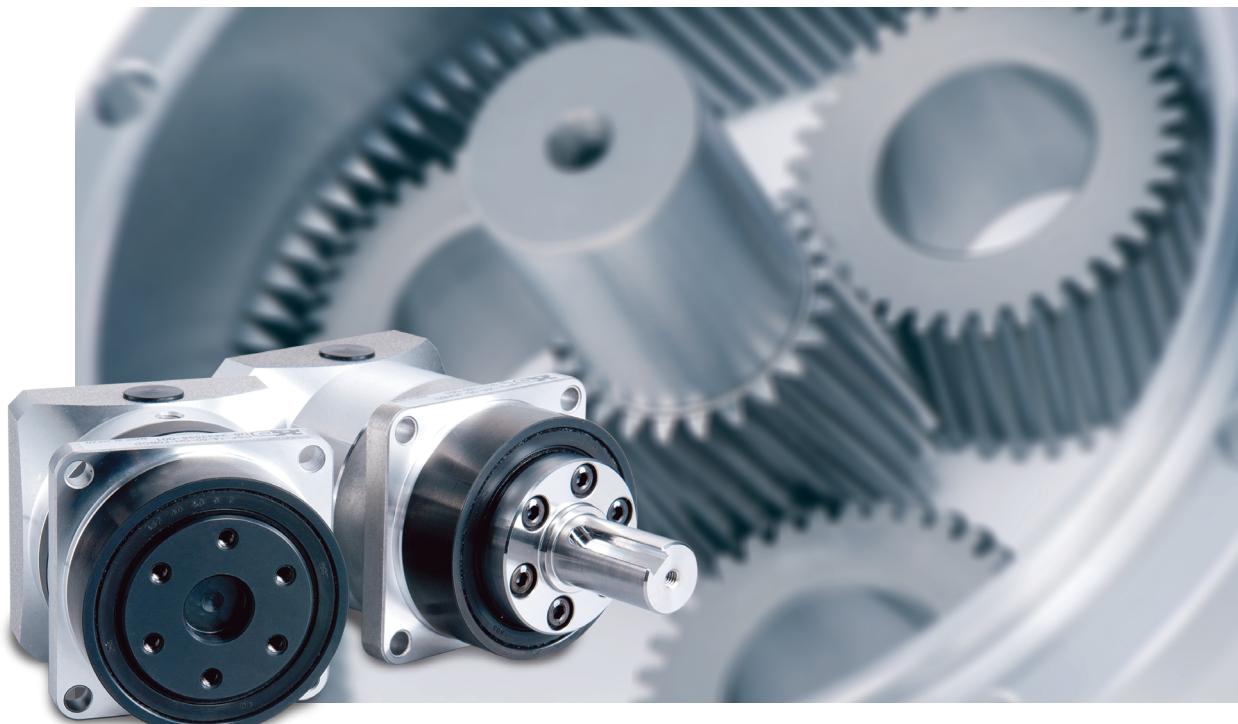


# HarmonicGearhead®

## High Performance Gear Head Series for Servo Motors

### HarmonicPlanetary® HPG Series Helical Gear Type

The two-stage speed reducer type has been added to the HarmonicPlanetary® HPG series Helical Gear Type. A new mechanism has been adopted to realize speed reducers with extremely low backlash as two-stage helical gears. As a result of adding the two-stage speed reducer type, we now offer a full lineup of varying reduction ratios of 3 through 50.



#### Realizing noise reduction and higher torque capacity by using helical gears

- Realizing noise reduction and higher torque capacity by using helical gears (increased by approximately 30% compared to conventional products)
- Low backlash (Standard: 3 arc-min or less, Precision class: 1 arc-min or less)
- Higher reliability due to thin-walled elastic gears (lower increase in backlash)
- Precision rotation due to our high-precision cross roller bearing (high surface runout accuracy)

## Ordering Code

**HPG - 20 R - 05 - J2 - XXXX - SP**

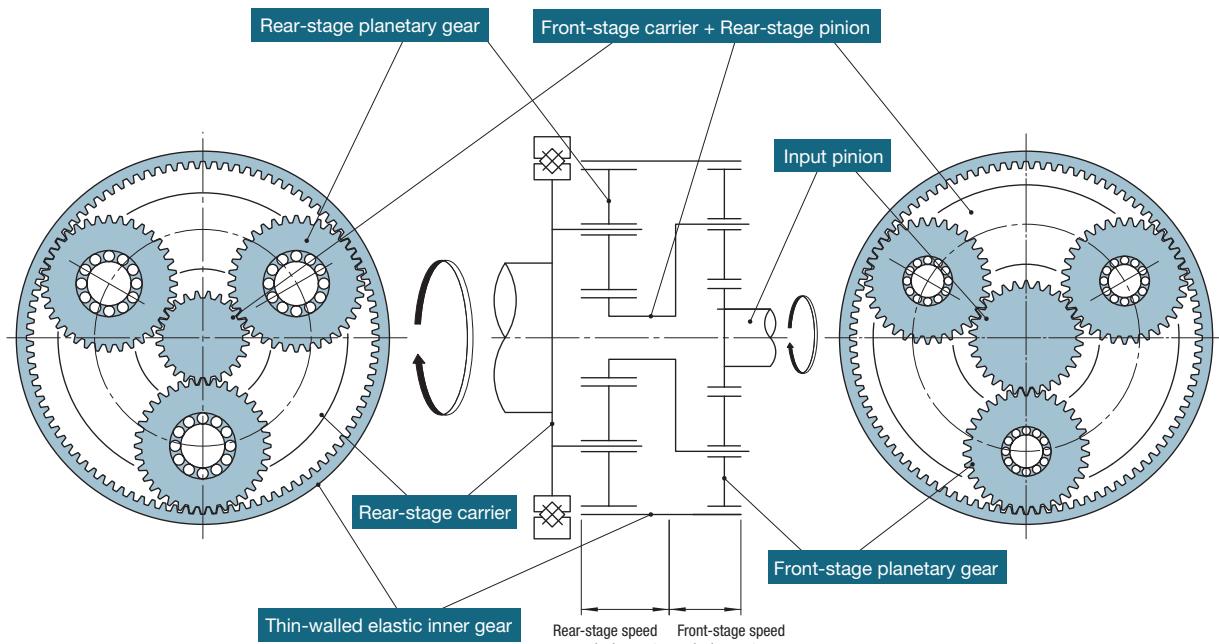
(1) (2) (3) (4) (5) (6) (7)

(1)	Model	HarmonicPlanetary® HPG standard type				
(2)	Size	11, 14, 20, 32, 40				
(3)	Design revision	R Helical Gear Type				
(4)	Reduction ratio	Size 11	4, 5, 6, 7, 8, 9, 10, 20, 25, 30, 35, 40, 45, 50		(6) Input-side configuration symbol	4 to 6 alphabetical characters : Motor flange and Input shaft coupling shape symbol (The symbols vary depending on the motor mounted. For more information on models matching the servo motors of other manufacturers, please use the model selection tool on our website at <a href="https://hds-tech.jp/ecat/ogctj/index.html">https://hds-tech.jp/ecat/ogctj/index.html</a> )
		Sizes 14, 20, 32, 40	3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50			
(5)	Output shaft shape	Size 11	F0 : Flange output J20 : Straight shaft (without key) J60 : Straight shaft (with key and center tapped hole)		(7) Special specifications	No symbol: Standard product SP : Special specifications BL1 : Backlash of 1 arc-min or less, special specifications (Sizes from 14 to 40) D : Input-side shield bearing is changed to contacted seal type [DDU]
		Sizes 14, 20, 32, 40	F0 : Flange output J2 : Straight shaft (without key) J6 : Straight shaft (with key and center tapped hole)			

## Operation Principle

The two-stage speed reducer mechanism (with a speed ratio of 15 or above) is used for illustration purposes.

For the single-stage speed reducer mechanism (with a speed ratio of 10 or less), the operation principle is applicable only to the rear-stage speed reducing part.



### Rear stage: Consists of a planetary speed reducer mechanism with 3 planetary gears.

The rear-stage pinion coupled with the front-stage carrier serves as an input to the rear-stage speed reducing part, and causes the orbital motion of the rear-stage planetary gears as in the front-stage speed reducing part. The orbital motion is transmitted to the rear-stage carrier (the inner ring of the cross roller bearing) and then outputted. The direction of rotation of the rear-stage carrier is the same as the input direction, as in the front-stage speed reducing part.

### Front stage (input side): Consists of a planetary speed reducer mechanism with 3 planetary gears.

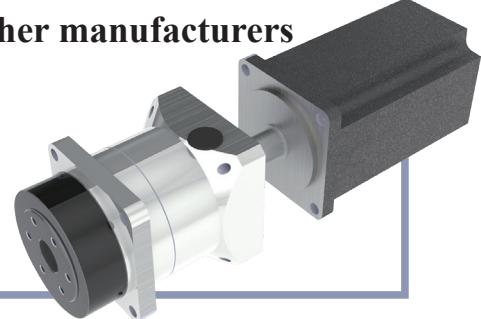
The rotation from the input pinion causes the orbital motion of the front-stage planetary gears that mesh with it. The orbital motion is transmitted to the front-stage carrier via the planetary shaft. The direction of rotation of the front-stage carrier is the same as the input direction.

**Simply attach it to a servo motor of any of the other manufacturers to form a high-precision actuator.**

#### Supported servo motor manufacturers

**YASKAWA Electric Corporation/Mitsubishi Electric Corporation/FANUC/Panasonic/SANYO DENKI/TAMAGAWA SEIKI/FUJI ELECTRIC/OMRON/TOSHIBA MACHINE/Keyence, etc.**

Servo motors other than those listed above can be supported.  
Please contact one of our sales offices.



