

# HarmonicGearhead<sup>®</sup>

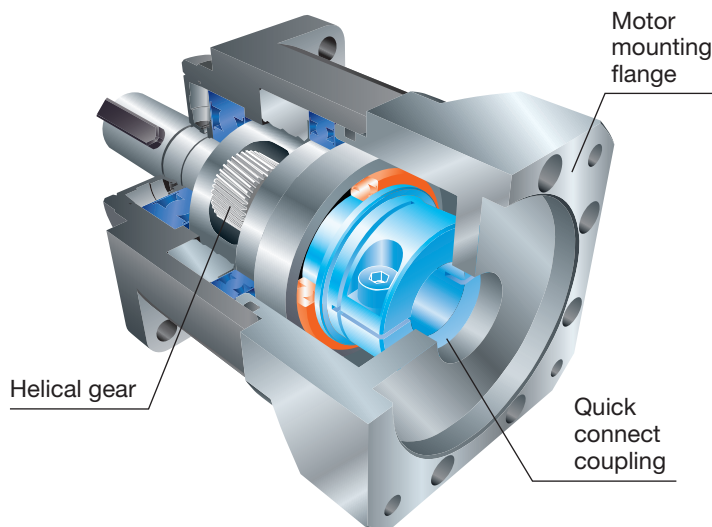
FINE MECHANICS & TOTAL *motion* CONTROL

High-performance Gearheads for Servo Motors

## HarmonicPlanetary<sup>®</sup> HPN Series



The precision planetary gear speed reducer achieved quiet, light weight and compact with low cost and quick delivery.

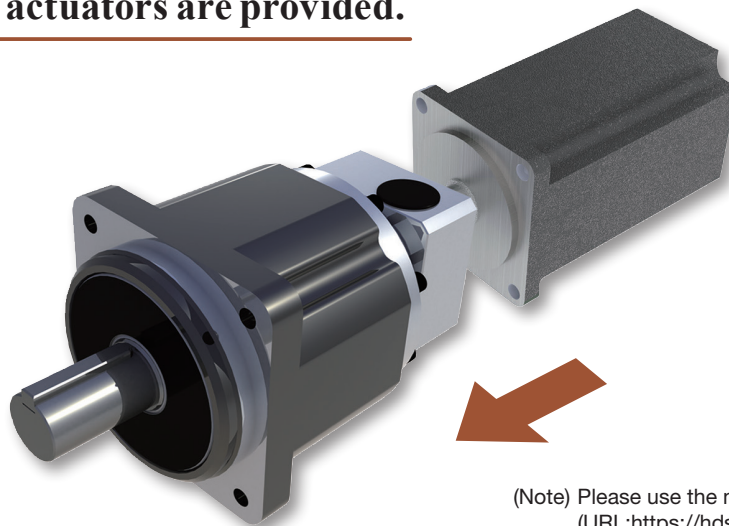


The HPN series adopts a high-precision helical gear. The precision planetary gear speed reducer achieved quiet, light weight and compact with low cost and quick delivery. The HPN series are newly added to our gear head series widely used in industrial machinery and enriched the product lineup. Selecting the HPN series from the gear head type speed reducers will improve the durability and reliability of the equipment.

- ◆ Backlash: 3/5 arc-min or less (Single stage type), 3/5/7 arc-min or less (Two stage type)
- ◆ Reduction ratio: 1/3 to 1/50
- ◆ Efficiency: 90% or more
- ◆ Helical gearing
- ◆ Quiet design: Noise 58dB or lower (Size 14)

**Easy quick connect installation to each manufacturer's servo motor!**

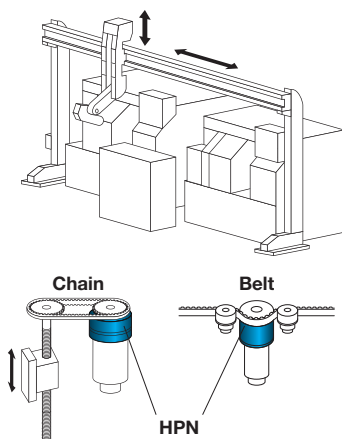
**High-precision actuators are provided.**



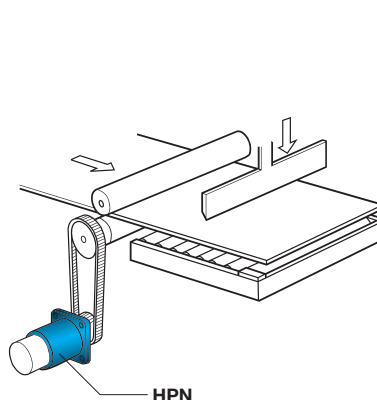
(Note) Please use the model selection tool  
(URL: <https://hds-tech.jp/ecat/ogcte/index.html>)  
on our website to find the model that matches  
with each manufacturer's servo motor.

## Various mechanical devices

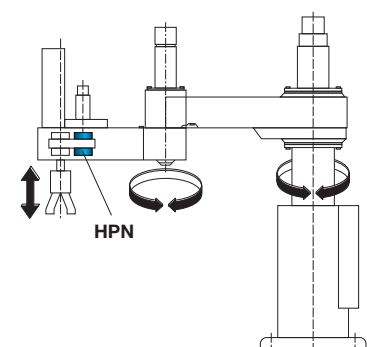
Gantry robots



Roller drive



Preliminary axes of SCARA robots



# HarmonicPlanetary® HPN Series

## Size

11, 14, 20, 32, 40

5  
Sizes

## Peak torque

9N·m to 752N·m

## Reduction ratio

Single stage: 3 to 10  
Two stage: 15 to 50

## Backlash

Single stage gear ratios:  
3/5 arc-min or less  
Two stage gear ratios:  
3/5/7 arc-min or less

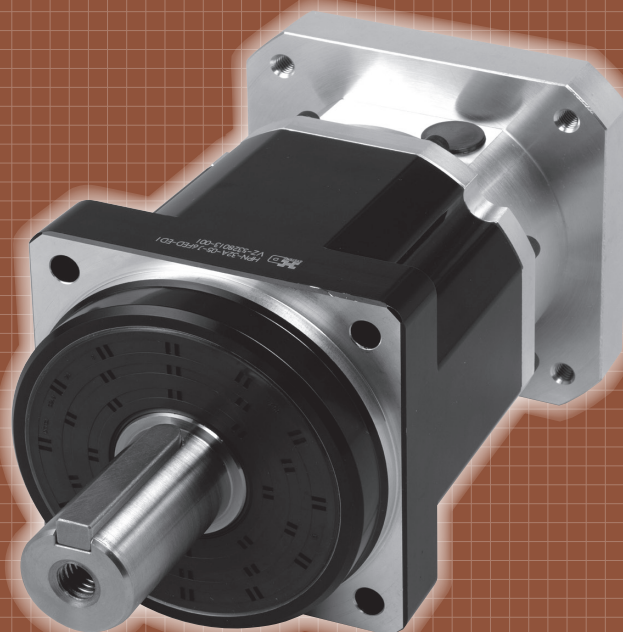
## High efficiency

90% or higher

## Easy mounting to a wide variety of servo motors

Yaskawa Electric, Mitsubishi Electric,  
Panasonic

For other servo motors, please feel free to contact the nearest sales office.



# CONTENTS

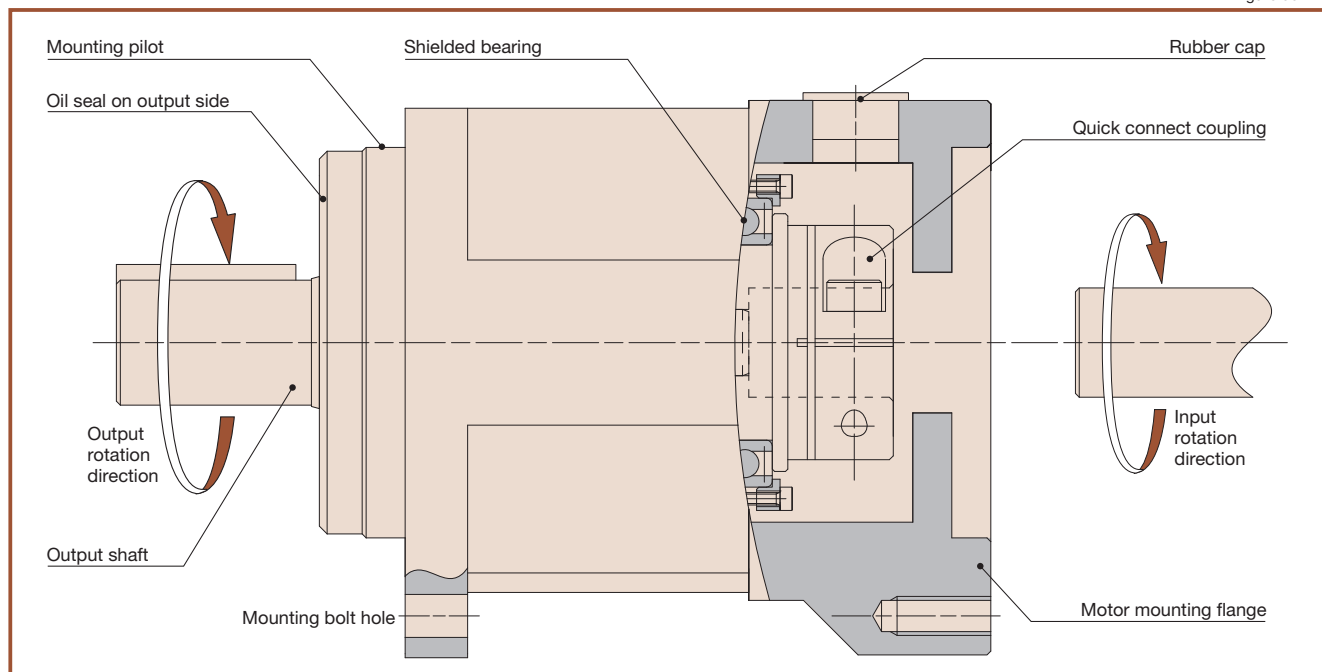
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Outline Dimensions	003

## HPN - 20 A - 05 - J6 ECB-DC1 - SPEC1 - SPEC2

Model Name	Size	Design Revision	Reduction Ratio	Output Shaft Configuration	Input side Configuration Symbol	Backlash Symbol				Special Specifications
HPN High performance HarmonicPlanetary®	11	A	4, 5, 7, 10, 15, 20, 25, 30, 35, 40, 45, 50	J6: Straight shaft (with key and center tapped hole)  J8: Straight shaft (without key, with center tapped hole)	Numeral/alphabet letters 5 or 6 digits: Motor flange and input shaft coupling shape symbol (Symbol varies in accordance with the mounted motor.)	Size	Reduction Ratio	Backlash	Symbol	None: standard product  SP: special specifications
	11		4~10			5 arc-min or less	None			
	14		3~10			5 arc-min or less	None			
	11, 14		15~50			7 arc-min or less	None			
	20		15~50			5 arc-min or less	BL5			
	20, 32, 40		3~10			3 arc-min or less	BL3			
						32, 40	15~50	3 arc-min or less	BL3	

## Structural drawing

Figure 001 - 1



Rating Table

Please contact us if you have any questions about specifications and comparisons with other company's products.

Table 002-1

Size	Number of stages	Reduction ratio	Rated output torque *1 L <sub>10</sub>	Rated output torque *1 L <sub>50</sub>	Permissible peak torque at start/stop *2	Permissible max. momentary torque *3	Rated Input Speed *4	Maximum Input Speed *5
			N·m	N·m	N·m	N·m	r/min	r/min
11	1	4	9	14	14	40	3000	10000
		5	9	14	16	40		
		7	8	11	11	40		
		10	7	9	9	40		
	2	15	11	18	24	40		
		20	13	22	24	40		
		25	13	20	24	40		
		30	15	25	26	40		
		35	16	26	26	40		
		40	17	26	26	40		
45	17	26	26	40				
50	18	26	26	40				
14	1	3	14	22	25	89	3000	6000
		4	18	28	50	110		
		5	18	29	50	107		
		7	20	30	37	100		
	2	10	14	18	18	79		
		15	21	30	43	97		
		20	23	30	49	100		
		25	26	30	38	102		
		30	26	40	48	98		
		35	28	40	49	99		
		40	29	30	38	100		
		45	29	30	38	100		
		50	20	26	26	94		
		20	1	3	31	51		
4	50			80	130	256		
5	52			80	149	256		
7	55			80	113	256		
2	10		41	54	54	216		
	15		59	80	129	256		
	20		66	80	147	256		
	25		72	80	114	256		
	30		72	80	139	250		
	35		79	80	112	256		
40	80	80	112	256				
45	80	80	112	256				
50	58	75	75	216				
32	1	3	94	153	254	625	3000	6000
		4	122	198	376	625		
		5	127	200	376	625		
		7	135	200	376	625		
	2	10	128	185	185	625		
		15	146	200	376	625		
		20	162	200	376	625		
		25	176	200	376	625		
		30	179	250	376	625		
		35	193	250	376	625		
		40	200	300	376	625		
		45	206	300	376	625		
50	193	251	251	625				
40	1	3	272	440	752	1137	3000	6000
		4	287	460	752	1265		
		5	298	480	752	1265		
		7	317	510	752	829		
	2	10	302	480	509	829		
		15	342	530	752	1265		
		20	380	600	752	1265		
		25	413	650	752	1127		
		30	421	650	752	1265		
		35	452	700	752	1127		
		40	468	700	752	1127		
		45	484	700	752	1127		
50	432	562	562	1162				

\*1: Torque at life of 20,000h when speed is at rated input speed. (L<sub>10</sub>:10% damage probability, L<sub>50</sub>:average life)  
\*2: Limit for torque during start and stop cycles.  
\*3: Limit for torque during emergency stops or from external shock loads. Always operate below this value.  
\*4: Limit for average input speed during operations. Make it a point to operate below this value especially when the operation mode is near continuous operation.  
\*5: Maximum instantaneous input speed.

