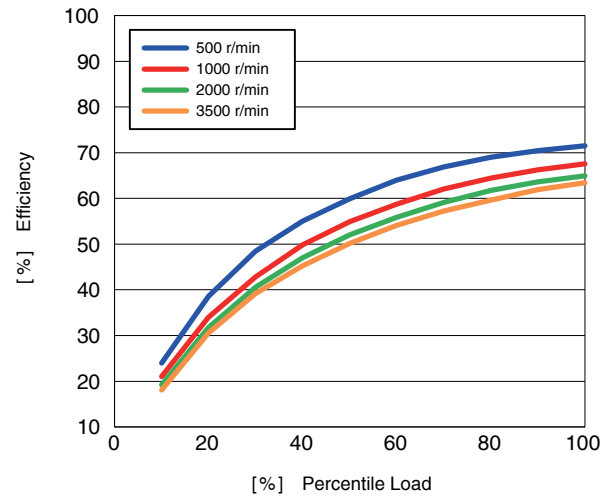
\* These diagrams represent the average value of the actual measurement.

STANDARD TYPE D

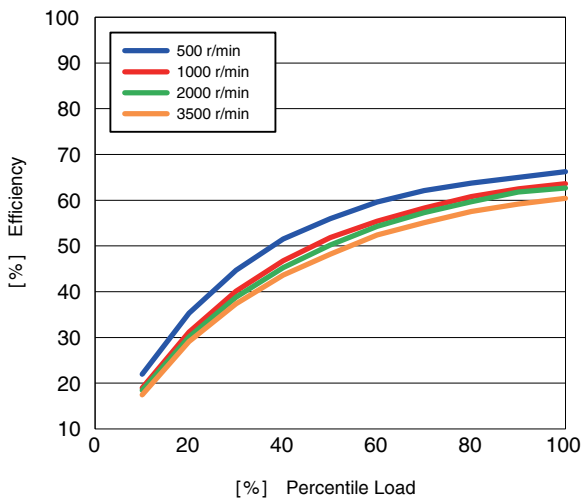
WPU-50-50



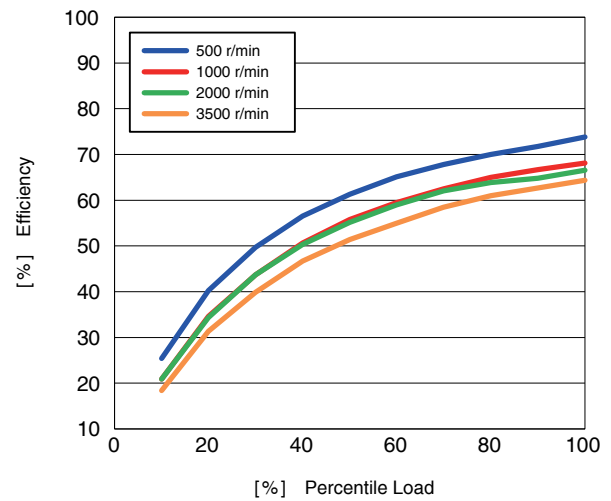
WPU-50-80



WPU-50-100



WPU-50-120

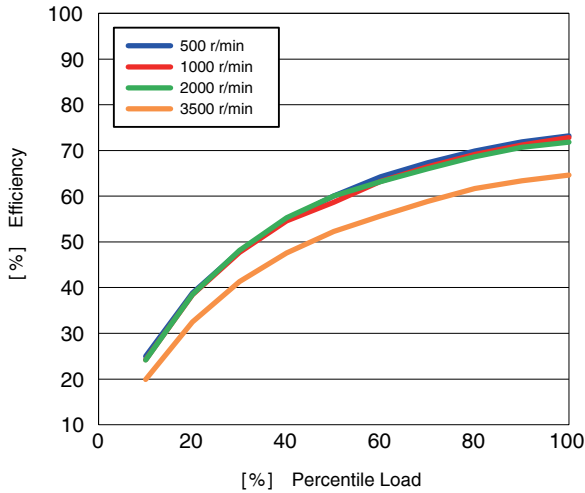


**Efficiency (Closed type, Unit)**

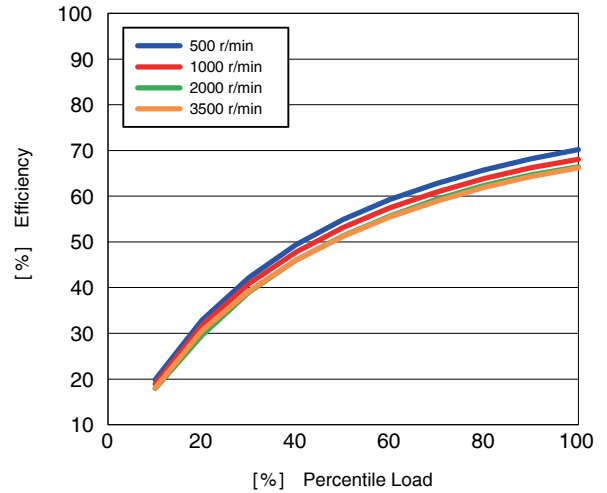
- Percentile Load (%) is equal to load torque divided by allowable average torque.
- Ambient temperature: 25 °C