# Rating Table

Table 3-1

Size	Reduction ratio	Rated output torque <sup>*1</sup>		Average load torque <sup>*2</sup>		Limit for repeated peak torque <sup>*3</sup>		Instantaneous maximum torque <sup>*4</sup>		Allowable average input speed <sup>*5</sup>	Maximum input speed <sup>*6</sup>	Moment of inertia (converted to input side) <sup>*7</sup>		Speed reducer unit weight <sup>*8</sup>	
		N·m	kgf·m	N·m	kgf·m	N·m	kgf·m	N·m	kgf·m			x10 <sup>-4</sup> kg·m <sup>2</sup>	x10 <sup>-4</sup> kg·m <sup>2</sup>	kg	kg
11	4	2.8	0.29	6.3	0.64	10	1.0	20	2.0	3000	10000	0.011	0.0084	0.24	0.19
	5	2.9	0.30	6.5	0.66	10	1.0					0.0069	0.0053		
	6	2.9	0.30	6.5	0.66	10	1.0					0.0047	0.0036		
	7	3.1	0.32	7.0	0.71	9.0	0.92					0.0035	0.0027		
	8	3.1	0.32	7.0	0.71	7.0	0.71					0.0026	0.0020		
	9	3.1	0.32	6.0	0.61	6.0	0.61					0.0021	0.0016		
	10	3.4	0.35	5.0	0.51	5.0	0.51					0.0017	0.0013		
	20	4.5	0.46	10	1.0							0.0031	0.0030	0.37	0.32
	25	4.8	0.49	10	1.0							0.0019	0.0019		
	30	5.1	0.52	11	1.1							0.0013	0.0013		
	35	5.3	0.54	12	1.2							0.00099	0.00096		
	40	5.6	0.57	12	1.2							0.00072	0.00070		
	45	5.8	0.59	13	1.3							0.00057	0.00055		
14	50	6.0	0.61	13	1.3							0.00049	0.00047		
	3	4.0	0.41	9.0	0.92	20	2.0	37	3.8	3000	5000	0.089	0.072	0.55	0.45
	4	7.0	0.71	16	1.6	30	3.1					0.047	0.037		
	5	7.2	0.73	16	1.6	30	3.1					0.030	0.023		
	6	7.3	0.74	16	1.6	30	3.1					0.028	0.024		
	7	7.8	0.80	18	1.8	26	2.7					0.021	0.018		
	8	7.8	0.80	18	1.8	20	2.0					0.016	0.014		
	9	7.9	0.81	17	1.7	17	1.7					0.013	0.011		
	10	8.5	0.87	15	1.5	15	1.5					0.010	0.0087		
	15	10	1.0	23	2.3							0.028	0.028	0.92	0.82
20	20	11	1.1	25	2.5			30	3.1	3000	6000	0.015	0.014		
	25	12	1.2	27	2.8							0.0093	0.0091		
	30	12	1.2	28	2.9							0.0061	0.0059		
	35	13	1.3	30	3.1							0.0046	0.0045		
	40	13	1.3	30	3.1							0.0035	0.0034		
	45	14	1.4	30	3.1							0.0027	0.0027		
	50	14	1.4	30	3.1							0.0023	0.0023		
	3	11	1.1	25	2.6	90	9.2	124	13	3000	6000	0.64	0.53	1.7	1.3
	4	23	2.3	51	5.2	133	14					0.36	0.30		
	5	23	2.4	53	5.4	133	14					0.23	0.19		
	6	23	2.4	53	5.4	126	13					0.15	0.13		
	7	25	2.5	56	5.7	108	11					0.11	0.093		
	8	25	2.5	56	5.7	84	8.6					0.085	0.070		
	9	25	2.6	57	5.8	73	7.4					0.067	0.055		
	10	27	2.8	61	6.2	65	6.6					0.055	0.046		
	15	32	3.3	73	7.4							0.24	0.23	2.8	2.4
32	20	35	3.6	80	8.2			133	14	3000	6000	0.12	0.12		
	25	38	3.9	85	8.7							0.077	0.076		
	30	40	4.1	90	9.2							0.050	0.049		
	35	42	4.3	94	9.6							0.038	0.037		
	40	43	4.4	98	10							0.029	0.028		
	45	45	4.6	102	10							0.023	0.022		
	50	46	4.7	105	11							0.019	0.019		
	3	50	5.1	110	11	290	30	507	52	3000	6000	3.5	2.8	4.5	3.1
	4	77	7.9	170	17	400	41					1.7	1.3		
	5	80	8.2	180	18	400	41					1.1	0.79		
	6	80	8.2	180	18	390	40					0.73	0.55		
	7	85	8.7	190	19	330	34					0.55	0.41		
	8	85	8.7	190	19	260	27					0.43	0.33		
	9	86	8.8	190	19	220	22					0.34	0.26		
	10	92	9.4	200	20	200	20					0.28	0.22		
	15	111	11	251	26							1.1	1.1	7.2	5.8
40	20	121	12	273	28			400	41	3000	6000	0.60	0.58		
	25	130	13	292	30							0.38	0.37		
	30	137	14	309	31							0.25	0.25		
	35	143	15	324	33							0.19	0.19		
	40	149	15	337	34							0.14	0.14		
	45	155	16	349	36							0.11	0.11		
	50	160	16	360	37							0.096	0.093		
	3	200	20	450	46	600	61	1200	122	3000	6000	11	7.9	9.8	7.2
	4	300	31	675	69	900	92					5.3	3.8		
	5	300	31	675	69	900	92					3.2	2.3		
	6	300	31	675	69	700	71					2.1	1.5		
	7	300	31	600	61	600	61					1.6	1.1		
	8	250	26	500	51	500	51					1.2	0.82		
	9	200	20	400	41	400	41					0.95	0.66		
	10	200	20	400	41	400	41					0.71	0.47		
	15			800	82	800	82					3.7	3.6	14.1	11.5
	20			900	92	1000	102					1.8	1.7		
	25											1.1	1.1		
	30											0.72	0.69		
	35														

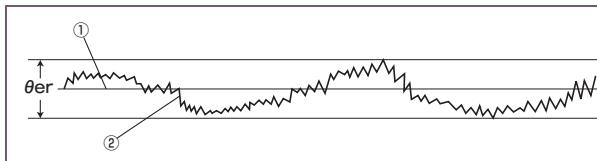
## Performance Table

Table 4-1

Size	Reduction ratio	Rotational transmission error <sup>*1</sup>		Repeatability <sup>*2</sup>		Starting torque <sup>*3</sup>		Overdrive starting torque <sup>*4</sup>		No-load running torque <sup>*5</sup>	
		arc-min	×10 <sup>-4</sup> rad	arc-sec	cN·m	kgf·cm	N·m	kgf·m	cN·m	kgf·cm	
11	4	5	14.5	±20	4.7	0.48	0.19	0.019	6.8	0.69	
	5				4.1	0.42	0.21	0.021	5.4	0.55	
	6				3.6	0.37	0.22	0.022	4.5	0.46	
	7				3.3	0.34	0.23	0.023	3.9	0.40	
	8				3.0	0.31	0.24	0.024	3.4	0.35	
	9				2.8	0.29	0.25	0.026	3.0	0.31	
	10				2.6	0.27	0.26	0.027	2.7	0.28	
	20	5	14.5	±20	3.9	0.40	0.77	0.079	1.4	0.14	
	25				3.1	0.32	0.78	0.080	1.3	0.13	
	30				2.6	0.27	0.79	0.081	1.2	0.12	
	35				2.3	0.23	0.80	0.082	1.1	0.11	
	40				2.0	0.20	0.81	0.083	1.1	0.11	
	45				1.8	0.18	0.81	0.083	1.0	0.10	
	50				1.6	0.16	0.82	0.084	1.0	0.10	
14	3	4	11.6	±15	13	1.3	0.38	0.039	22	2.2	
	4				11	1.1	0.45	0.046	17	1.7	
	5				10	1.0	0.51	0.052	13	1.3	
	6				9.5	0.97	0.57	0.058	11	1.1	
	7				9.0	0.92	0.63	0.064	9.4	0.96	
	8				8.5	0.87	0.68	0.069	8.3	0.85	
	9				8.1	0.83	0.73	0.074	7.3	0.74	
	10				7.8	0.80	0.78	0.080	6.6	0.67	
	15	4	11.6	±15	8.7	0.89	1.3	0.13	4.4	0.45	
	20				6.7	0.68	1.4	0.14	3.8	0.39	
	25				5.5	0.56	1.4	0.14	3.4	0.35	
	30				4.7	0.48	1.4	0.14	3.2	0.33	
	35				4.1	0.42	1.4	0.14	2.9	0.30	
	40				3.6	0.37	1.5	0.15	2.7	0.28	
	45				3.3	0.34	1.5	0.15	2.6	0.27	
	50				3.0	0.31	1.5	0.15	2.5	0.26	
20	3	4	11.6	±10	31	3.2	0.93	0.095	50	5.1	
	4				25	2.6	1.0	0.10	38	3.9	
	5				22	2.2	1.1	0.11	30	3.1	
	6				20	2.0	1.2	0.12	25	2.6	
	7				18	1.8	1.3	0.13	21	2.1	
	8				17	1.7	1.4	0.14	19	1.9	
	9				17	1.7	1.5	0.15	17	1.7	
	10				16	1.6	1.6	0.16	15	1.5	
	15	4	11.6	±10	15	1.5	2.4	0.24	11	1.1	
	20				12	1.2	2.5	0.26	9.5	0.97	
	25				10	1.0	2.6	0.27	8.5	0.87	
	30				8.8	0.90	2.6	0.27	7.8	0.80	
	35				7.7	0.79	2.7	0.28	7.2	0.73	
	40				6.9	0.70	2.8	0.29	6.8	0.69	
	45				6.3	0.64	2.8	0.29	6.4	0.65	
	50				5.8	0.59	2.9	0.30	6.1	0.62	
32	3	4	11.6	±10	56	5.7	1.7	0.17	135	14	
	4				52	5.3	2.1	0.21	101	10	
	5				49	5.0	2.5	0.26	81	8.3	
	6				47	4.8	2.8	0.29	68	6.9	
	7				45	4.6	3.2	0.33	58	5.9	
	8				44	4.5	3.5	0.36	51	5.2	
	9				43	4.4	3.9	0.40	45	4.6	
	10				42	4.3	4.2	0.43	41	4.2	
	15	4	11.6	±10	32	3.3	4.7	0.48	29	3.0	
	20				26	2.7	5.2	0.53	25	2.6	
	25				23	2.3	5.7	0.58	23	2.3	
	30				20	2.0	6.1	0.62	21	2.1	
	35				18	1.8	6.4	0.65	19	1.9	
	40				17	1.7	6.8	0.69	18	1.8	
	45				16	1.6	7.1	0.72	17	1.7	
	50				15	1.5	7.4	0.76	16	1.6	
40	3	3	8.7	±10	77	7.9	2.3	0.23	365	37	
	4				72	7.3	2.9	0.30	273	28	
	5				67	6.8	3.4	0.35	219	22	
	6				64	6.5	3.8	0.39	184	19	
	7				61	6.2	4.3	0.44	157	16	
	8				60	6.1	4.8	0.49	138	14	
	9				59	6.0	5.3	0.54	122	12	
	10				58	5.9	5.8	0.59	111	11	
	15	3	8.7	±10	39	4.0	5.9	0.60	78	8.0	
	20				30	3.1	6.0	0.61	68	6.9	
	25				27	2.8	6.8	0.69	62	6.3	
	30				24	2.4	7.2	0.73	57	5.8	
	35				21	2.1	7.4	0.76	51	5.2	
	40				20	2.0	8.0	0.82	49	5.0	
	45				19	1.9	8.6	0.88	46	4.7	
	50				18	1.8	9.0	0.92	43	4.4	