Performances

Table 002-2

Size	11	14	20	32	40	11	14	20	32	40
Number of stages	1					2				
Reduction ratio	4, 5, 7, 10		3, 4, 5, 7, 10			15, 20, 25, 30, 35, 40, 45, 50				
Backlash arc·min	5 or less		3 or less			7 or less		5 or less	3 or less	
Noise dB	56 or less	58 or less	60 or less	63 or less	65 or less	56 or less	58 or less	60 or less	63 or less	65 or less

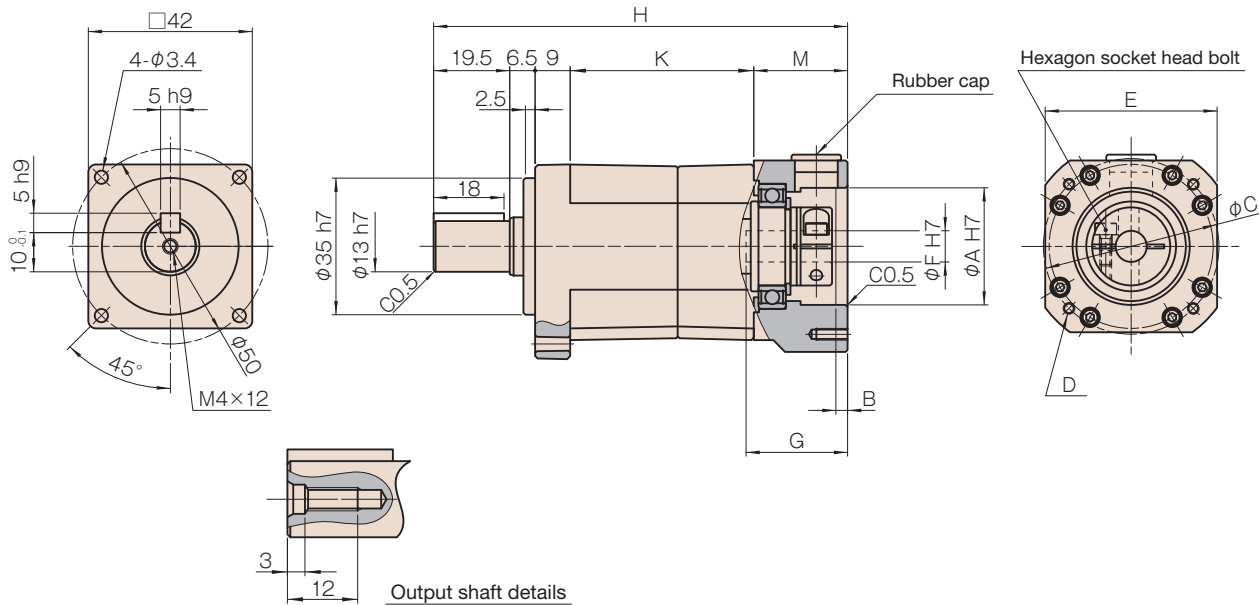
\* Noise values exclude reduction ratio 1/3. Please contact us for details.



# HPN-11A Outline Dimensions

Figure 003 - 1

[Unit: mm]



\* The dimension tolerances that are not specified vary depending on the manufacturing method (casting, machined components). Please contact us for dimension tolerances not shown on the drawing above.  
 \* Output shaft configuration shown is J6 (with a key and center tapped hole). The configuration J8 does not have a key.

## Dimension Table

Table 003 - 1  
[Unit: mm]

	Configuration symbol *1	A (H7)	B	C	D	E	F (H7)		G	H	K	M	Mass (kg) *2
							Min	Max					
Single stage	BH-□	30	3	45	4-M3×8	□44	8	8	25.5	86.5	27.5	24	0.44
	HH-□			46	4-M4×10				27.5	88.5		26	0.45
	QH-□			46	4-M4×10				27.5	88.5		26	0.45
Two stage	BH-□	30	3	45	4-M3×8	□44	8	8	25.5	106	47	24	0.57
	HH-□			46	4-M4×10				27.5	108		26	0.58
	QH-□			46	4-M4×10				27.5	108		26	0.58

Dimensions of typical products are shown. Please contact us for dimensions of products not listed above.  
 For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.  
 Contact us if special installation methods are required.

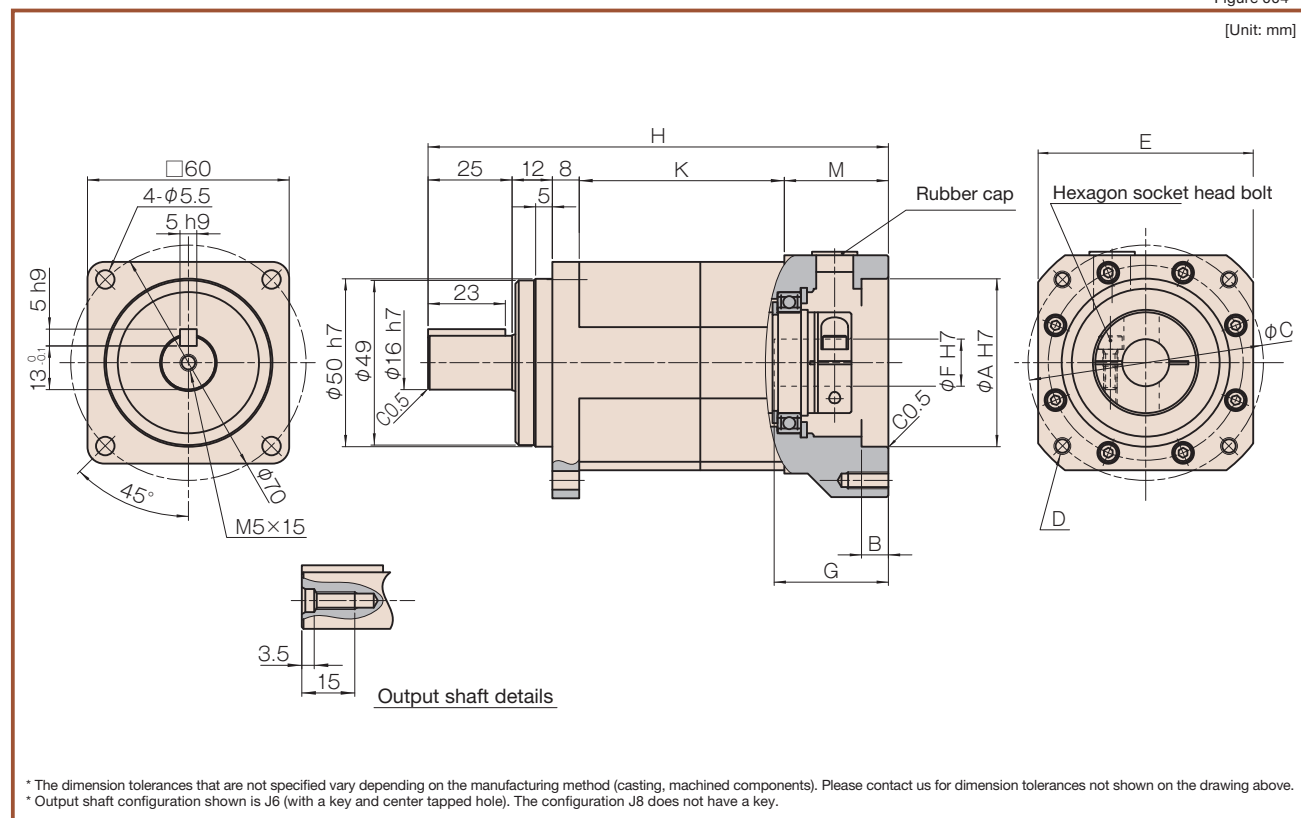
\*1: A symbol for input shaft coupling is supplied in "□" in configuration symbols. Please use the model selection tool (URL: <https://hds-tech.jp/ecat/ogcte/index.html>) on our website.

\*2: The mass varies slightly depending on the reduction ratio and on the inside diameter of input shaft coupling.

## HPN-14A Outline Dimensions

Figure 004 - 1

[Unit: mm]



## Dimension Table

Table 004 - 1  
[Unit: mm]

	Configuration symbol *1	A (H7)	B	C	D	E	F (H7)		G	H	K	M	Mass (kg) *2
							Min	Max					
Single stage	VA-□	30	5	46	4-M4×10	□41.6	8	8	25.5	107	36	26	0.95
	WA-□			45	4-M3×8								
	XA-□	50	5.5	70	4-M5×12	□62	8	14	30.5	112		31	1.20
	YA-□			4-M4×10									
Two stage	VA-□	30	5	46	4-M4×10	□41.6	8	8	27	132	61	26	1.30
	WA-□			45	4-M3×8								
	XA-□	50	5.5	70	4-M5×12	□62	8	14	32.5	137		31	1.60
	YA-□			4-M4×10									

Dimensions of typical products are shown. Please contact us for dimensions of products not listed above.

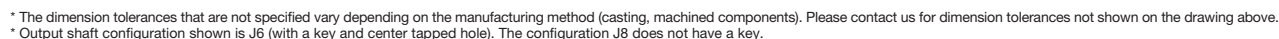
For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.

Contact us if special installation methods are required.

\*1: A symbol for input shaft coupling is supplied in "□" in configuration symbols. Please use the model selection tool (URL: <https://hds-tech.jp/ecat/ogcte/index.html>) on our website.

\*2: The mass varies slightly depending on the reduction ratio and on the inside diameter of input shaft coupling.

## [Unit: mm]

Table 005-1  
[Unit: mm]

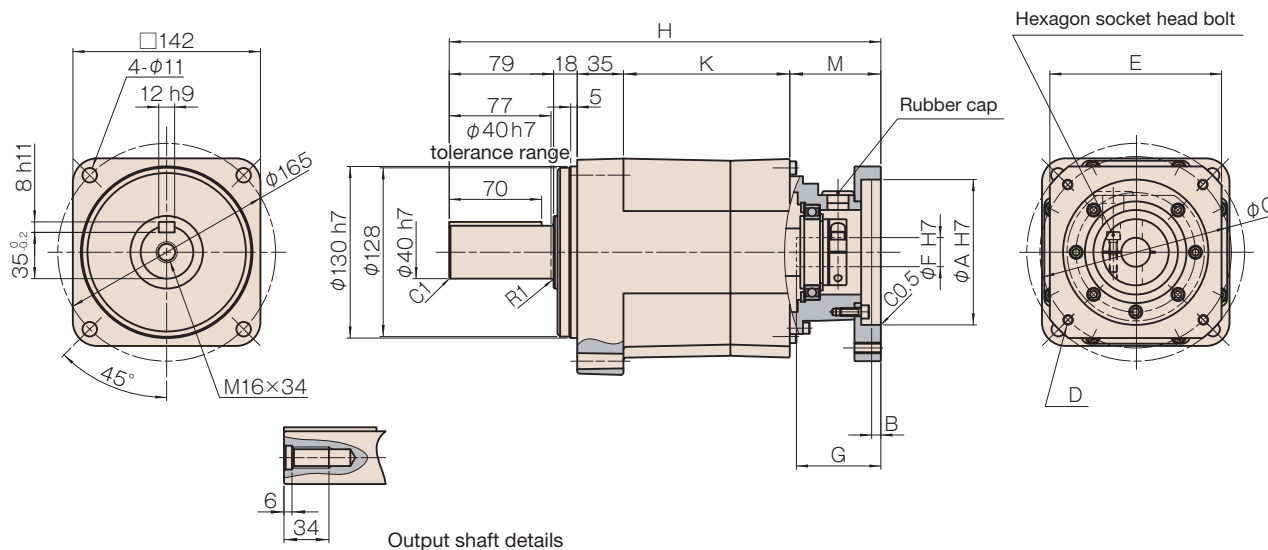
\*1: A symbol for input shaft coupling is supplied in "□" in configuration symbols. Please use the model selection tool (URL:<https://hds-tech.jp/ecat/ogcte/index.html>) on our website.  
\*2: The mass varies slightly depending on the reduction ratio and on the inside diameter of input shaft coupling.



# HPN-40A Outline Dimensions

Figure 007 - 1

[Unit: mm]



\* The dimension tolerances that are not specified vary depending on the manufacturing method (casting, machined components). Please contact us for dimension tolerances not shown on the drawing above.  
 \* Output shaft configuration shown is J6 (with a key and center tapped hole). The configuration J8 does not have a key.