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

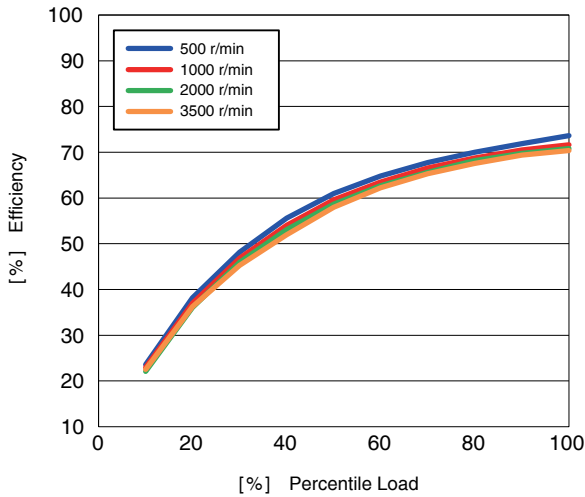
WPU-63-50



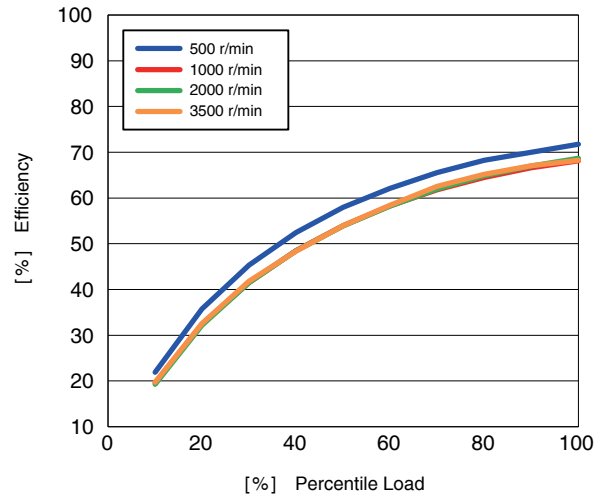
WPU-63-80



WPU-63-100



WPU-63-120



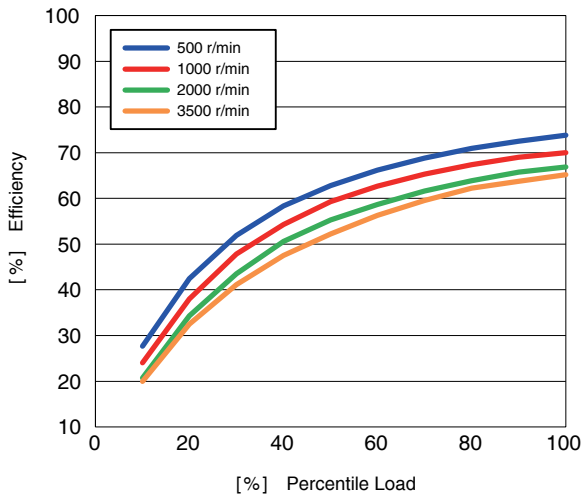
**Efficiency (Closed type, Unit)**

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

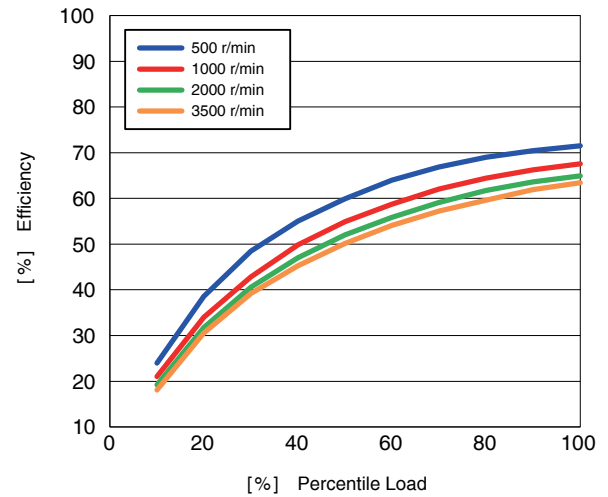
\* These diagrams represent the average value of the actual measurement.

STANDARD TYPE D

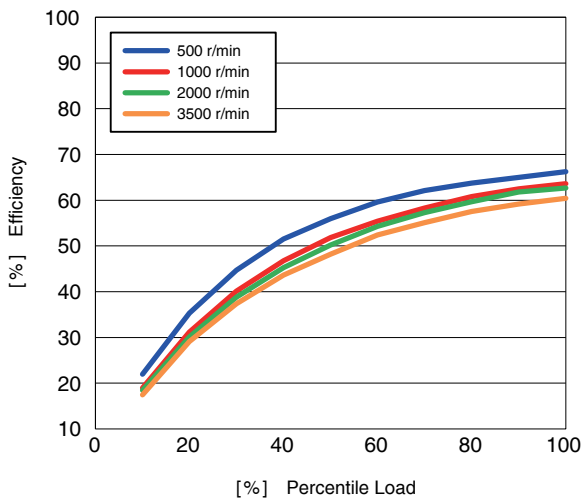
WPU-80-50



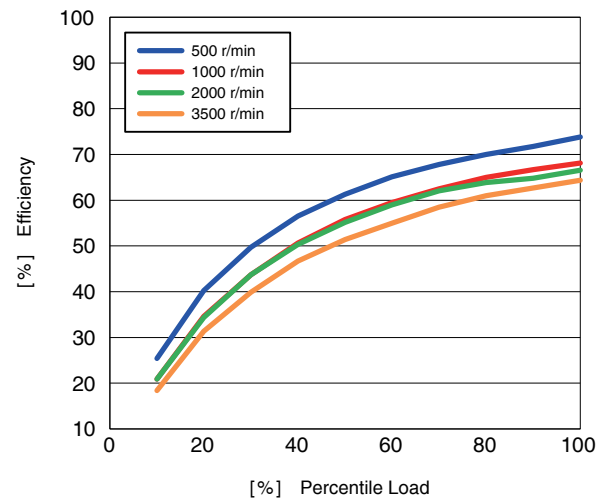
WPU-80-80



WPU-80-100



WPU-80-120





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