\*1 The rotational transmission error refers to the difference between (1) Logical output rotation angle and (2) Actual output rotation angle when any rotation angle is given to the input. Note that the values in the table show the maximum values.

Figure 5-1



$\theta_{er}$ : Rotational transmission error

$\theta_1$  : Input rotation angle

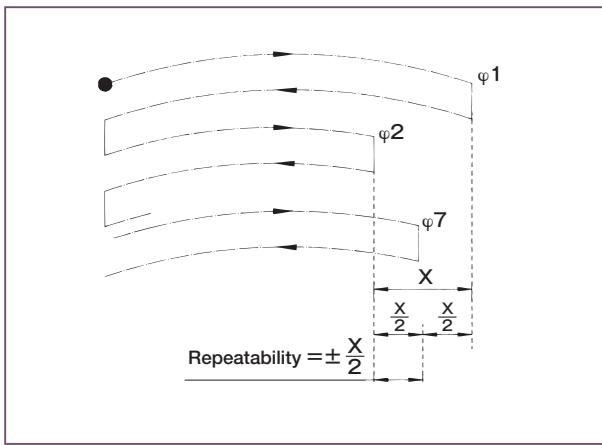
$\theta_2$  : Actual output rotation angle

R : Reduction ratio of the HPG series

$$\theta_{er} = \theta_2 - \frac{\theta_1}{R}$$

\*2 The repeatability is calculated by repeating the positioning at any position from the same direction seven times, measuring the stop position of the output shaft, and calculating the maximum difference. Measured values are expressed in angles and indicated as the 1/2 of the maximum difference with a +/- sign attached. Note that the values in the table show the maximum values.

Figure 5-2



\*3 The starting torque refers to the "start-up torque" at the moment of starting rotation at the output side when torque is applied to the input side. Note that the values in the table show the maximum values.

Table 5-3

Load	No load
HPG speed reducer surface temperature	25°C

\*4 The overdrive starting torque refers to the "start-up torque" at the moment of starting rotation at the input side when torque is applied to the output side. Note that the values in the table show the maximum values.

Table 5-4

Load	No load
HPG speed reducer surface temperature	25°C

\*5 The no-load running torque refers to the torque at the input side that is required for rotating the speed reducer under no load. Note that the values in the table show the average values.

Table 5-5

Input rotating speed	3000 r/min
Load	No load
HPG speed reducer surface temperature	25°C

# Torque – Torsional Characteristics

## Gear head type standard product

Table 6-1

Size	Reduction ratio	Backlash		Single-side torsional amount at $T^{\circ} \times 0.15$		Torsional stiffness	
				D		A/B	
		arc-min	$\times 10^{-4}$ rad	arc-min	$\times 10^{-4}$ rad	kgf-m/arc-min	$\times 100N\cdot m/rad$
11	4	3.0	8.7	2.5	7.3	0.065	22
	5						
	6						
	7						
	8						
	9						
	10						
	20						
	25						
	30						
14	35	3.0	8.7	3.0	8.7	0.065	22
	40						
	45						
	50						
	3	3.0	8.7	2.2	6.4	0.14	47
	4						
	5						
	6						
	7						
20	8						
	9						
	10						
	15	3.0	8.7	2.7	7.9	0.14	47
	20						
	25						
	30						
	35						
	40						
	45						
	50						
32	3	3.0	8.7	1.5	4.4	0.55	180
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	3.0	8.7	2.0	5.8	0.55	180
	20						
40	25						
	30						
	35						
	40						
	45						
	50						
	3	3.0	8.7	1.3	3.8	2.2	740
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	3.0	8.7	1.7	4.9	2.2	740
	20						
40	25						
	30						
	35						
	40						
	45						
	50						
	3	3.0	8.7	1.3	3.8	4.8	1600
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	3.0	8.7	1.7	4.9	4.8	1600
	20						

## Gear head type BL1 specification (Backlash of 1 arc-min or less)

Table 6-2

Size	Reduction ratio	Backlash		Single-side torsional amount at $T^{\circ} \times 0.15$		Torsional stiffness	
				D		A/B	
		arc-min	$\times 10^{-4}$ rad	arc-min	$\times 10^{-4}$ rad	kgf-m/arc-min	$\times 100N\cdot m/rad$
14	3	1.0	2.9	1.1	3.2	0.14	47
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	1.0	2.9	1.7	4.9	0.14	47
20	20						
	30	1.0	2.9	1.1	3.2	0.55	180
	35						
	40						
	45						
	50						
32	3	1.0	2.9	0.5	1.5	2.2	740
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	1.0	2.9	1.0	2.9	2.2	740
40	20						
	25						
	30						
	35						
	40						
	45						
	50						

## Backlash (Hysteresis loss)

The width at zero torque between (2) and (4) in Figure 4-1 "Torque-Torsional Angle Diagram" is called the hysteresis loss. The backlash of the HPG series is defined as the hysteresis loss during a transition from "Rated forward output torque" and "Rated reverse output torque". The backlash of the HPG series is 3 arc-min or less (1 arc-min or less for special products) at the time of shipping.

Torque-Torsional Angle Diagram

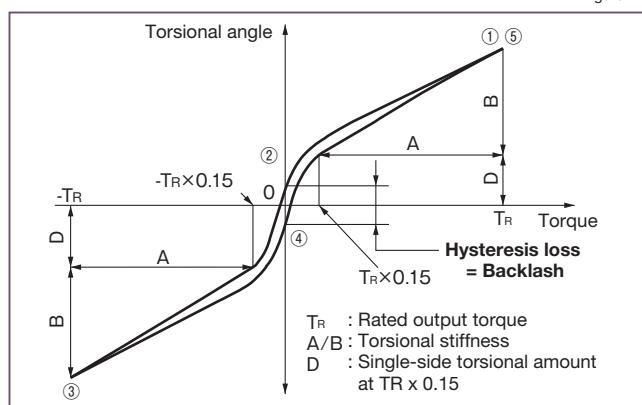


Figure 7-1

## Torsional stiffness (wind-up curve)

When a torque is applied to the output side with the input side and casing of the speed reducer fixed, torsion corresponding to the torque is exerted on the output side. When the torque value is changed gradually in the order of (1) Rated forward output torque, (2) Zero, (3) Rated reverse output torque, (4) Zero, and (5) Rated forward output torque, a loop passing through (1), (2), (3), (4), and (5) (back to (1)) is formed as shown in Figure 4-1 "Torque-Torsional Angle Diagram".

The slope is low in the region from "0.15 x Rated output torque" and "Rated output torque", the average of which is the torsional stiffness of the HPG series. The slope is high in the region from "zero torque" and "0.15 x Rated output torque". This is caused by slight uneven contact in the meshing part or unbalanced load on the planetary gear under light load conditions.

## Calculating the total torsional amount (wind-up)

The following describes how to calculate the single-side total torsional amount (average value) when load is applied to the speed reducer under no load.