## Dimension Table

Table 007 - 1  
[Unit: mm]

	Configuration symbol *1	A (H7)	B	C	D	E	F (H7)		G	H	K	M	Mass (kg) *2
							Min	Max					
Single stage	LGG-□	95	7	115	4-M6 Through	□100	16	24	71	282.5	81	69.5	13
	LGJ-□				4-M8 Through								
	LGD-□	110	7	145	4-M8 Through	□130	16	24	71	282.5		69.5	13
	JGK-□		6.5	145	4-M8 Through							□130	28
	JGH-□	114.3	6.5	200	4-M12 Through	□180	28	35	84	295.5		82.5	18
	KGH-□						42	42	117	328.5		115.5	17
	JGI-□	200	6.5	235	4-M12 Through	□220	28	35	84	295.5		82.5	16
Two stage	FEG-□	95	7	115	4-M6 Through	□100	16	24	63	327	126	69	16
	FEJ-□				4-M8 Through								17
	FED-□	110	7	145	4-M8 Through	□130	16	24	63	327		69	17
	LED-□								71	335		77	
	JEK-□	114.3	6.5	145	4-M8 Through	□130	22	35	84	348		90	17
	JEH-□		6.5	200	4-M12 Through	□180	22	35	84	348		90	18
	JEI-□	200	6.5	235	4-M12 Through	□220	22	35	84	348		90	18

Dimensions of typical products are shown. Please contact us for dimensions of products not listed above.

For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.

Contact us if special installation methods are required.

\*1: A symbol for input shaft coupling is supplied in "□" in configuration symbols. Please use the model selection tool (URL: <https://hds-tech.jp/ecat/ogcte/index.html>) on our website.

\*2: The mass varies slightly depending on the reduction ratio and on the inside diameter of input shaft coupling.





# HarmonicPlanetary® HPN Right Angle Type

## Size

11, 14, 20, 32, 40

5

Sizes

## Peak torque

9N·m to 752N·m

## Reduction ratio

Single stage: 3 to 10  
Two stage: 15 to 50

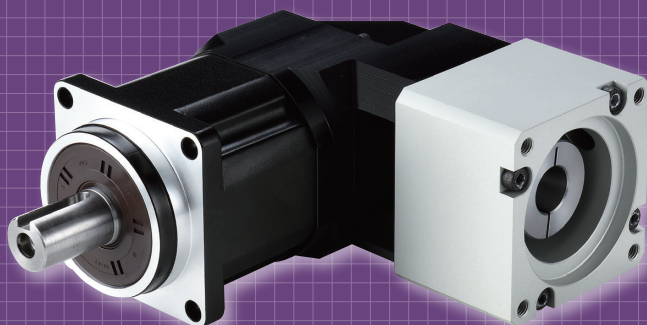
## Backlash

Single stage gear ratios:  
6 arc-min or less  
Two stage gear ratios:  
9 arc-min or less

## Easy mounting to a wide variety of servo motors

Yaskawa Electric, Mitsubishi Electric,  
Panasonic

For other servo motors, please feel free to contact the nearest sales office.



There is also a Right angle type. Please contact the nearest office for details.

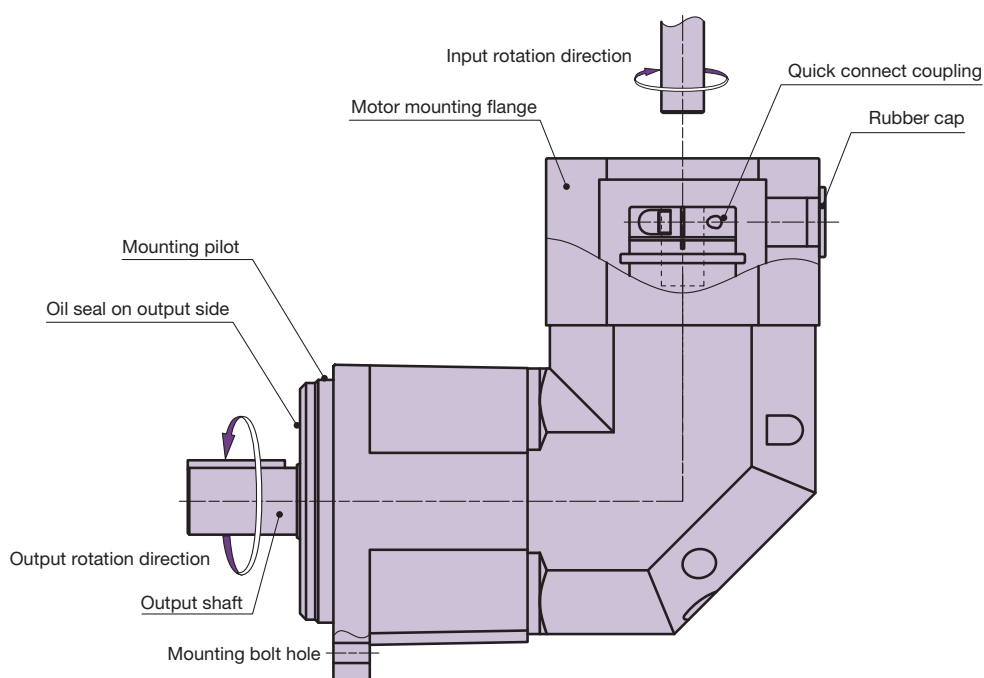
**HPN - 20 | A - 15 - J6 | PC - WB - RA2**

Model Name	Size	Design Revision	Reduction Ratio	Output Shaft Configuration	Configuration Symbol 1	Configuration Symbol 2	Right Angle Part Symbol
<div>HPN</div> <div>Right Angle</div> <div>HarmonicPlanetary®</div>	11	A	4, 5, 7, 10	J6: Straight shaft (with key and center tapped hole)	Configuration symbol of motor flange*	Configuration symbol of input shaft coupling*	RA1
	14		3, 4, 5, 7, 10, 15, 20, 25, 30, 35, 40, 45, 50	J8: Straight shaft (without key, with center tapped hole)			RA1, RA2
	20						RA2, RA3
	32						RA3, RA4
	40						RA4, RA5

\* Symbol varies in accordance with the mounted motor.

## Structural drawing

Figure 009 - 1



Rating Table

Please contact us if you have any questions about specifications and comparisons with other company's products.

Table 010 - 1

Size	Number of stages	Reduction ratio	Rated output torque *1 L <sub>10</sub>	Rated output torque *1 L <sub>50</sub>	Permissible peak torque at start/stop *2	Permissible max. momentary torque *3	Rated Input Speed *4	Maximum Input Speed *5	Backlash
			N·m	N·m	N·m	N·m	r/min	r/min	arc·min
11A	1	4	9	14	14	40	3000	10000	9 or less
		5	9	14	16	40			8 or less
		7	8	11	11	40			7 or less
		10	7	9	9	40			
14A	1	3	14	21	21	78	3000	6000	6 or less
		4	18	28	28	104			
		5	18	29	35	107			
		7	20	30	37	100			
	2	10	14	18	18	79			9 or less
		15	21	30	43	97			
		20	23	30	49	100			
		25	26	30	38	102			
		30	26	40	48	98			
		35	28	40	49	99			
		40	29	30	38	100			
		45	29	30	38	100			
		50	20	26	26	94			
20A	1	3	31	45	45	147	3000	6000	6 or less
		4	50	60	60	196			
		5	52	75	75	245			
		7	55	80	105	256			
	2	10	41	54	54	216			9 or less
		15	59	80	105	256			
		20	66	80	140	256			
		25	72	80	114	256			
		30	72	80	139	250			
		35	79	80	112	256			
		40	80	80	112	256			
		45	80	80	112	256			
		50	58	75	75	216			
32A	1	3	84	84	84	288	3000	6000	6 or less
		4	112	112	112	384			
		5	127	139	139	480			
		7	135	195	195	625			
	2	10	128	185	185	625			9 or less
		15	146	200	225	625			
		20	162	200	297	625			
		25	176	200	371	625			
		30	179	250	376	625			
		35	193	250	376	625			
		40	200	300	376	625			
		45	206	300	376	625			
		50	193	251	251	625			
40A	1	3	186	186	186	1,137	3000	5000	6 or less
		4	245	245	245	1,265			
		5	298	310	310	1,265			
		7	317	430	430	829			
	2	10	302	480	509	829		6000	9 or less
		15	342	417	417	1265			
		20	380	555	555	1265			
		25	413	650	694	1127			
		30	421	650	752	1265			
		35	452	700	752	1127			
		40	468	700	752	1127			
		45	484	700	752	1,127			
		50	432	562	562	1,162			

\*1: Torque at life of 20,000h when speed is at rated input speed. (L<sub>10</sub>:10% damage probability, L<sub>50</sub>:average life)  
\*2: Limit for torque during start and stop cycles.  
\*3: Limit for torque during emergency stops or from external shock loads. Always operate below this value.  
\*4: Limit for average input speed during operations. Make it a point to operate below this value especially when the operation mode is near continuous operation.  
\*5: Maximum instantaneous input speed.

Performances

Table 010 - 2

Size	11			14	20	32	40	14	20	32	40
Number of stages	1						2				
Reduction ratio	4	5	7, 10	3, 4, 5, 7, 10				15, 20, 25, 30, 35, 40, 45, 50			
Backlash arc·min	9 or less	8 or less	7 or less	6 or less				9 or less			

## Figure 011 - 1



Table 011 - 1  
[Unit: mm]

	Configuration symbol <sup>†</sup>	A(H7)	B	C	D	E	F (H7)		G	H	J	K	L	M	N	Mass (kg) <sup>‡2</sup>
							Min	Max								
Single stage	UA- <input type="checkbox"/>	30	3.5	45	M3x6	<input type="checkbox"/> 42.5	8	8	25	121.7	95.7	98.2	76.9	95.7	74.4	0.95
	UB- <input type="checkbox"/>	30	3.5	46	M4x8	<input type="checkbox"/> 42.5	8	8	25	121.7	95.7	98.2	76.9	95.7	74.4	0.95
	UD- <input type="checkbox"/>	30	3.5	46	M4x8	<input type="checkbox"/> 42.5	8	8	27.5	121.7	95.7	100.9	79.6	95.7	74.4	0.95
	UE- <input type="checkbox"/>	30	3.5	45	M3x6	<input type="checkbox"/> 42.5	8	8	27.5	121.7	95.7	100.9	79.6	95.7	74.4	0.95

## Figure 011 -2

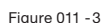
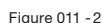
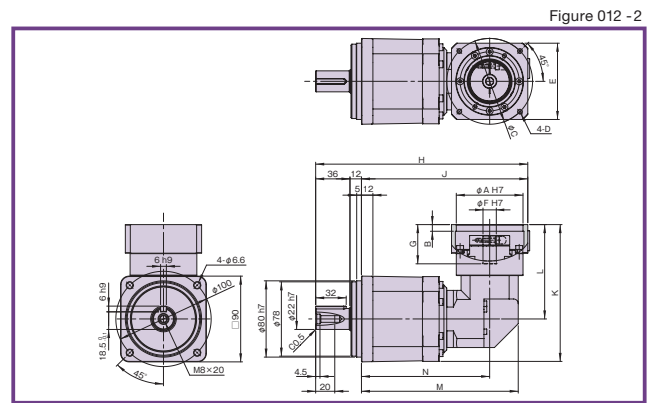
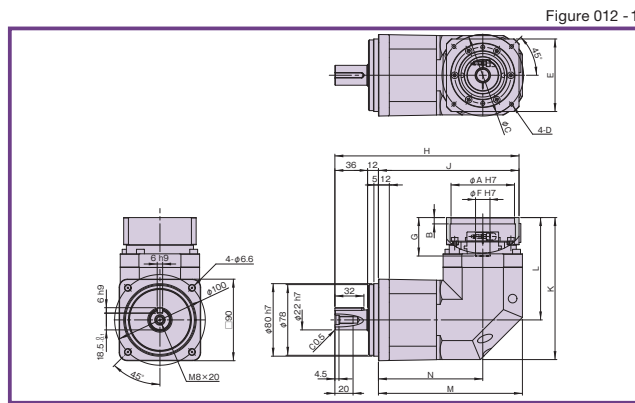


Table 011 -2  
[Unit: mm]

	Configuration symbol <sup>*1</sup>	A(H7)	B	C	D	E	F (H7)		G	H	J	K	L	M	N	Mass (kg) <sup>*2</sup>
							Min	Max								
Single stage	TA- □	50	5	70	M5×10	□ 60	8	14	32	156	119	118.5	88.5	119	89	2.1
	TB- □	50	5	70	M4×8	□ 60	8	14	32	156	119	118.5	88.5	119	89	2.1
	SB- □	70	7	90	M6×12	□ 80	14	24	40.5	166	129	129	99	119	89	2.3
	SC- □	80	7	100	M6×12	□ 90	14	24	40.5	171	134	129	99	119	89	2.3
	SF- □	70	7	90	M5×12	□ 80	14	24	40.5	166	129	129	99	119	89	2.3
	DC- □	80	7	100	M6×12	□ 90	14	24	43	171	134	131.7	101.7	119	89	2.3
Two stage	UA- □	30	3.5	45	M3×6	□ 42.5	8	8	25	165.7	128.7	106.9	76.9	128.7	107.4	1.7
	UB- □	30	3.5	46	M4×8	□ 42.5	8	8	25	165.7	128.7	106.9	76.9	128.7	107.4	1.7
	UD- □	30	3.5	46	M4×8	□ 42.5	8	8	27.5	165.7	128.7	109.6	79.6	128.7	107.4	1.7
	UE- □	30	3.5	45	M3×6	□ 42.5	8	8	27.5	165.7	128.7	109.6	79.6	128.7	107.4	1.7
	TA- □	50	5	70	M5×10	□ 60	8	14	32	179	142	118.5	88.5	142	112	2.3
	TB- □	50	5	70	M4×8	□ 60	8	14	32	179	142	118.5	88.5	142	112	2.3

\*2: The mass varies slightly depending on the reduction ratio and on the inside diameter of input shaft coupling.

## 20A Outline Dimensions

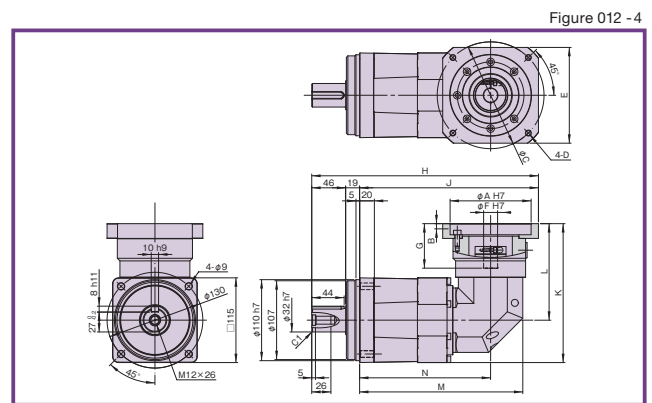
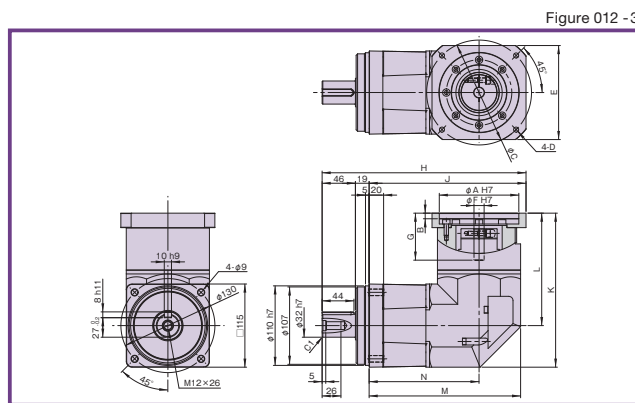


## Dimension Table

Table 012 - 1  
[Unit: mm]

	Configuration symbol <sup>1)</sup>	A(H7)	B	C	D	E	F (H7)		G	H	J	K	L	M	N	Mass (kg) <sup>2)</sup>
							Min	Max								
Single stage	RA-□	50	7	70	M5×12	□90	14	19	41.5	208.1	160.1	158	113	158.9	115.1	5.4
	RB-□	50	7	70	M4×8	□90	14	19	41.5	208.1	160.1	158	113	158.9	115.1	5.4
	PB-□	70	7	90	M6×12	□80	14	19	41.5	203.1	155.1	158	113	158.9	115.1	5.2
	PC-□	80	7	100	M6×12	□90	14	19	41.5	208.1	160.1	158	113	158.9	115.1	5.2
	MD-□	110	7	145	M8 Through	□130	19	24	59.5	228.1	180.1	176	131	158.9	115.1	5.9
	MG-□	95	7	115	M6 Through	□100	19	24	59.5	213.1	165.1	176	131	158.9	115.1	5.8
Two stage	MJ-□	95	7	115	M8 Through	□100	19	24	59.5	213.1	165.1	176	131	158.9	115.1	5.8
	TA-□	50	5	70	M5×10	□60	8	14	32	212.5	164.5	133.5	88.5	164.5	134.5	4.1
	TB-□	50	5	70	M4×8	□60	8	14	32	212.5	164.5	133.5	88.5	164.5	134.5	4.1
	SB-□	70	7	90	M6×12	□80	14	24	40.5	222.5	174.5	144	99	164.5	134.5	4.3
	SC-□	80	7	100	M6×12	□90	14	24	40.5	227.5	179.5	144	99	164.5	134.5	4.3
	SF-□	70	7	90	M5×12	□80	14	24	40.5	222.5	174.5	144	99	164.5	134.5	4.3
	DC-□	80	7	100	M6×12	□90	14	24	43	227.5	179.5	146.7	101.7	164.5	134.5	4.3

## 32A Outline Dimensions



## Dimension Table

Table 012 - 2  
[Unit: mm]

	Configuration symbol <sup>1)</sup>	A(H7)	B	C	D	E	F (H7)		G	H	J	K	L	M	N	Mass (kg) <sup>2)</sup>
							Min	Max								
Single stage	NA-□	70	7	90	M6×13	Φ 115	14	19	53.5	274.5	209.5	189	131.5	209.5	152	13
	NB-□	70	7	90	M5×11	Φ 115	14	19	53.5	274.5	209.5	189	131.5	209.5	152	13
	NC-□	80	7	100	M6×13	Φ 115	14	19	53.5	274.5	209.5	189	131.5	209.5	152	13
	LD-□	110	7	145	M8 Through	□130	14	24	64.5	282	217	213	155.5	209.5	152	13
	LG-□	95	7	115	M6 Through	□100	14	24	64.5	267	202	213	155.5	209.5	152	13
	KD-□	110	7	145	M8 Through	□130	14	24	72.5	282	217	221	163.5	209.5	152	13
	JK-□	110	6.5	145	M8 Through	□130	28	35	85.5	282	217	226	168.5	209.5	152	14
	JH-□	114.3	6.5	200	M12 Through	□180	28	35	85.5	307	242	234	176.5	209.5	152	15
	JI-□	200	6.5	235	M12 Through	□220	28	35	85.5	327	262	234	176.5	209.5	152	15
Two stage	PB-□	70	7	90	M6×12	□80	14	19	41.5	282.8	217.8	170.5	113	221.6	177.8	10
	PC-□	80	7	100	M6×12	□90	14	19	41.5	287.8	222.8	170.5	113	221.6	177.8	10
	MD-□	110	7	145	M8 Through	□130	19	24	59.5	307.8	242.8	188.5	131	221.6	177.8	10
	MG-□	95	7	115	M6 Through	□100	19	24	59.5	292.8	227.8	188.5	131	221.6	177.8	11
	MJ-□	95	7	115	M8 Through	□100	19	24	59.5	292.8	227.8	188.5	131	221.6	177.8	11

\* The dimension tolerances that are not specified vary depending on the manufacturing method (casting, machined components). Please contact us for dimension tolerances not shown on the drawing above.

\* Output shaft configuration shown is J6 (with a key and center tapped hole). The configuration J8 does not have a key. Dimensions of typical products are shown. Please contact us for dimensions of products not listed above.

For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc. Contact us if special installation methods are required.

\*1: A symbol for input shaft coupling is supplied in "□" in configuration symbols. Please contact your nearest sales office.

\*2: The mass varies slightly depending on the reduction ratio and on the inside diameter of input shaft coupling.

## 40A Outline Dimensions

Figure 013 - 1

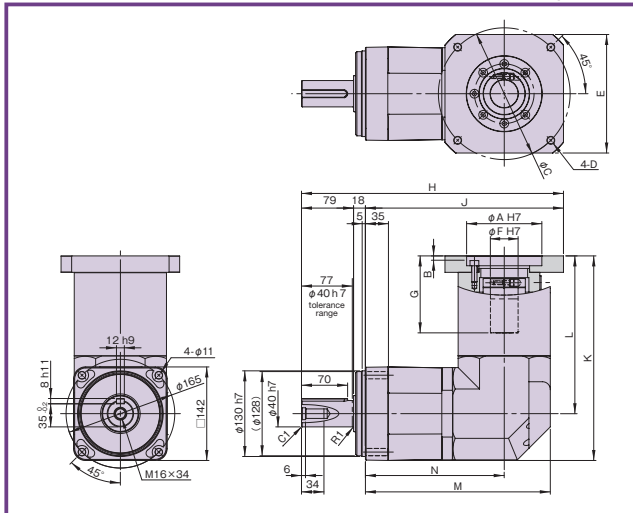
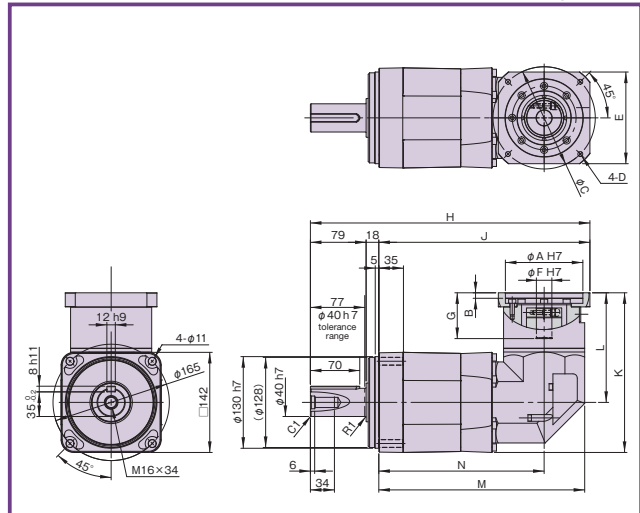


Figure 013 - 2



## Dimension Table

Table 013 - 1  
[Unit: mm]

	Configuration symbol <sup>1)</sup>	A(H7)	B	C	D	E	F (H7)		G	H	J	K	L	M	N	Mass (kg) <sup>2)</sup>
							Min	Max								
Single stage	HJ- □	95	7	115	M8 Through	□ 100	19	24	70	357.7	260.7	264.5	193.5	280.7	210.7	25
	GD- □	110	7	145	M8 Through	□ 130	19	24	70	372.7	275.7	264.5	193.5	280.7	210.7	26
	FK- □	110	6.5	145	M8 Through	□ 130	28	35	84	372.7	275.7	278.5	207.5	280.7	210.7	26
	FH- □	114.3	6.5	200	M12 Through	□ 180	28	35	84	397.7	300.7	278.5	207.5	280.7	210.7	26
	FI- □	200	6.5	235	M12 Through	□ 220	28	35	84	417.7	320.7	278.5	207.5	280.7	210.7	26
Two stage	EH- □	114.3	6.5	200	M12 Through	□ 180	42	42	122	397.7	300.7	315.5	245.5	280.7	210.7	28
	LD- □	110	7	145	M8 Through	□ 130	14	24	64.5	441.5	344.5	226.5	155.5	337	279.5	22
	LG- □	95	7	115	M6 Through	□ 100	14	24	64.5	426.5	329.5	226.5	155.5	337	279.5	22
	LJ- □	95	7	115	M8 Through	□ 100	14	24	64.5	426.5	329.5	226.5	155.5	337	279.5	22
	KD- □	110	7	145	M8 Through	□ 130	14	24	72.5	441.5	344.5	234.5	163.5	337	279.5	22
	JK- □	110	6.5	145	M8 Through	□ 130	28	35	85.5	441.5	344.5	239.5	168.5	337	279.5	24
	JH- □	114.3	6.5	200	M12 Through	□ 180	28	35	85.5	466.5	369.5	247.5	176.5	337	279.5	24
	JI- □	200	6.5	235	M12 Through	□ 220	28	35	85.5	486.5	389.5	247.5	176.5	337	279.5	24

\* The dimension tolerances that are not specified vary depending on the manufacturing method (casting, machined components). Please contact us for dimension tolerances not shown on the drawing above.

\* Output shaft configuration shown is J6 (with a key and center tapped hole). The configuration J8 does not have a key. Dimensions of typical products are shown. Please contact us for dimensions of products not listed above.

For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.

Contact us if special installation methods are required.

\*1: A symbol for input shaft coupling is supplied in "□" in configuration symbols. Please contact your nearest sales office.

\*2: The mass varies slightly depending on the reduction ratio and on the inside diameter of input shaft coupling.





# Harmonic Planetary<sup>®</sup>

## Technical Information

Model Number Selection .....	016
Efficiency Characteristics .....	017
Output Shaft Bearing Load Limits .....	021

## Product Handling

Motor Assembly Procedure .....	022
Speed reducer assembly Mounting the load to the output flange .....	023
Lubrication, Lubricant .....	024
Warranty, Discarding .....	025

## Model Number Selection (HPN Series)

Check your operating conditions and select suitable model Nos. based on the flowchart to fully demonstrate the excellent performance of the Harmonic Planetary® HPN series.