Formula 7-1

● Calculation formula

$$\theta = D + \frac{T - T_L}{A}$$

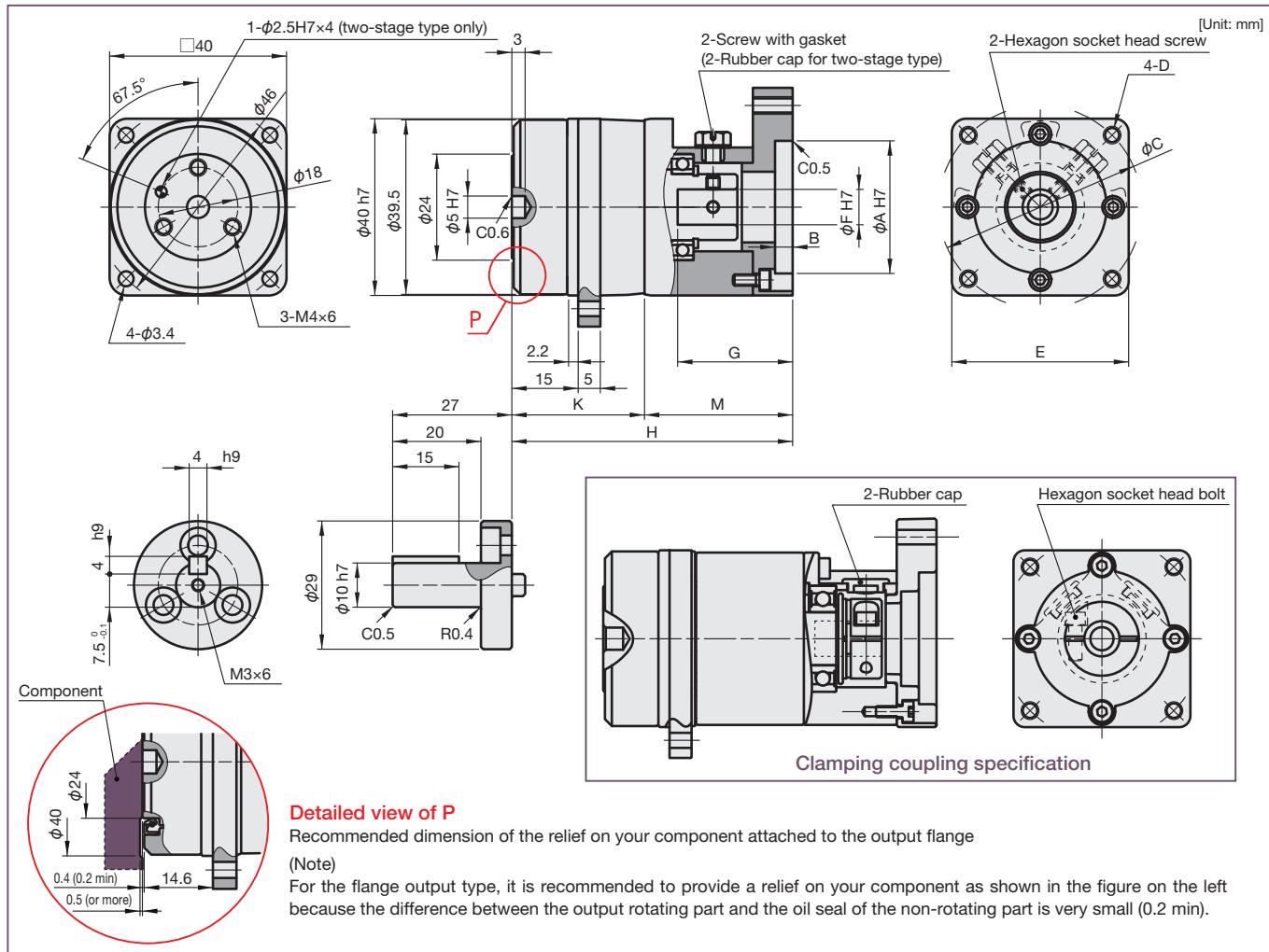
Symbols in calculation formula

$\theta$	Total torsional amount	—
D	Single-side torsional amount at rated output torque x 0.15	See Figure 7-1, Table 6-1, and Table 6-2
T	Load torque	—
$T_L$	Rated output torque x 0.15 (TR x 0.15)	See Figure 7-1
A / B	Torsional stiffness	See Figure 7-1 and Tables 6-1 and 6-2

## External Dimensions - Size 11

This dimension drawing shows the major dimensions. For more information on the details of dimensions and shapes, refer to our delivery specification drawings. You can download the CAD data of this product from our website. URL: <https://www.hds.co.jp/>

Figure 8-1



\* The tolerance varies depending on the manufacturing method (casting or machining) of the parts. For more information on the tolerance of a dimension without a tolerance, please contact us.

## Dimension Table

Table 8-1

	Configuration symbol <small>Note 1</small>	A (H7)	B	C	D	E	F (H7)		G	K	H	M	Weight (kg) <small>Note 2</small>								
							Min	Max					Shaft output	Flange output							
Single-stage <small>(Note 3)</small>	RAB□	20	3	28	φ3.4 through-hole	□25	5	8	20.5	40.6	49.5	28.5	0.32	0.27							
	RAC□	22		43.8		□40			16.5		45.5	24.5	0.33	0.28							
	RAA□	28		33	M2.5X5	φ40			25.5		54.5	33.5	0.31	0.26							
	RAD□	30	4	46	M4X9	□40			45.4		75.4	30.0	0.35	0.30							
	RAE□			45	M3X9								0.40	0.35							
	RAN□	34		48	M4X9	□60							0.49	0.44							
	RAF□	50		70																	
	RAG□			60	M5X9																
Two-stage <small>(Note 3)</small>	RAH□																				
	SB□	20	3	28	φ3.4 through-hole	φ40	5	5	16.4	45.4	70.4	25.0	0.48	0.43							
	SD□	30	4	46	M4X9	□40	6	7	26.4		75.4	30.0	0.49	0.44							
	SE□			45	M3X9		8*	8*	27.5												
	SF□	50		70	M4X9	□60	6	7	26.4												
	SG□				M5X9		8*	8*	27.5												

\* Clamping coupling specification.

The dimension table above shows the values of typical products. For products not listed above, please contact us.

For more information on the details of dimensions and shapes, refer to our delivery specification drawings.

When installing the speed reducer as a single unit or in a special manner, please contact us.

(Notes) 1. The square (□) in the configuration symbols indicates the symbol of the input shaft coupling. Please use the model selection tool on our website (<https://hds-tech.jp/ecat/ogctj/index.html>).

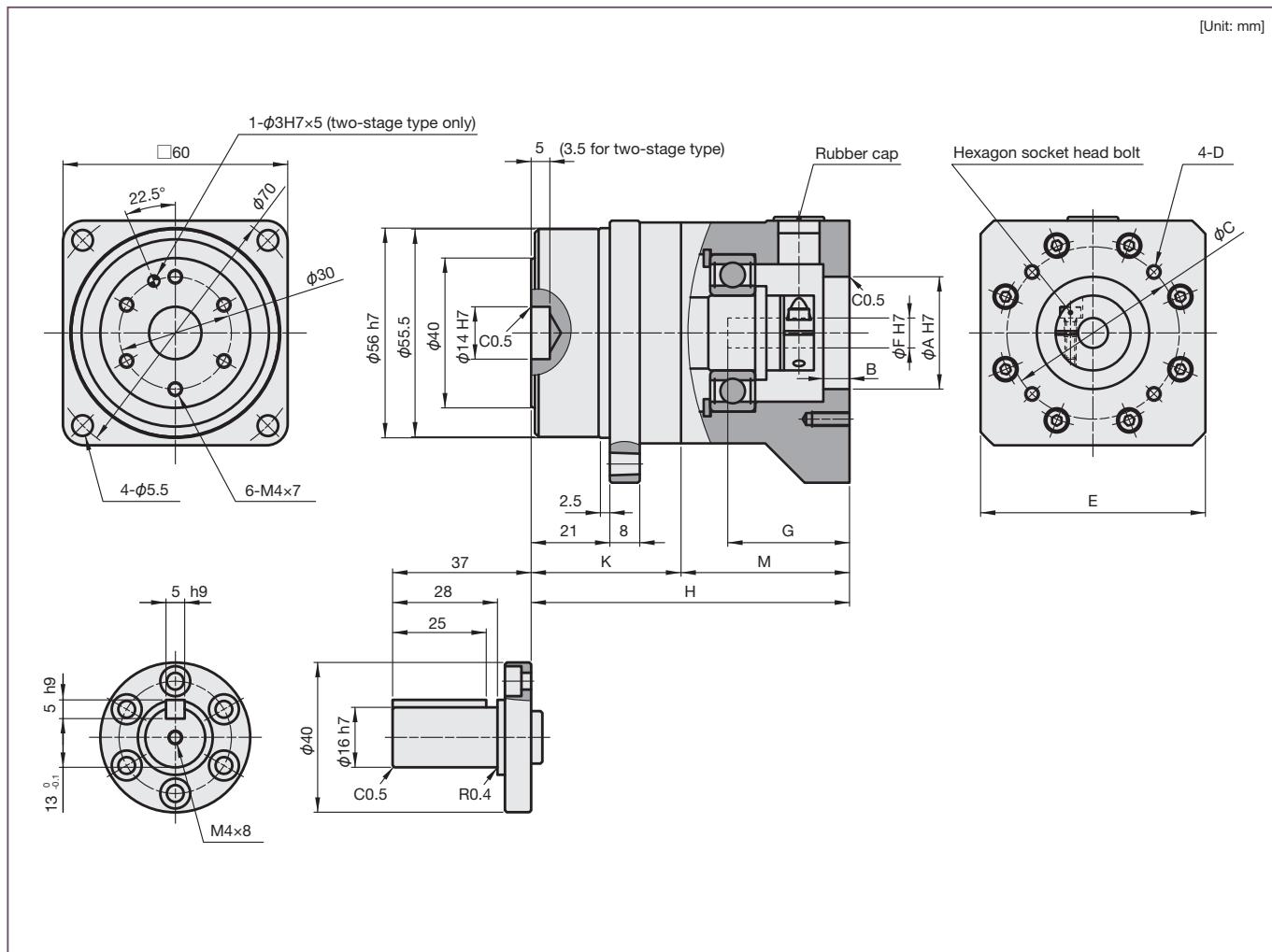
2. Weight may slightly vary depending on the reduction ratio and the inner diameter of the input shaft coupling.

3. Reduction ratios are 4, 5, 6, 7, 8, 9, and 10 for single-stage speed reducers and 20, 25, 30, 35, 40, 45, and 50 for two-stage speed reducers.

## External Dimensions - Size 14

This dimension drawing shows the major dimensions. For more information on the details of dimensions and shapes, refer to our delivery specification drawings. You can download the CAD data of this product from our website. URL: <https://www.hds.co.jp/>

Figure 9-1



\* The tolerance varies depending on the manufacturing method (casting or machining) of the parts. For more information on the tolerance of a dimension without a tolerance, please contact us.

### Dimension Table

Table 9-1

	Configuration symbol Note 1	A (H7)	B	C	D	E	F (H7)		G	K	H	M	Weight (kg) Note 2	
							Min	Max					Shaft output	Flange output
Single-stage (Note 3)	AA□	30	7	45	M3X8	□60	6	8	32	40	85	45	1.02	0.92
	AB□			46	M4X10									
	AF□			48	M3X8									
	AC□	50	6.5	70	M5X12	□60	9	14	33	40	86	46	1.07	0.97
	AD□			60	M4X10									
	AE□			70	M5X12									
	RAX□			60	M6X12									
	RAY□			70	M5X12									
Two-stage (Note 3)	RAZ□	70	7	90	M6X12	□80	11	14	33.5	58.5	86	27.5	1.24	1.14
	RDA□			90	M5X12									
	RDB□			90	M6X12	□80	11	14	33.5	58.5	86	27.5	1.24	1.14
	MA□	30	7	45	M3X8									
	MB□			46	M4X10									
	MD□	50	6.5	M5X12	M4X10	□60	6	8	32.5	58.5	85	26.5	1.20	1.10
	ME□			70	M4X10									
	NA□			M5X12	M6X12									
	NB□			M5X12	M5X12	□80	9	14	33.5	58.5	86	27.5	1.24	1.14
	LA□			M6X12	M5X12									
	LB□			M5X12	M5X12									

The dimension table above shows the values of typical products. For products not listed above, please contact us.