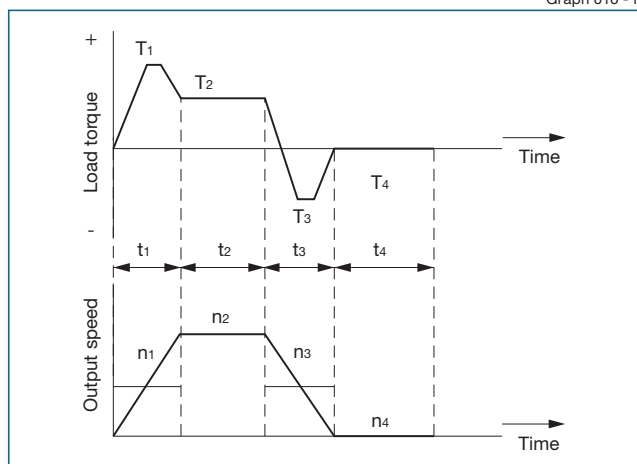
In general, the servo system is rarely in a continuous constant load state. The load torque changes according to the input rotational speed variation and comparatively large torque are applied at start and stop. Unexpected impact torque may be applied.

Check your operating conditions against the following load torque pattern and select suitable model Nos. based on the flowchart shown on the right. For confirmation of output shaft bearing, refer to "Output Shaft Bearing Load Limits" (page 021) in the technical data.

### Checking the load torque pattern

First, you need to look at the picture of the load torque pattern. Check the specifications shown in the figure below.

Graph 016 - 1



#### Obtain the value of each load torque pattern.

Load torque	T <sub>1</sub> to T <sub>n</sub> (N·m)
Time	t <sub>1</sub> to t <sub>n</sub> (sec)
Output speed	n <sub>1</sub> to n <sub>n</sub> (r/min)

#### <Normal operation pattern>

Starting time	T <sub>1</sub> , t <sub>1</sub> n <sub>1</sub>
Steady operation time	T <sub>2</sub> , t <sub>2</sub> , n <sub>2</sub>
Stopping (slowing) time	T <sub>3</sub> , t <sub>3</sub> , n <sub>3</sub>
Break time	T <sub>4</sub> , t <sub>4</sub> n <sub>4</sub>

#### <Maximum rotational speed>

Max. output rotational speed	n <sub>o max</sub> ≥ n <sub>1</sub> to n <sub>n</sub>
Max. input rotational speed (Restricted by motors)	n <sub>i max</sub> ≥ n <sub>1</sub> × R to n <sub>n</sub> × R R: Reduction ratio

#### <Impact torque>

When impact torque is applied T<sub>s</sub>

#### <Required lifespan>

L<sub>10</sub> = L (hours)

### Flowchart of model number selection

Select a model number according to the following flowchart.

If you find a value exceeding that from the ratings, you should review it with the upper-level model number or consider reduction of conditions including the load torque.

Calculate the average load torque applied on the output side from the load torque pattern: T<sub>av</sub> (N·m).

$$T_{av} = \sqrt[10/3]{\frac{|n_1| \cdot t_1 \cdot |T_1|^{10/3} + |n_2| \cdot t_2 \cdot |T_2|^{10/3} + \dots + |n_n| \cdot t_n \cdot |T_n|^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + \dots + n_n \cdot t_n}}$$

Calculate the average output speed based on the load torque pattern: n<sub>o av</sub> (r/min)

$$n_{o av} = \frac{|n_1| \cdot t_1 + |n_2| \cdot t_2 + \dots + |n_n| \cdot t_n}{t_1 + t_2 + \dots + t_n}$$

Select a model number temporarily with the following condition:  
T<sub>av</sub> ≤ Average load torque (See the rating table on page 002, 010)

Determine the reduction ratio (R) based on the maximum output rotational speed (n<sub>o max</sub>) and maximum input rotational speed (n<sub>i max</sub>).

$$\frac{n_{i max}}{n_{o max}} \geq R$$

(A limit is placed on n<sub>i max</sub> by motors.)

Calculate the maximum input rotational speed (n<sub>i max</sub>) from the maximum output rotational speed (n<sub>o max</sub>) and the reduction ratio (R).  
n<sub>i max</sub> = n<sub>o max</sub> × R

Calculate the average input rotational speed (n<sub>i av</sub>) from the average output rotational speed (n<sub>o av</sub>) and the reduction ratio (R): n<sub>i av</sub> = n<sub>o av</sub> × R ≤ Permissible average input rotational speed (n<sub>i</sub>).

Check whether the maximum input rotational speed is equal to or less than the values in the rating table.  
n<sub>i max</sub> ≤ maximum input rotational speed (r/min)

Check whether T<sub>1</sub> and T<sub>3</sub> are equal to or less than the permissible peak torque (N·m) value at start and stop from the ratings.

Check whether T<sub>s</sub> is equal to or less than the permissible maximum momentary torque (N·m) value from the ratings.

Calculate the lifetime and check whether it meets the specification requirement.

T<sub>r</sub>: Output torque  
n<sub>i</sub>: Permissible average input rotational speed

$$L_{10} = 20000 \cdot \left( \frac{T_r}{T_{av}} \right)^{10/3} \cdot \left( \frac{n_r}{n_{i av}} \right) \quad (\text{Hour})$$

The model number is determined.

### Caution

Check impacts by speed reducer temperature rise, vibration during acceleration and deceleration and other factors if the operating conditions are as specified below. Study to "increase the speed reducer size", "review the operating conditions" and other means if it becomes necessary to study safety. Exercise reasonable caution especially when operating conditions are close to continuous operation.

Average load torque (T<sub>av</sub>) > Permissible maximum value of average load torque (see page 002, 010)

Calculate average input rotational speed (n<sub>i av</sub>) > Permissible average input rotational speed (n<sub>i</sub>)

Check the description in Caution below.

Review of the operation conditions, model No and reduction ratio.

# Efficiency Characteristics

In general, the efficiency of a speed reducer depends on the reduction ratio, input rotational speed, load torque, temperature and lubrication condition.

The efficiency under the following measurement conditions is plotted in the graphs on the next page.

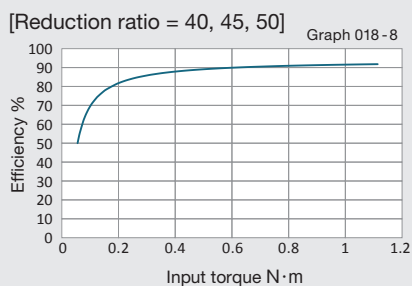
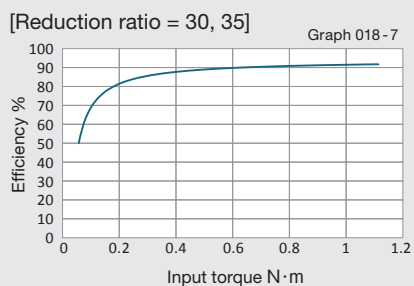
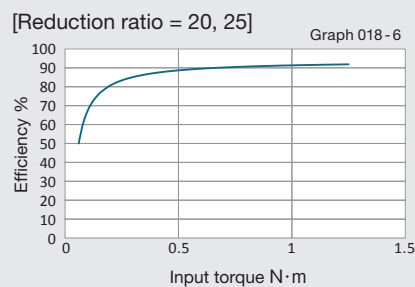
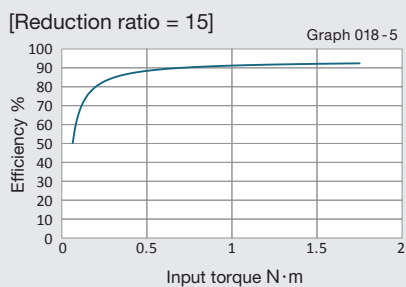
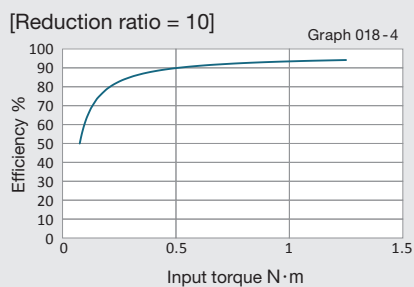
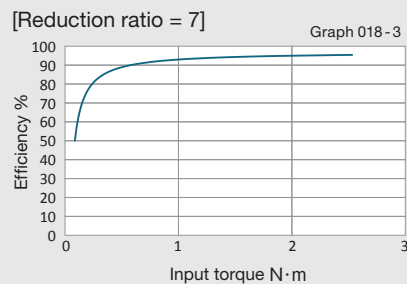
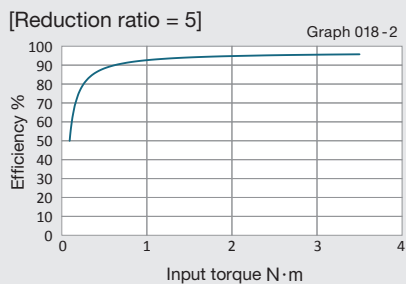
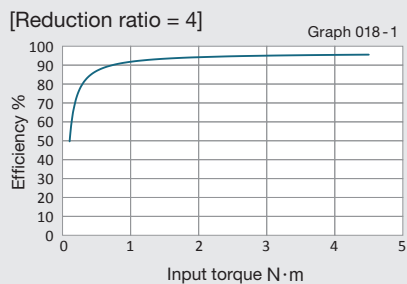
The values in the graph are average values.

## ■ Measurement condition

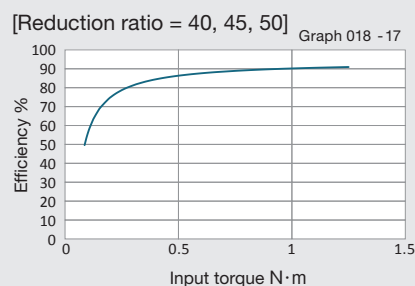
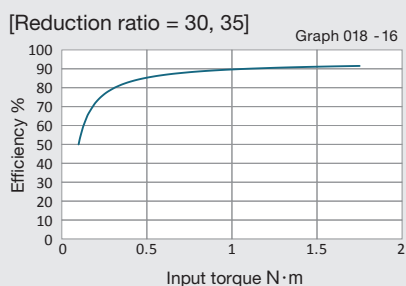
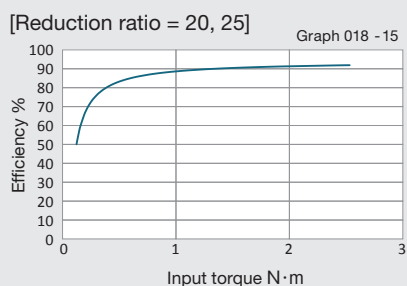
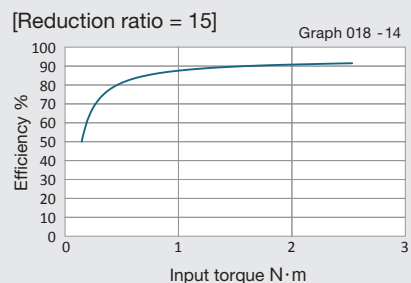
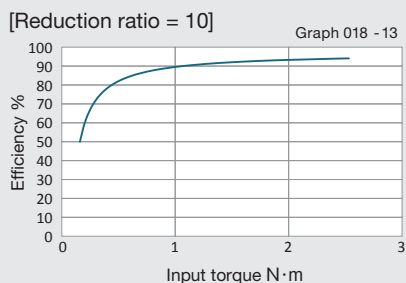
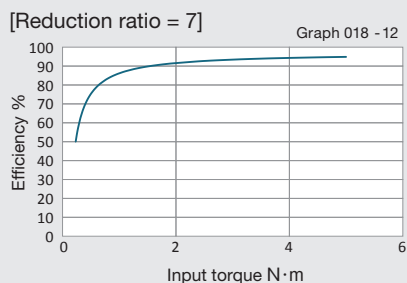
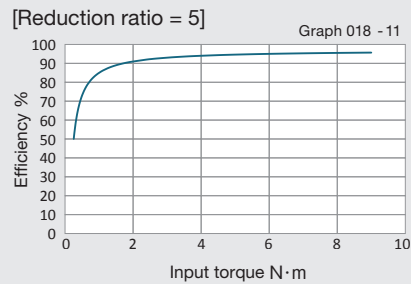
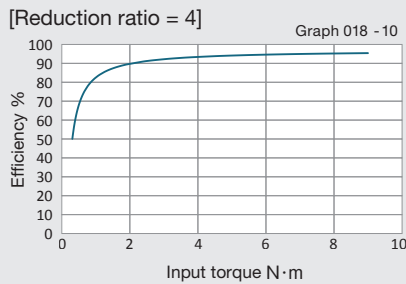
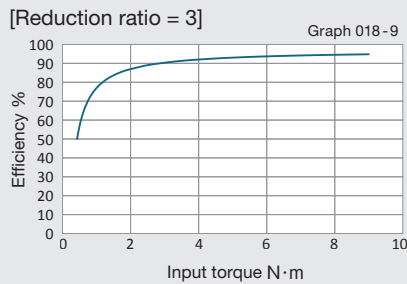
Table 017 - 1

Input speed	HPN: 3000r/min
Ambient temperature	25°C
Lubricant	Use standard lubricant. (See page 024 for details.)

## Size 11A Gearhead HPN



## Size 14A Gearhead HPN

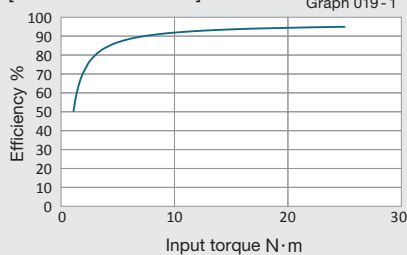


## Size 20A Gearhead

HPN

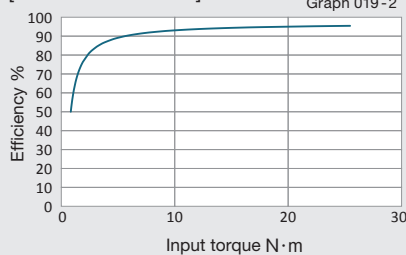
[Reduction ratio = 3]

Graph 019 - 1



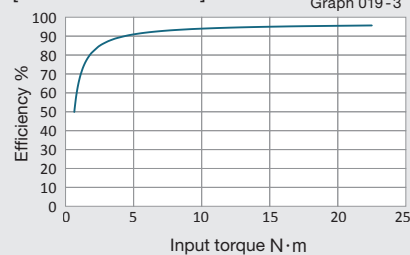
[Reduction ratio = 4]

Graph 019 - 2



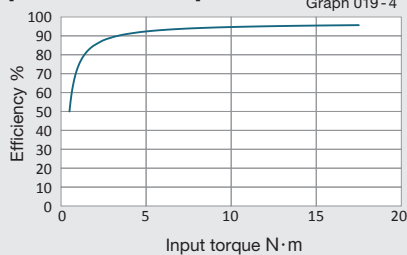
[Reduction ratio = 5]

Graph 019 - 3



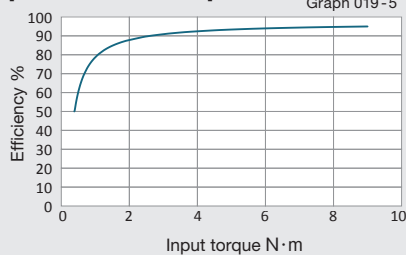
[Reduction ratio = 7]

Graph 019 - 4



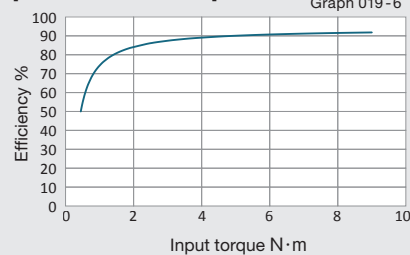
[Reduction ratio = 10]

Graph 019 - 5



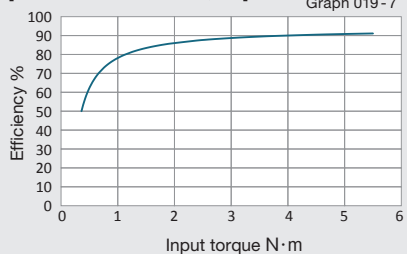
[Reduction ratio = 15]

Graph 019 - 6



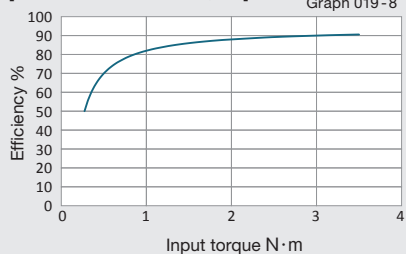
[Reduction ratio = 20, 25]

Graph 019 - 7



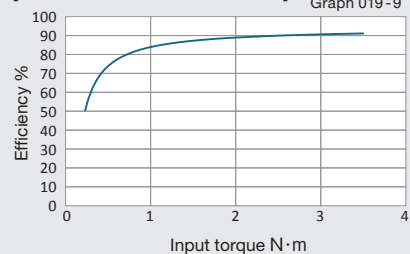
[Reduction ratio = 30, 35]

Graph 019 - 8



[Reduction ratio = 40, 45, 50]

Graph 019 - 9

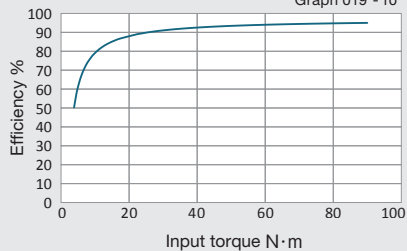


## Size 32A Gearhead

HPN

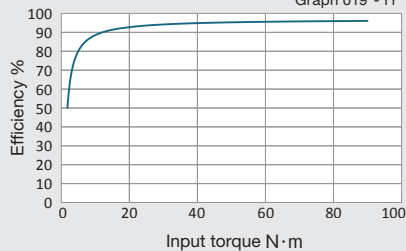
[Reduction ratio = 3]

Graph 019 - 10



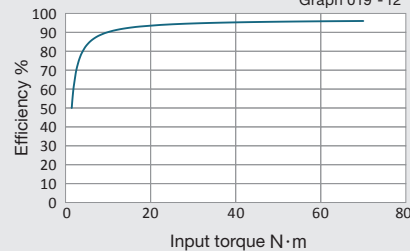
[Reduction ratio = 4]

Graph 019 - 11



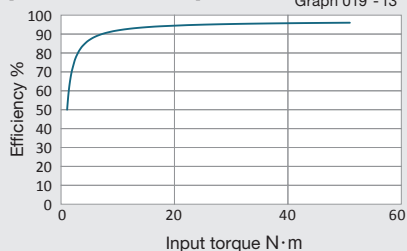
[Reduction ratio = 5]

Graph 019 - 12



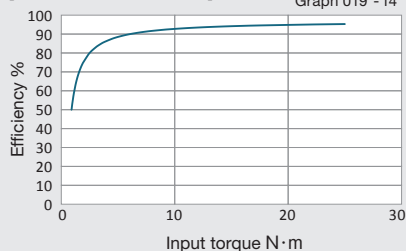
[Reduction ratio = 7]

Graph 019 - 13



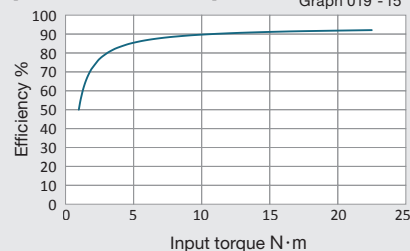
[Reduction ratio = 10]

Graph 019 - 14



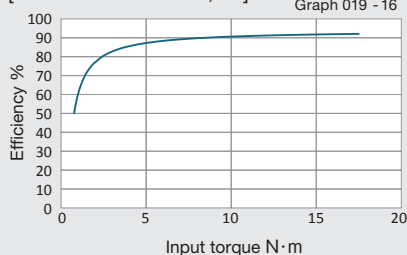
[Reduction ratio = 15]

Graph 019 - 15



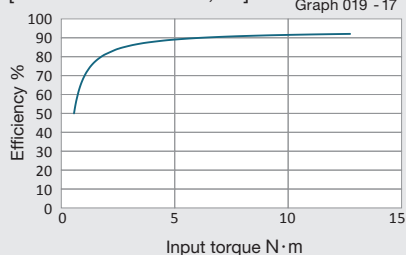
[Reduction ratio = 20, 25]

Graph 019 - 16



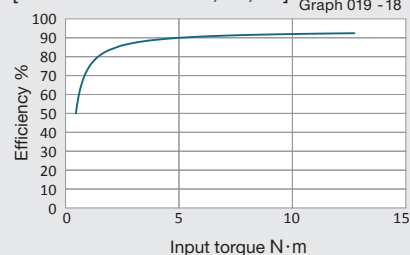
[Reduction ratio = 30, 35]

Graph 019 - 17



[Reduction ratio = 40, 45, 50]

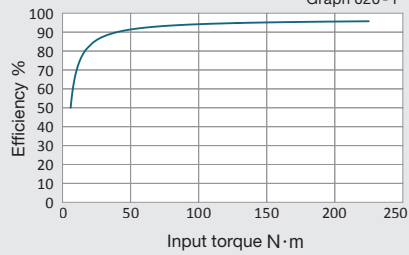
Graph 019 - 18



## Size 40A Gearhead HPN

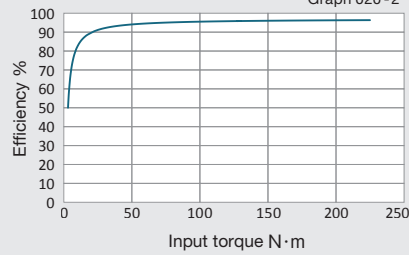
[Reduction ratio = 3]

Graph 020 - 1



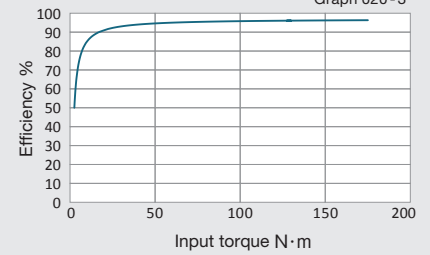
[Reduction ratio = 4]

Graph 020 - 2



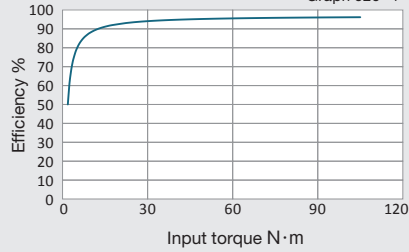
[Reduction ratio = 5]

Graph 020 - 3



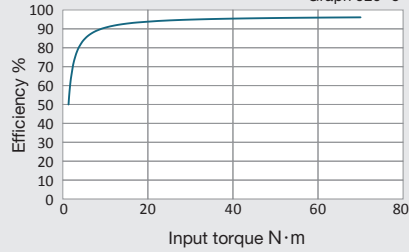
[Reduction ratio = 7]

Graph 020 - 4



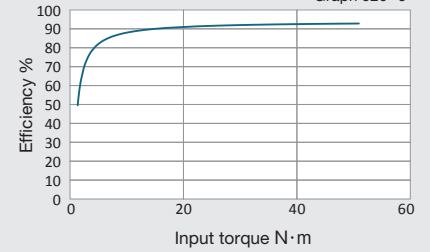
[Reduction ratio = 10]

Graph 020 - 5



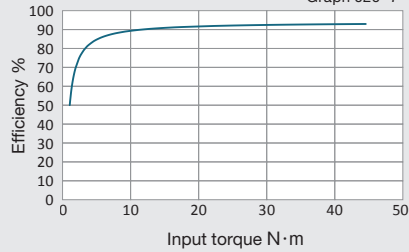
[Reduction ratio = 15]

Graph 020 - 6



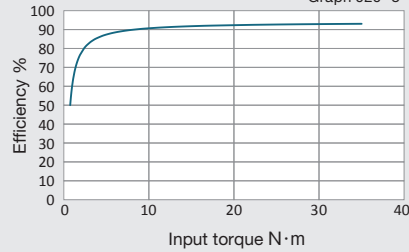
[Reduction ratio = 20, 25]

Graph 020 - 7



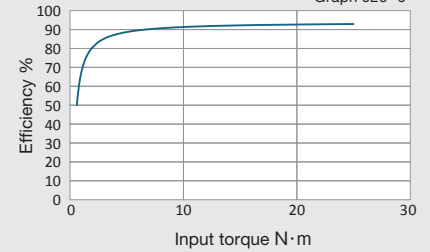
[Reduction ratio = 30, 35]

Graph 020 - 8



[Reduction ratio = 40, 45, 50]