For more information on the details of dimensions and shapes, refer to our delivery specification drawings.

When installing the speed reducer as a single unit or in a special manner, please contact us.

(Notes) 1. The square (□) in the configuration symbols indicates the symbol of the input shaft coupling. Please use the model selection tool on our website (<https://hds-tech.jp/ecat/ogctj/index.html>).

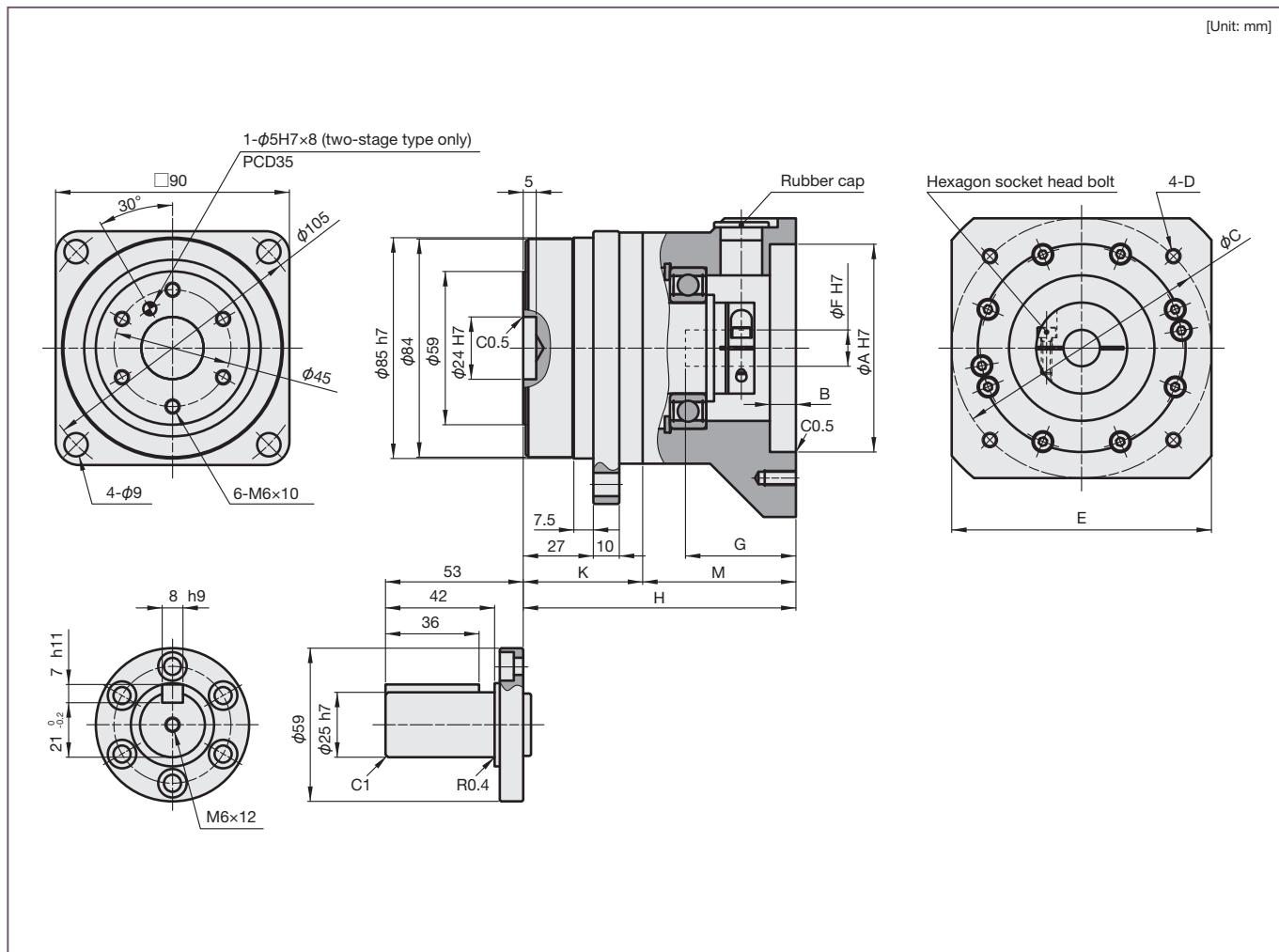
2. Weight may slightly vary depending on the reduction ratio and the inner diameter of the input shaft coupling.

3. Reduction ratios are 3, 4, 5, 6, 7, 8, 9, and 10 for single-stage speed reducers and 15, 20, 25, 30, 35, 40, 45, and 50 for two-stage speed reducers.

## External Dimensions - Size 20

This dimension drawing shows the major dimensions. For more information on the details of dimensions and shapes, refer to our delivery specification drawings. You can download the CAD data of this product from our website. URL: <https://www.hds.co.jp/>

Figure 10-1



\* The tolerance varies depending on the manufacturing method (casting or machining) of the parts. For more information on the tolerance of a dimension without a tolerance, please contact us.

### Dimension Table

Table 10-1

	Configuration symbol Note 1	A (H7)	B	C	D	E	F (H7)		G	K	H	M	Weight (kg) Note 2				
							Min	Max					Shaft output	Flange output			
Single-stage (Note 3)	PGC□	50	10	70	M5X12	φ89	7	19	38	46	98	52	2.8	2.4			
	PGD□				M4X10												
	PGE□			60	M4X8												
	PFF□	70	7	90	M5X12	□80	9	19	45		105	59	3.0	2.6			
	PFE□				M6X12												
	PHC□	80	20	100	M8X16	□100	19	24	71		134	64	4.3	3.9			
	PHD□	95	6	115									128	58	3.8	3.4	
Two-stage (Note 3)	ZA□	30	5	45	M3X8	φ55	8	8	30.5	70	98.5	28.5	3.1	2.7			
	ZB□			46	M4X10												
	YA□	50	5	70	M5X12	φ89	9	19	35		98	28					
	YB□				M4X10								3.3	2.9			
	WA□	70	7	90	M6X12	□80	19	24	42		105	35					
	WB□				M5X12												
	XA□	80	10	100	M6X12	□100	19	24	59		134	64	4.3	3.9			
	XB□	95	6	115	M8X16								128	58	3.8	3.4	
	XC□				M6X12												
	TA□	110	7	145	M8X25	□130	19	24	65		122	52	4.1	3.7			
	UA□				M8X16												
	VA□	114.3	6.5	200	M8X25	□130	19	24	71								
	VB□				M12X25												

The dimension table above shows the values of typical products. For products not listed above, please contact us.  
For more information on the details of dimensions and shapes, refer to our delivery specification drawings.

When installing the speed reducer as a single unit or in a special manner, please contact us.

(Notes) 1. The square (□) in the configuration symbols indicates the symbol of the input shaft coupling. Please use the model selection tool on our website (<https://hds-tech.jp/ecat/ogctj/index.html>).

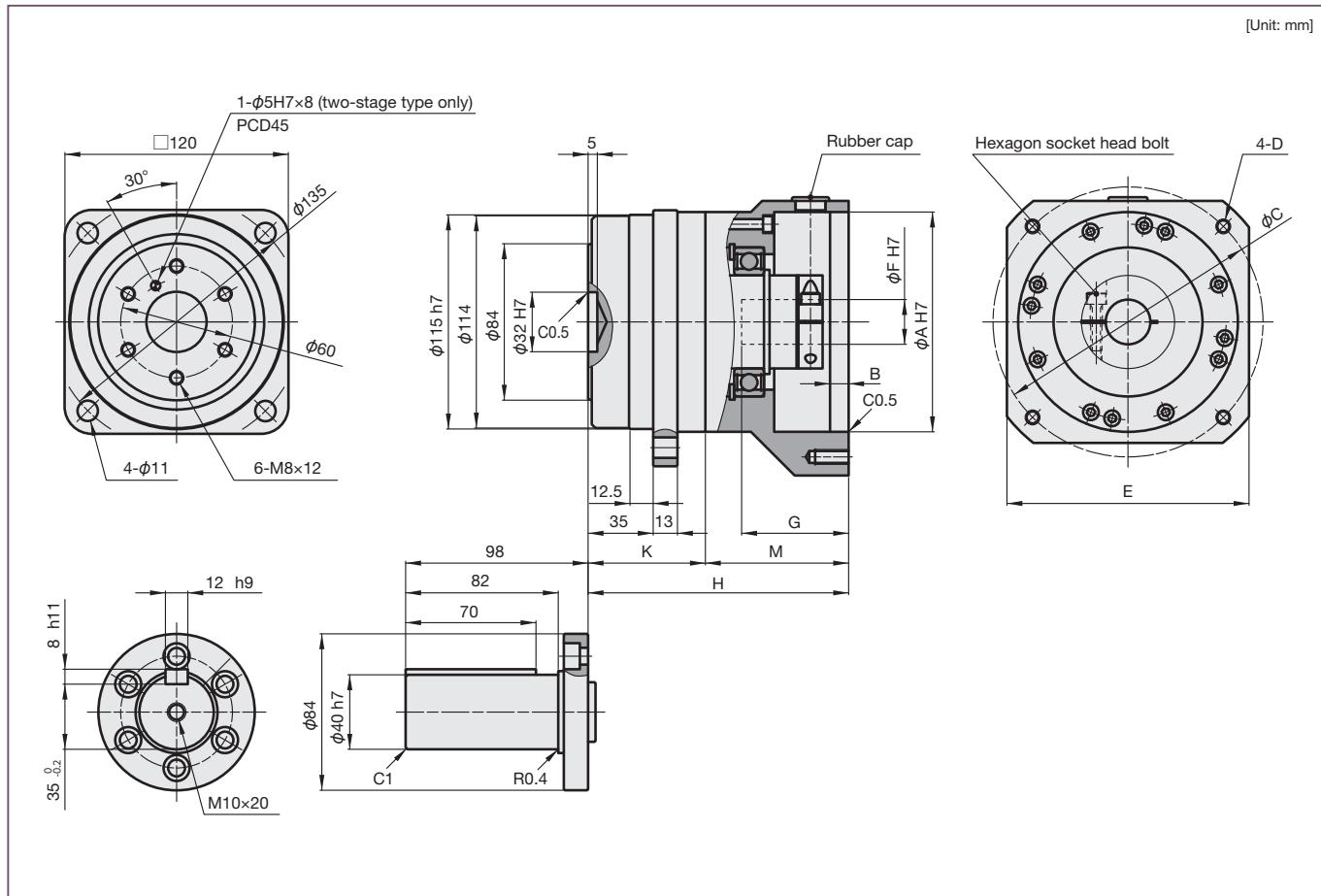
2. Weight may slightly vary depending on the reduction ratio and the inner diameter of the input shaft coupling.