Graph 020 - 9

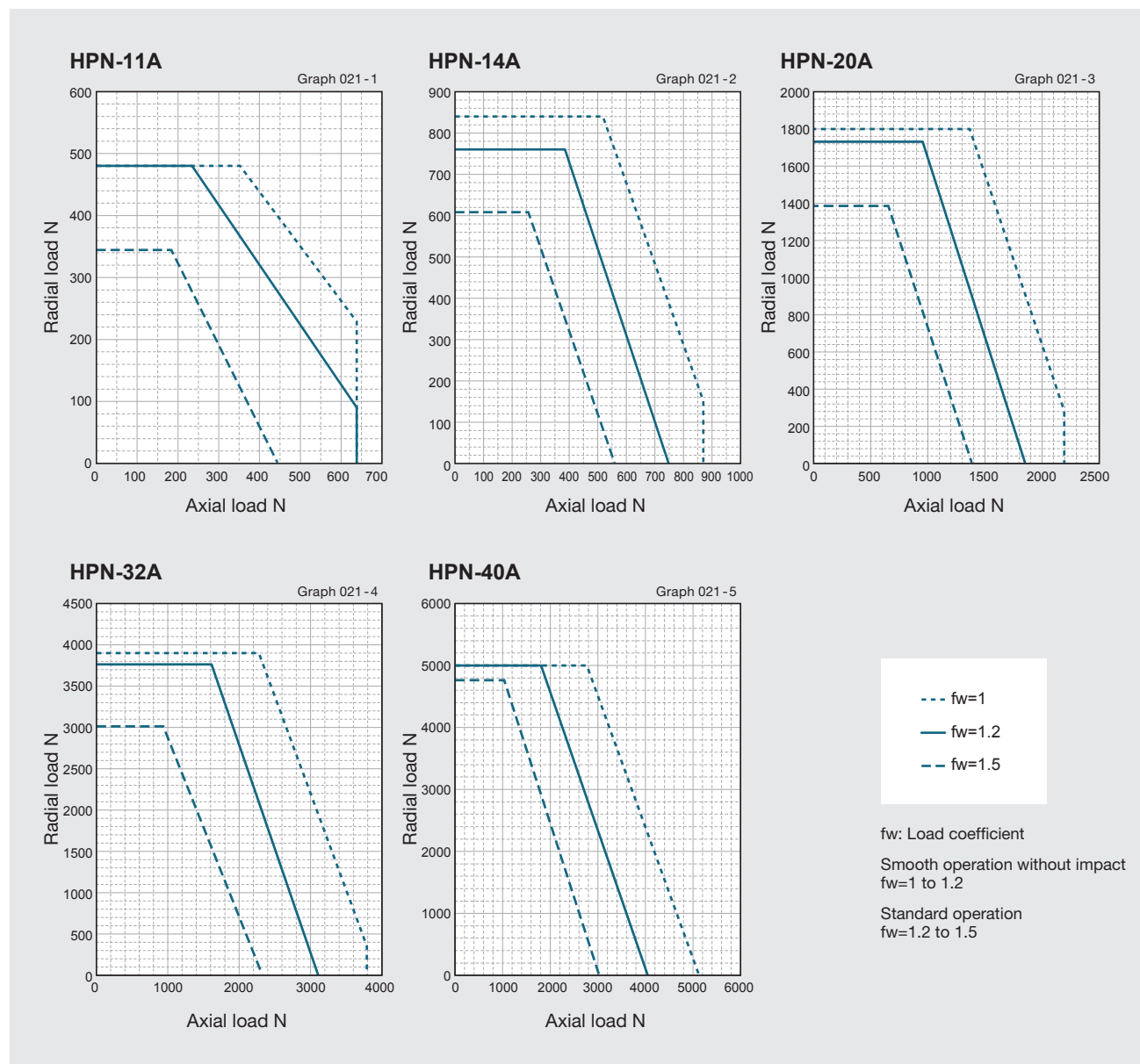




# Output Shaft Bearing Load Limits

**HPN Series** Output shaft load limits are plotted below.

HPN series uses radial ball bearings to support the output shaft. Please use the curve on the graph for the appropriate load coefficient ( $f_w$ ) that represents the expected operating condition.



The graph shows the allowable load for an output shaft rotation speed of 100r/min and bearing life of 20,000h.  
 The load point is when the radial load is at the center of the shaft and the axial load is at the axial center.

## Assembly

Assemble and mount your gearhead in accordance with these instructions to achieve the best performance. Be sure to use the recommended bolts and use a torque wrench to achieve the proper tightening torques as recommended in tables below.

### Motor assembly procedure

To properly mount the motor to the gearhead, follow the procedure outlined below.

- 1 Turn the input shaft coupling and align the bolt head with the rubber cap hole.
- 2 Apply a sealant to the surface of the motor flange that will contact the gearhead mounting flange. (Recommended sealant: LOCKTITE 515)
- 3 With the speed reducer in an upright position as illustrated in the figure below, slowly insert the motor shaft into the coupling of speed reducer. Slide the motor shaft without letting it drop down. If the speed reducer cannot be positioned upright, slowly insert the motor shaft into the coupling of speed reducer, then tighten the motor bolts evenly until the motor flange and gearhead flange are in full contact. Exercise care to avoid tilting the motor when inserting it into the gearhead.
- 4 Fasten the motor and speed reducer flange with bolts.

#### Bolt\* tightening torque

Table 022-1

Bolt size		M2.5	M3	M4	M5	M6	M8	M10	M12
Tightening torque	N·m	0.59	1.4	3.2	6.3	10.7	26.1	51.5	89.9
	kgf·m	0.06	0.14	0.32	0.64	1.09	2.66	5.25	9.17

Recommended bolt: JIS B 1176 Hexagon socket head bolt, Strength: JIS B 1051 12.9 or higher Caution: Be sure to tighten the bolts to the tightening torques specified in the table.

- 5 Tighten the input shaft coupling bolt to the recommended torque specified in the table below. The bolt(s) or screw(s) is (are) already inserted into the input shaft coupling when delivered. Check the bolt size on the confirmation drawing provided.

#### Bolt\* tightening torque

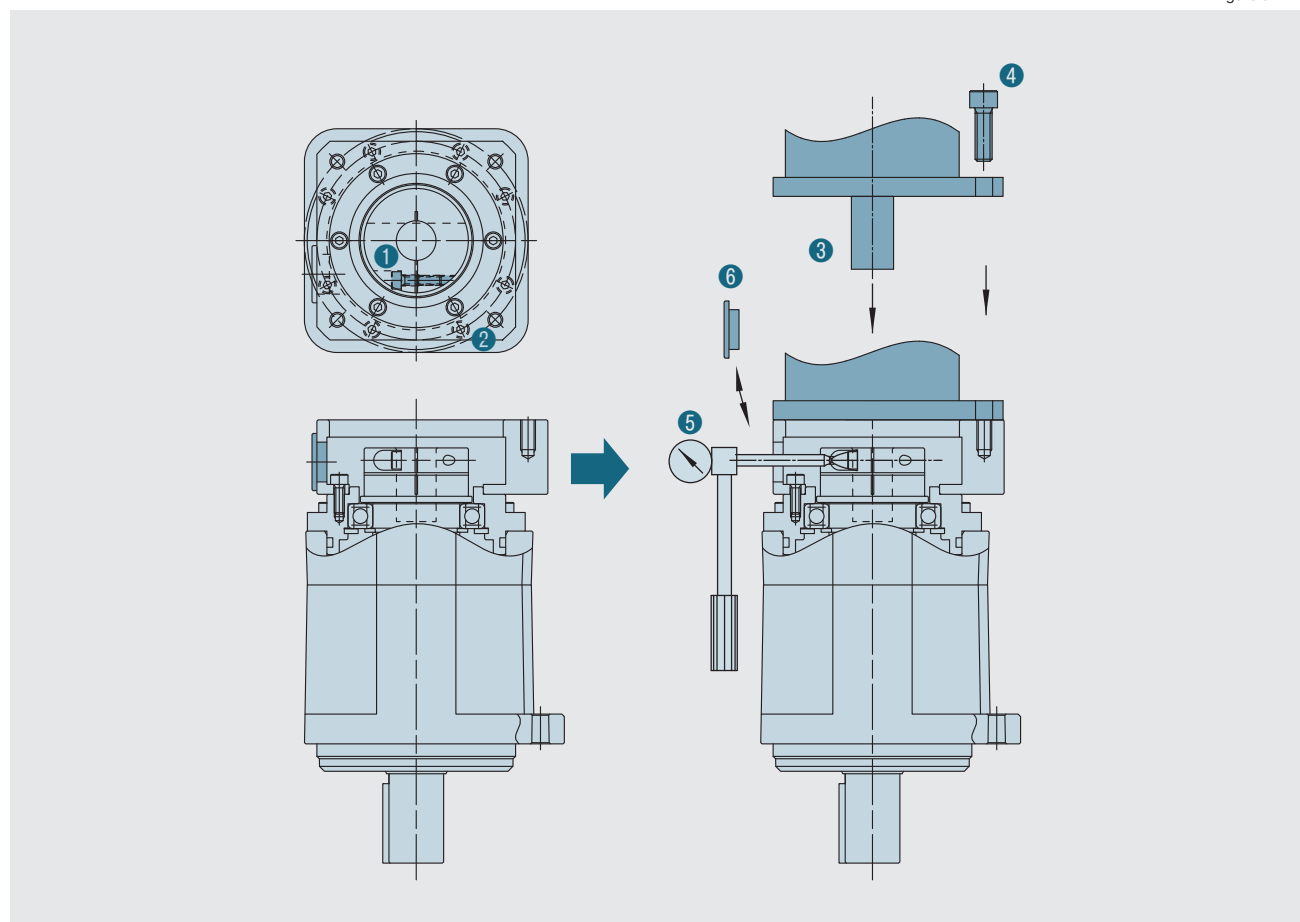
Table 022-2

Bolt size		M3	M4	M5	M6	M8	M10	M12
Tightening torque	N·m	2.0	4.5	9.0	15.3	37.2	73.5	128
	kgf·m	0.20	0.46	0.92	1.56	3.8	7.5	13.1

Caution: Always tighten the bolts to the tightening torque specified in the table above. If bolt is not tightening to the torque value recommended slippage of the motor shaft in the shaft coupling may result. The bolt size will vary depending on the size of the gear and the shaft diameter of the mounted motor.

- 6 Insert the rubber cap provided. This completes the mounting work.

Figure 022 - 1



## Speed reducer assembly

No thread for eyebolt is provided because the mounting orientation varies depending on the customer's need. When mounting the reducer, hoist it using a sling extreme attention to safety.

When assembling gearheads into your equipment, check the flatness of your mounting surface and look for any burrs on tapped holes. Then fasten the flange (Part A in the diagram below) using appropriate bolts.

### Bolt\* tightening torque

Table 023 -1

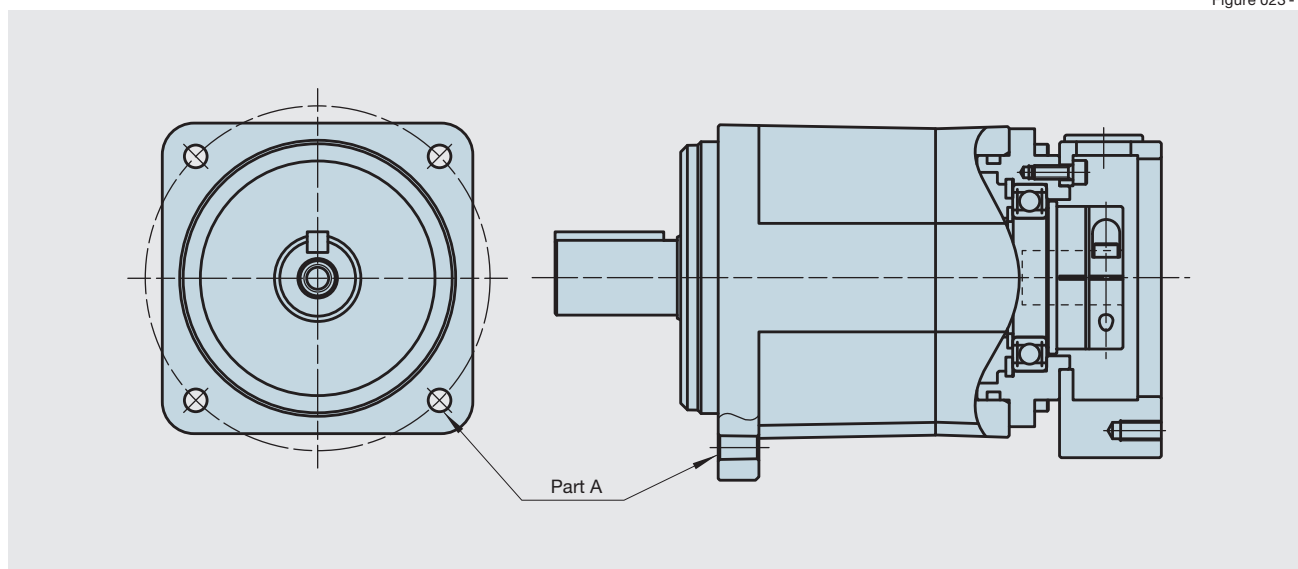
Size		HPN				
		11	14	20	32	40
Number of bolts		4	4	4	4	4
Bolt size		M3	M5	M6	M8	M10
Mounting PCD		50	70	100	130	165
Tightening torque	N·m	1.4	6.3	10.7	26.1	51.5
	kgf·m	0.14	0.64	1.09	2.66	5.26
Transfer torque	N·m	27.9	110	223	528	1063
	kgf·m	2.85	11.3	22.8	53.9	108.5

\* Recommended bolts: JIS B 1176 "Hexagon socket head bolts. "Strength classification 12.9 or higher in JIS B 1051.

## Mounting the load to the output shaft

When mounting a load onto the output shaft, take the specification of the output bearing into consideration.

Figure 023 - 1



## Gearheads with an output shaft

Do not subject the output shaft to any impact when mounting a pulley, pinion and other parts.

An impact to the output bearing will deteriorate the speed reducer precision and may cause reduced life or failure.

## ■ Lubrication

### Prevention of grease and oil leakage

- Only use the recommended greases.
- Provisions for proper sealing to prevent grease leakage are incorporated into the gearheads. However, please note that some leakage may occur depending on the application or operating condition. Discuss other sealing options with our applications engineers.
- When mounting the gearhead horizontally, position the gearhead so that the rubber cap in the adapter flange is facing upwards.

### Sealing

- A countermeasure for leakage is considered for the input and output shaft. However, depending on the application, please take measures against oil leakage on the device being installed side.
- A double lip Teflon oil seal is used for the output shaft, gaskets or o-rings are used on all mating surfaces.
- When assembling the HPN series gearhead to a motor, apply a sealant to the surface of the motor flange. (See page 022.)