3. Reduction ratios are 3, 4, 5, 6, 7, 8, 9, and 10 for single-stage speed reducers and 15, 20, 25, 30, 35, 40, 45, and 50 for two-stage speed reducers.

## External Dimensions - Size 32

This dimension drawing shows the major dimensions. For more information on the details of dimensions and shapes, refer to our delivery specification drawings. You can download the CAD data of this product from our website. URL: <https://www.hds.co.jp/>

Figure 11-1



\* The tolerance varies depending on the manufacturing method (casting or machining) of the parts. For more information on the tolerance of a dimension without a tolerance, please contact us.

### Dimension Table

Table 11-1

	Configuration symbol Note 1	A (H7)	B	C	D	E	F (H7)		G	K	H	M	Weight (kg) Note 2	
							Min	Max					Shaft output	Flange output
Single-stage (Note 3)	PNG□	70	4	90	M6X12	φ122	10	24	38	63	139	76	7.5	6.1
	PNA□				M5X12				56					
	PNC□				M6X12				62					
	PNB□	80	7	100	M8X10	φ135	16	35	59		145	82	7.6	6.2
	PNF□	95			M6X10				81					
	PNJ□	110			M8X18				62		142	79	7.5	6.1
	PMC□	114.3	6.5	145	M8X25	□135	16	35	59					
	PPA□	200			M12X25				81		164	101	8.1	6.7
	PPB□	200			□180				9.1					
	PQP□	200			□220				14.7					
	PPC□	200			□220				13.3					
	LA□	50	10	70	M5X12	φ80	10	19	39.5		135	38	8.3	6.9
	LB□				M4X10									
	KA□	70	7	90	M5X12						139	42	8.8	7.4
	KB□				M6X12	φ122								
	KC□	80		100	M6X10	24	62							
	JJ□	95	6	115	M8X10				145		48	8.9	7.5	
	JF□				M8X10									
Two-stage (Note 3)	HA□	110	10	145	M8X18	□130	16	59		97	142	45	9.0	7.6
	GA□				M8X25									
	GB□	114.3	6.5	200	M12X25						164	67	9.4	8.0
	GF□	130			M10X25	□180								
	GC□	200			M12X25	35	81							
					□220									

The dimension table above shows the values of typical products. For products not listed above, please contact us.  
For more information on the details of dimensions and shapes, refer to our delivery specification drawings.

When installing the speed reducer as a single unit or in a special manner, please contact us.

(Notes) 1. The square (□) in the configuration symbols indicates the symbol of the input shaft coupling. Please use the model selection tool on our website (<https://hds-tech.jp/ecat/ogctj/index.html>).

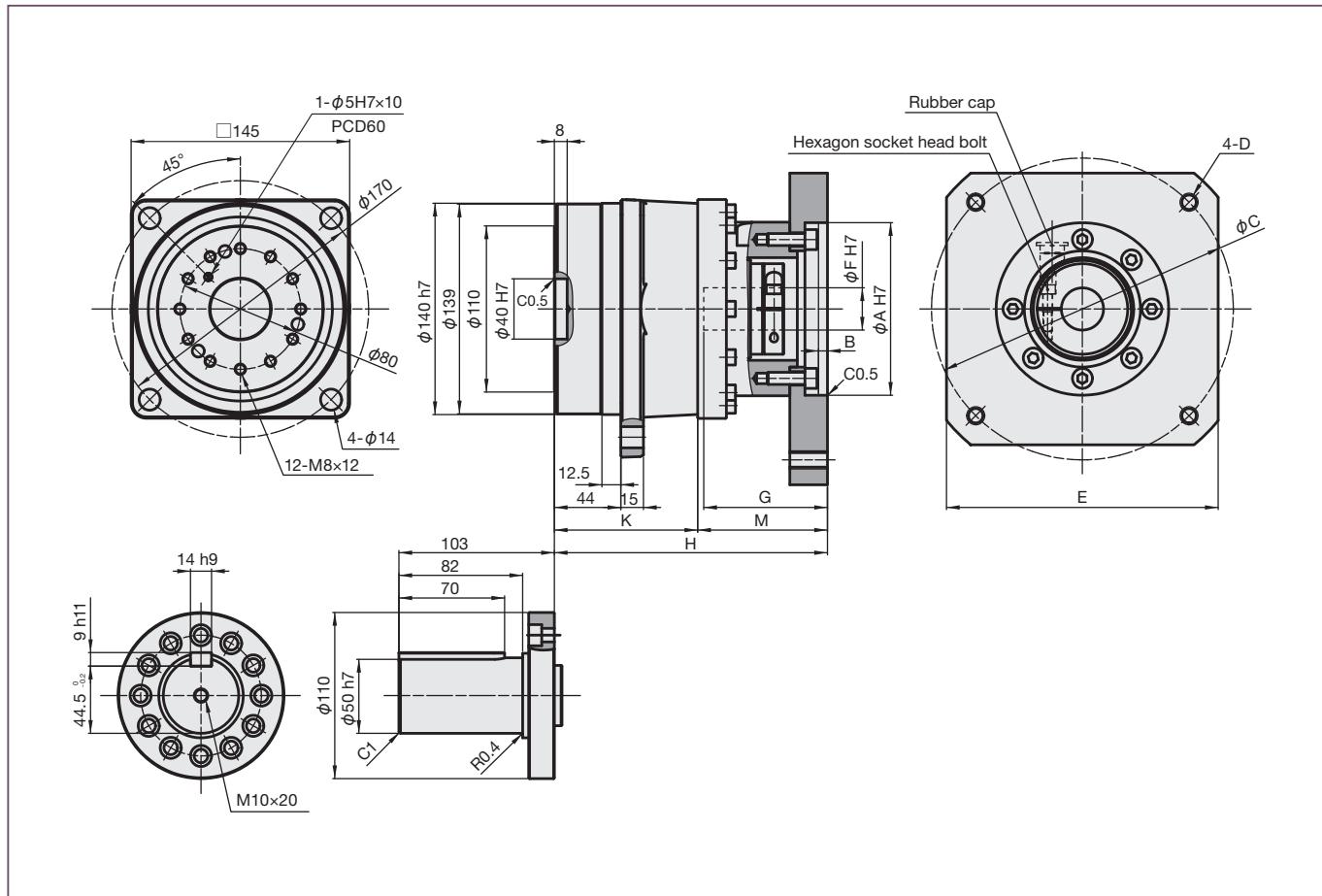
2. Weight may slightly vary depending on the reduction ratio and the inner diameter of the input shaft coupling.

3. Reduction ratios are 3, 4, 5, 6, 7, 8, 9, and 10 for single-stage speed reducers and 15, 20, 25, 30, 35, 40, 45, and 50 for two-stage speed reducers.

## External Dimensions - Size 40

This dimension drawing shows the major dimensions. For more information on the details of dimensions and shapes, refer to our delivery specification drawings. You can download the CAD data of this product from our website.

Figure 12-1



\* The tolerance varies depending on the manufacturing method (casting or machining) of the parts. For more information on the tolerance of a dimension without a tolerance, please contact us.

## ■ Dimension Table

Table 12-1

	Configuration symbol Note 1	A (H7)	B	C	D	E	F (H7)		G	K	H	M	Weight (kg) Note 2	
							Min	Max					Shaft output	Flange output
Single-stage (Note) 3	AA□	110	6.5	145	M8x25	□130	19	35	81	181	86	12.6	10.0	
	AB□	114.3	6.5	200	M12x25	□180						13.6	11.0	
	AC□	200	6.5	235	M12x25	□220						13.7	11.1	
	AF□	130	6.5	165	M10x25	□180						13.5	10.9	
	BA□	80	7	100	M6x12	Φ145	19	24	64	95	69	12.6	10.0	
	BB□	95	7	115	M6x12	Φ145						12.6	10.0	
	BC□	95	7	115	M8x16	Φ145						12.6	10.0	
	CA□	110	6.5	145	M8x25	□130	42	42	90	190	95	12.6	10.0	
	CB□	114.3	6.5	200	M12x25	□180						13.6	11.0	
	CC□	200	6.5	235	M12x25	□220						13.7	11.1	
	CF□	130	6.5	165	M10x25	□180						13.5	10.9	
Two-stage (Note) 3	DA□	110	10	145	M8x18	Φ165	19	24	64	180	56	17.0	14.4	
	EA□	70	7	90	M5x12	Φ145						16.6	14.0	
	EB□	70	7	90	M6x12	Φ145						16.6	14.0	
	EC□	80	7.5	100	M6x12	Φ145	14	24	61	177	53	16.6	14.0	
	ED□	95	7.5	115	M6x12	Φ145						16.6	14.0	
	EE□	95	7.5	115	M8x16	Φ145						16.6	14.0	
	FA□	110	6.5	145	M8x25	□130	19	35	81	197	73	16.9	14.3	
	FB□	114.3	6.5	200	M12x25	□180						17.9	15.3	
	FC□	200	6.5	235	M12x25	□220						18.0	15.4	
	FF□	130	6.5	165	M10x25	□180						17.8	15.2	

The dimension table above shows the values of typical products. For products not listed above, please contact us.

The dimension table above shows the values of typical products. For products not listed above, please contact us. For more information on the details of dimensions and shapes, refer to our delivery specification drawings.

For more information on the details of dimensions and shapes, refer to our delivery specification.  
When installing the speed reducer as a single unit or in a special manner, please contact us.

(Notes) 1. The square  in the form symbols indicates the symbol of the input shaft coupling. Please use the model selection tool on our website (URL: <https://hds-tech.jp/ecat/octgj/index.html>).

1. The square (□) in the form symbols indicates the symbol of the input shaft coupling. Please use the model set.

2. Weight may vary slightly depending on the reduction ratio and the inner diameter of the input shaft coupling.

3. Reduction ratios are 3, 4, 5, 6, 7, 8, 9, and 10 for single-stage speed reducers and 15, 20, 25, 30, 35, 40, 45, and 50 for two-stage speed reducers.

# Efficiency Characteristics

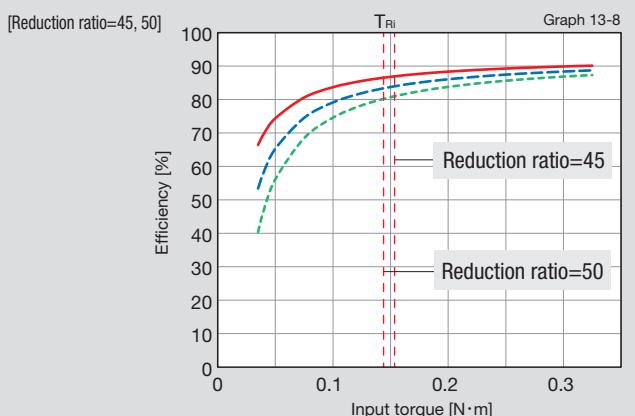
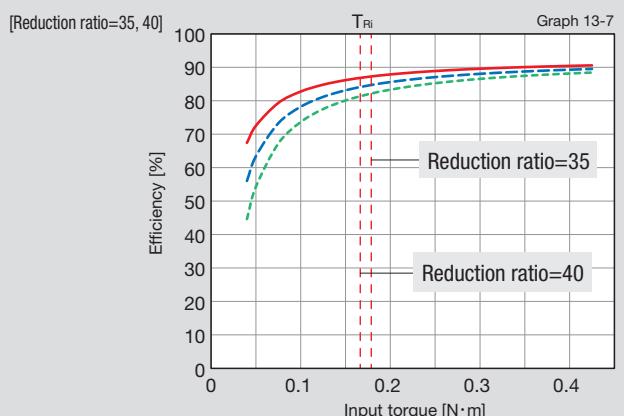
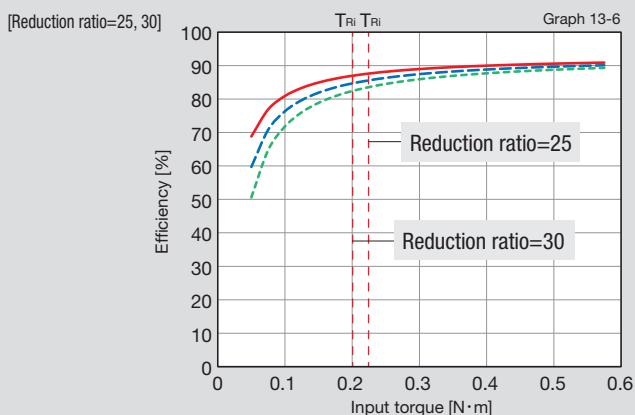
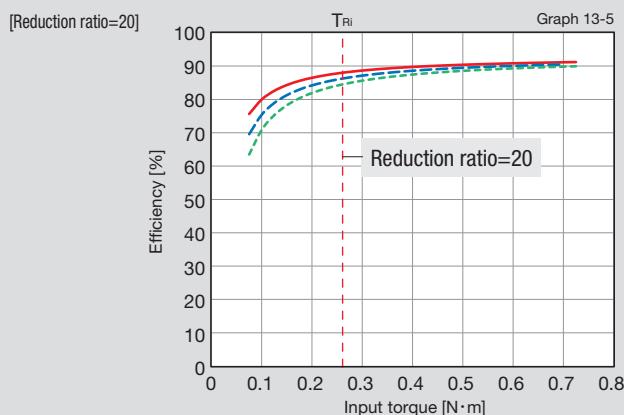
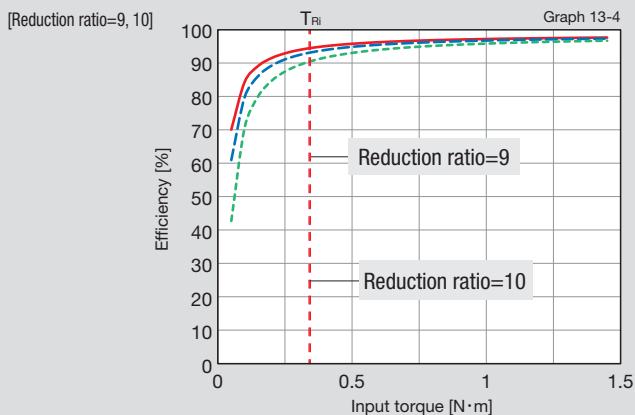
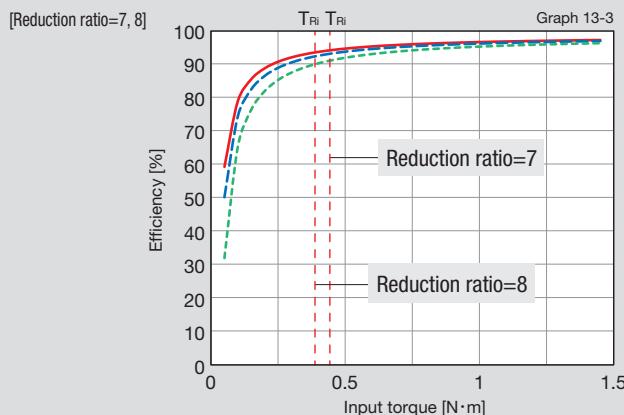
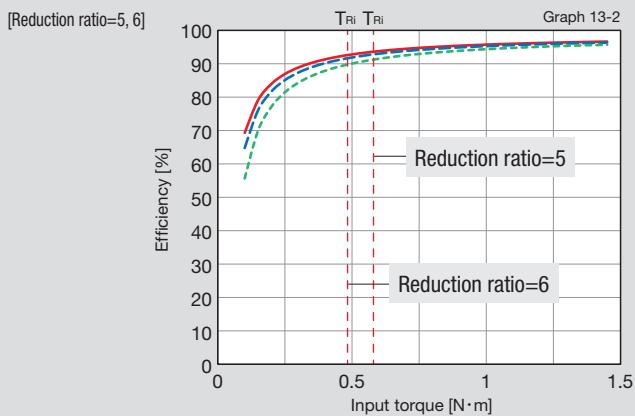
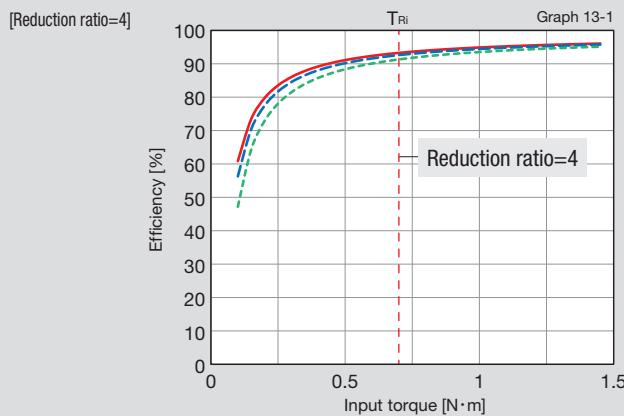
Generally, the efficiency of a speed reducer varies depending on the reduction ratio, input speed, load torque, temperature, and lubrication conditions. The efficiencies of different series under the following measuring conditions are shown below. \* The graphs show the average values.

## Measuring conditions

Table 13-1

Input speed	3000 r/min
Ambient temperature	25°C
Lubrication agent	Refer to page 18 of this document.