## ■ Lubricant

The standard lubrication for the HPN series is grease. All gearheads are lubricated at the factory prior to shipment and additional application of grease during assembly is not required. The gearheads are lubricated for the life of the gear and do not require re-lubrication.

High efficiency is achieved thorough the unique planetary gear design and grease selection.

### Name of Lubricant

**PYRONOC UNIVERSAL 0**

Manufacturer: Nippon Oil Co.

Base oil: Rened mineral oil	Consistency: 375 at 25°C
Soap radical: Urea	Dropping point: 250°C or higher
Standard: NLGI No. 0	Product appearance: Light yellow

### Ambient operating temperature range: 0°C to +40°C

The lubricant may deteriorate if the ambient operating temperature is too high or too low. Please contact the our sales office or distributor for operation outside of the ambient operating temperature range.

The temperature rise of the gear depends upon the operating cycle, ambient temperature and heat conduction and radiation as affected by the customers installation of the gear. A housing surface temperature of 70°C is the maximum allowable limit.

## ■ Warranty

Products that are described in this catalog are warranted as follows:

### Warranty period

Under the condition that the products are handled, used and maintained properly followed each item of the technical materials, the manuals, and this catalog, all the products are warranted against defects in workmanship and materials for the shorter period of either one year after delivery or 2,000 hours of operation time.

### Warranty terms

All the products are warranted against defects in workmanship and materials for the warranted period. This limited warranty does not apply to any product that has been subject to:

- ① User's misapplication, improper installation, inadequate maintenance, or misuse.
- ② Disassembling, modification or repair by others than Harmonic Drive Systems, Inc.
- ③ Imperfection caused by the other than the products.
- ④ Disaster or others that does not belong to the responsibility of Harmonic Drive Systems, Inc.

Our liability shall be limited exclusively to repairing or replacing the product only found by Harmonic Drive Systems, Inc. to be defective.

Harmonic Drive Systems, Inc. shall not be liable for consequential damages of other equipment caused by the defective products, and shall not be liable for the incidental and consequential expenses and the labor costs for detaching from and installing to the driven equipment.

## ■ Disposal

When disposing of the product, disassemble it and sort the component parts by material type and dispose of the parts as industrial waste in accordance with the applicable laws and regulations. The component part materials can be classied into three categories.

- ① Rubber parts: Oil seals, O-rings, rubber caps
- ② Aluminum parts: Housings, motor flanges
- ③ Steel parts: Other parts







# Safety



## Warning

Means that improper use or handling could result in a risk of death or serious injury.



## Caution

Means that improper use or handling could result in personal injury or damage to property.

## Limited Applications

This product cannot be used for the following applications:

- \* Space flight hardware
- \* Aircraft equipment
- \* Nuclear power equipment
- \* Equipment and apparatus used in domestic homes
- \* Vacuum environments
- \* Automotive equipment
- \* Personal recreation equipment
- \* Equipment that directly works on human bodies
- \* Equipment for transport of humans
- \* Equipment for use in a special environment

Please consult Harmonic Drive Systems beforehand when intending to use one of its product for the aforementioned applications.

Install a safety device that avoids an accident even if output of this product becomes uncontrollable due to breakdown when using it in equipment that affects human lives and that may trigger serious damage.

### Design Precaution: Be certain to read the catalog when designing the equipment.

 Caution	<b>Use only in a specified environment.</b> <ul style="list-style-type: none"> <li>In case of using Harmonic Planetary® please ensure the following environmental conditions are complied with:               <ul style="list-style-type: none"> <li>Ambient temperature 0 to 40°C</li> <li>Do not expose to corrosive or explosive gas</li> <li>No splashing of water or oil</li> <li>No dust such as metal powder</li> </ul> </li> </ul>	 Caution	<b>Install the equipment in a specified manner.</b> <ul style="list-style-type: none"> <li>Carry out assembly precision in the specified order according to the catalog.</li> <li>Observe our recommended tightening methods (such as bolts used)</li> <li>Operating the equipment without precise assembly can cause troubles such as generation of vibration, reduction of life, deterioration of precision and breakdown.</li> </ul>
 Caution	<b>Install the equipment in a specified precision.</b> <ul style="list-style-type: none"> <li>Design and assemble parts to keep the recommended installation precision on the catalog.</li> <li>Failure to keep the precision can cause troubles such as generation of vibration, reduction of life, deterioration of precision and breakdown.</li> </ul>	 Caution	<b>Use the specified lubricant.</b> <ul style="list-style-type: none"> <li>Using other lubricant than our recommended products can reduce the life. Replace the lubricant in a specified condition.</li> <li>Grease is sealed in a unit product for Harmonic Planetary®. Do not mix other kinds of grease.</li> </ul>

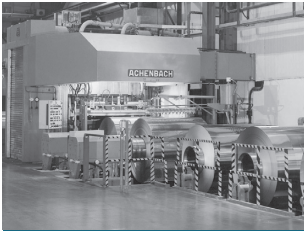
### Operational Precaution: Be certain to read the catalog before operating the equipment.

 Warning	<b>Do not put a finger into the gearing to turn it.</b> <ul style="list-style-type: none"> <li>If the gearing is turned by inserting a finger into it to turn it, the finger may be caught in the gear, resulting in an unexpected injury. Do not attempt this under any circumstances.</li> </ul>	 Warning	<b>This is a heavy item. Please handle with care.</b> <ul style="list-style-type: none"> <li>This item is very heavy and may cause back injury or injuries due to dropping or knocking over the product and getting fingers caught in between. Please take precautions such as wearing safety shoes and use a supporting tool when handling.</li> </ul>
 Caution	<b>Be careful in handling products and parts.</b> <ul style="list-style-type: none"> <li>Do not give strong shock to parts and units with a hammer.</li> <li>If you use the equipment in a damaged condition, the specified performance may not be retained. It can also cause troubles such as breakdown.</li> </ul>	 Caution	<b>Apply torque within the allowable range.</b> <ul style="list-style-type: none"> <li>Do not apply torque exceeding the limit for momentary torque. Applying excess torque can cause troubles such as loose tightening bolts, generation of backlash and breakdown.</li> <li>Striking an arm directly attached to the output shaft can damage the arm and make the output shaft uncontrollable.</li> </ul>
 Caution	<b>Do not change product and part setting.</b> <ul style="list-style-type: none"> <li>Harmonic Planetary® products are manufactured by incorporating their parts in a set. If settings are changed, specified performance cannot be maintained.</li> </ul>	 Caution	<b>Do not break down unit products.</b> <ul style="list-style-type: none"> <li>Do not break down and reassemble unit products. Original performance may not be reproduced.</li> </ul>
 Caution	<b>Be careful of oil leaks.</b> <ul style="list-style-type: none"> <li>Although a highly reliable oil seal is used as an output shaft, it does not guarantee leak-tight sealing. Depending on the use, please apply grease or oil for protection.</li> </ul>	 Caution	<b>Stop operating the system when an anomaly is detected</b> <ul style="list-style-type: none"> <li>Shut down the system promptly if an abnormal sound or vibration is detected, rotation is stopped, abnormally high temperature is generated, an abnormal current value is observed or other anomalies are detected. Continuing to operate the system without stopping may adversely affect the system.</li> <li>Please contact our sales office or distributor if an anomaly is detected.</li> </ul>

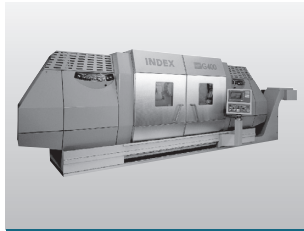
### Handling Lubricant

 Warning	<b>Precautions on handling lubricant</b> <ul style="list-style-type: none"> <li>Lubricant got in the eye can cause an inflammation. Wear protective glasses to prevent it from getting in your eye when you handle it.</li> <li>Lubricant coming in contact with the skin can cause an inflammation. Wear protective gloves to prevent it from contacting your skin when you handle it.</li> <li>Do not eat it (to avoid diarrhea and vomiting).</li> <li>When you open the container, you might have your hand cut by it. Wear protective gloves.</li> <li>Keep lubricant off children.</li> </ul>	 Caution	<b>Treatment of waste oil and containers</b> <ul style="list-style-type: none"> <li>Treatment methods are obliged by law. Treat wastes appropriately according to the law. If you are unsure how to treat them, you should consult with the dealer before treating them.</li> <li>Do not apply pressure on an empty container. The remainder may ignite with an explosion.</li> <li>Do not weld, heat, drill or cut the container. The remainder may ignite with an explosion.</li> </ul>
 Warning	<b>First-aid</b> <ul style="list-style-type: none"> <li>If lubricant gets in your eye, you should wash your eye with clean water for 15 minutes and submit to medical treatment.</li> <li>If lubricant comes in contact with your skin, you should thoroughly wash it with water and soap.</li> <li>If you swallowed it, you should immediately submit to medical treatment without throwing it up by constraint.</li> </ul>	 Caution	<b>Storage</b> <ul style="list-style-type: none"> <li>Tightly plug the container after use to prevent intrusion of dusts and water. Avoid direct sunlight to store lubricant in a dark place.</li> </ul>
		 Caution	<b>Disposal</b> <p><b>Please dispose as industrial waste.</b></p> <ul style="list-style-type: none"> <li>Please dispose of the products as industrial waste when their useful life is over.</li> </ul>

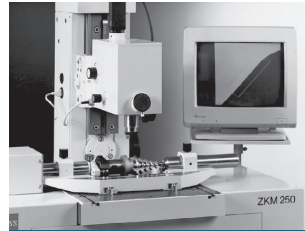
# Major Applications of Our Products



**Metal Working Machine**



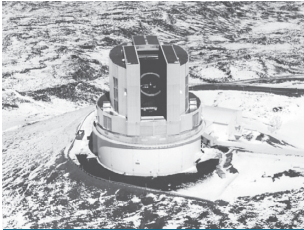
**Processing Machine Tools**



**Measurement, Analytical and Test Systems**

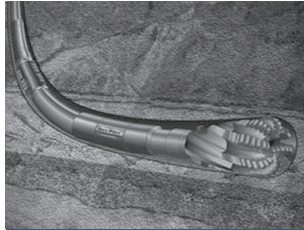


**Medical Equipment**



**Telescopes**

Source: National observatory of Inter-University Research Institute Corporation



**Energy**

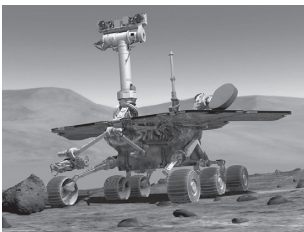
Courtesy of Halliburton/Sperry Drilling Services



**Crating and Packaging Machines**

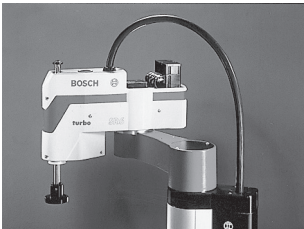


**Communication Equipment**

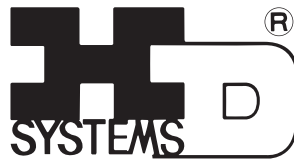


**Space Flight Hardware**

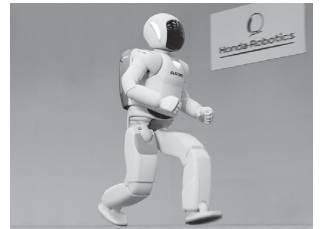
Rover image created by Dan Maas, copyrighted to Cornell and provided courtesy NASA/ JPL-Caltech.



**Robots**

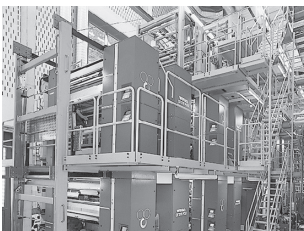


**Glass and Ceramic Manufacturing Systems**

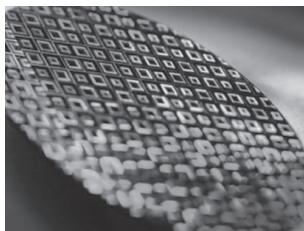


**Humanoid Robots**

Source: Honda Motor Co., Ltd.



**Printing, Bookbinding and Paper Machines**



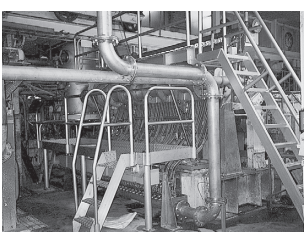
**Semiconductor Manufacturing Equip.**



**Optical Machines**



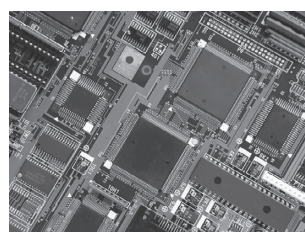
**Machine Tools**



**Paper-making Machines**



**Flat Panel Display Manufacturing Equip.**



**Printed Circuit Board Manufacturing Machines**



**Aerospace**



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 Business hours: Monday ~ Friday 9:00~12:00 13:00~ 17:00 (Except Saturdays, Sundays, national holidays and our specified days off)

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