## Efficiency characteristics graph - Size 11

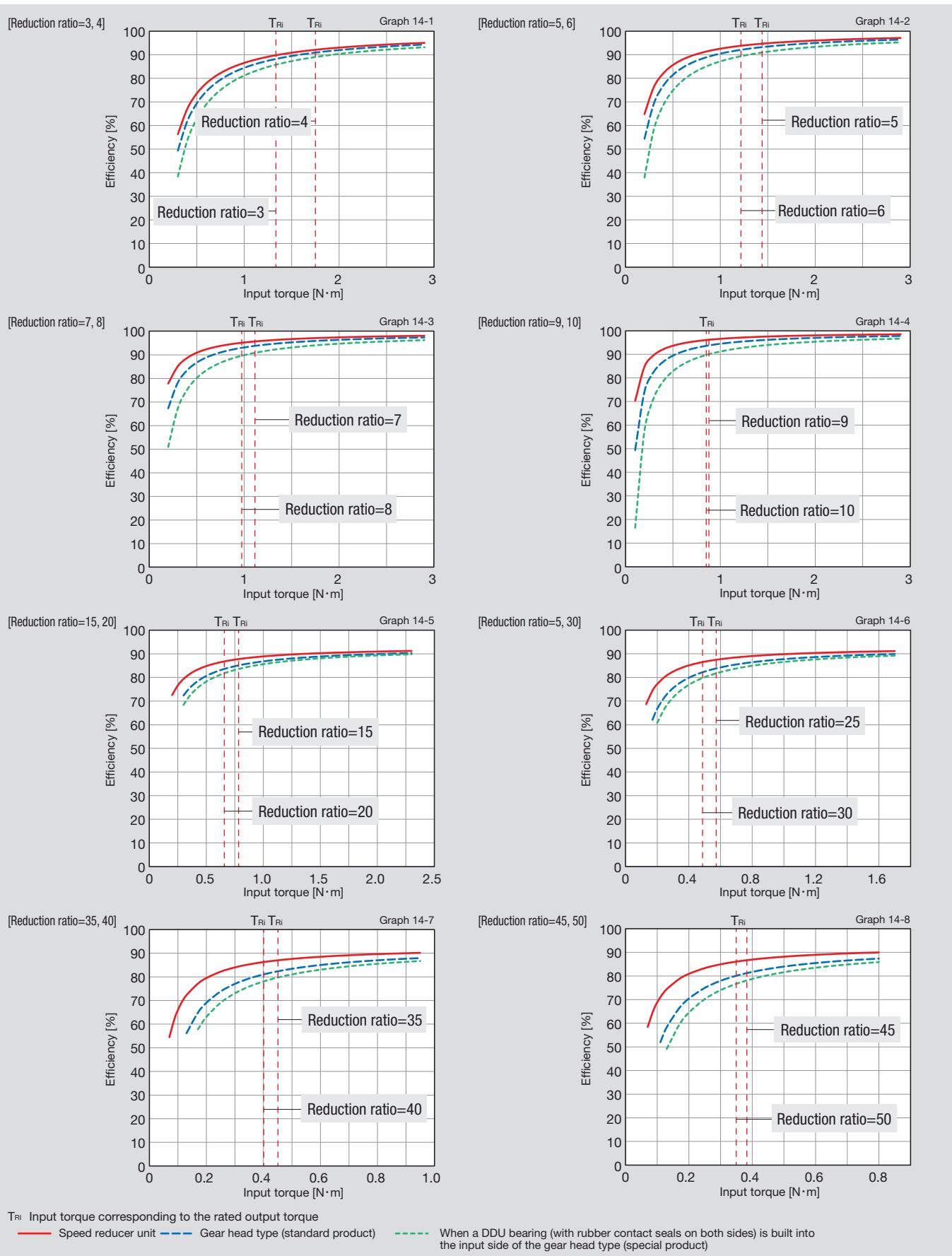


$T_{Ri}$  Input torque corresponding to the rated output torque

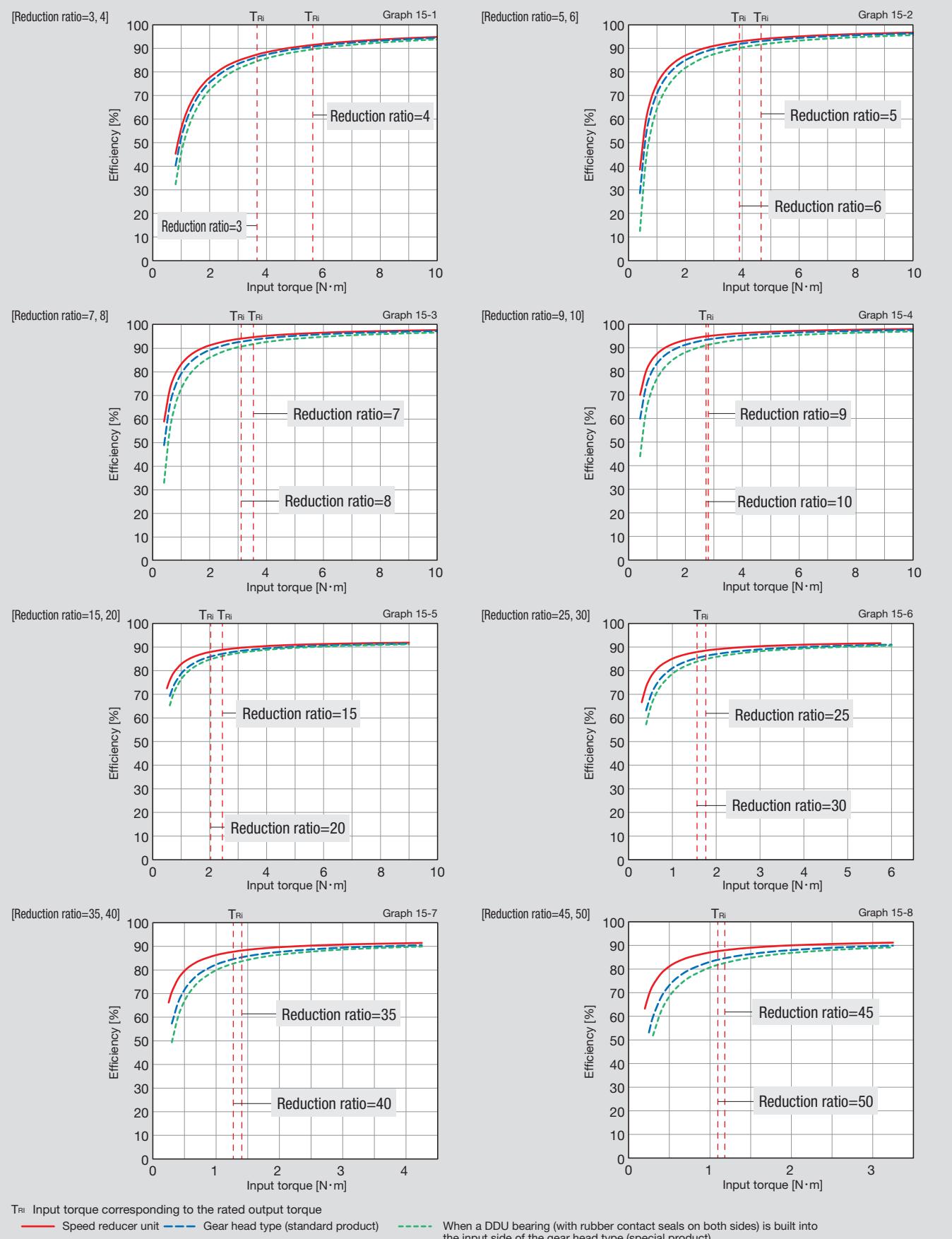
— Speed reducer unit — Gear head type (standard product)

— When a DDU bearing (with rubber contact seals on both sides) is built into the input side of the gear head type (special product)

## Efficiency characteristics graph - Size 14



## Efficiency characteristics graph - Size 20

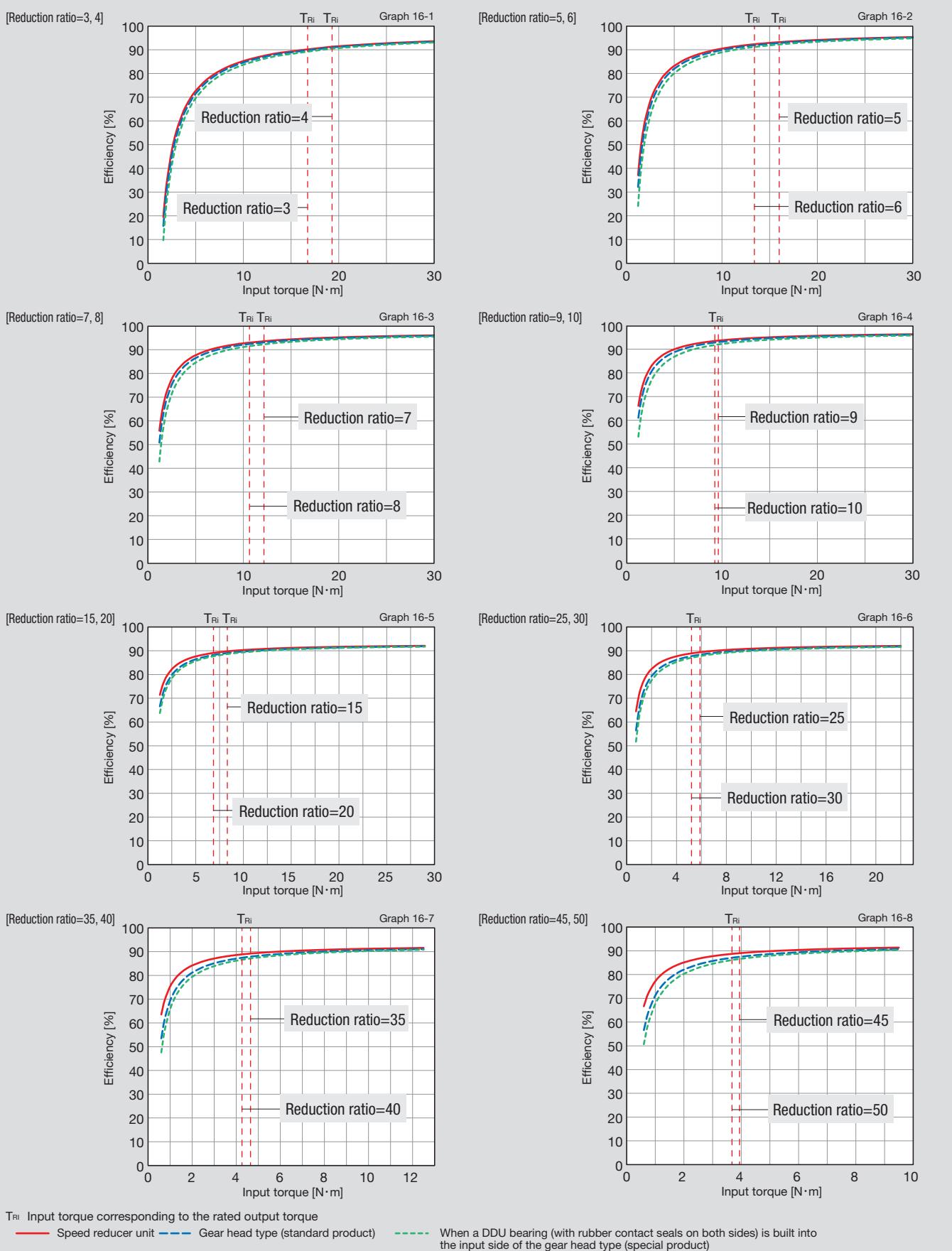


$T_{RI}$  Input torque corresponding to the rated output torque

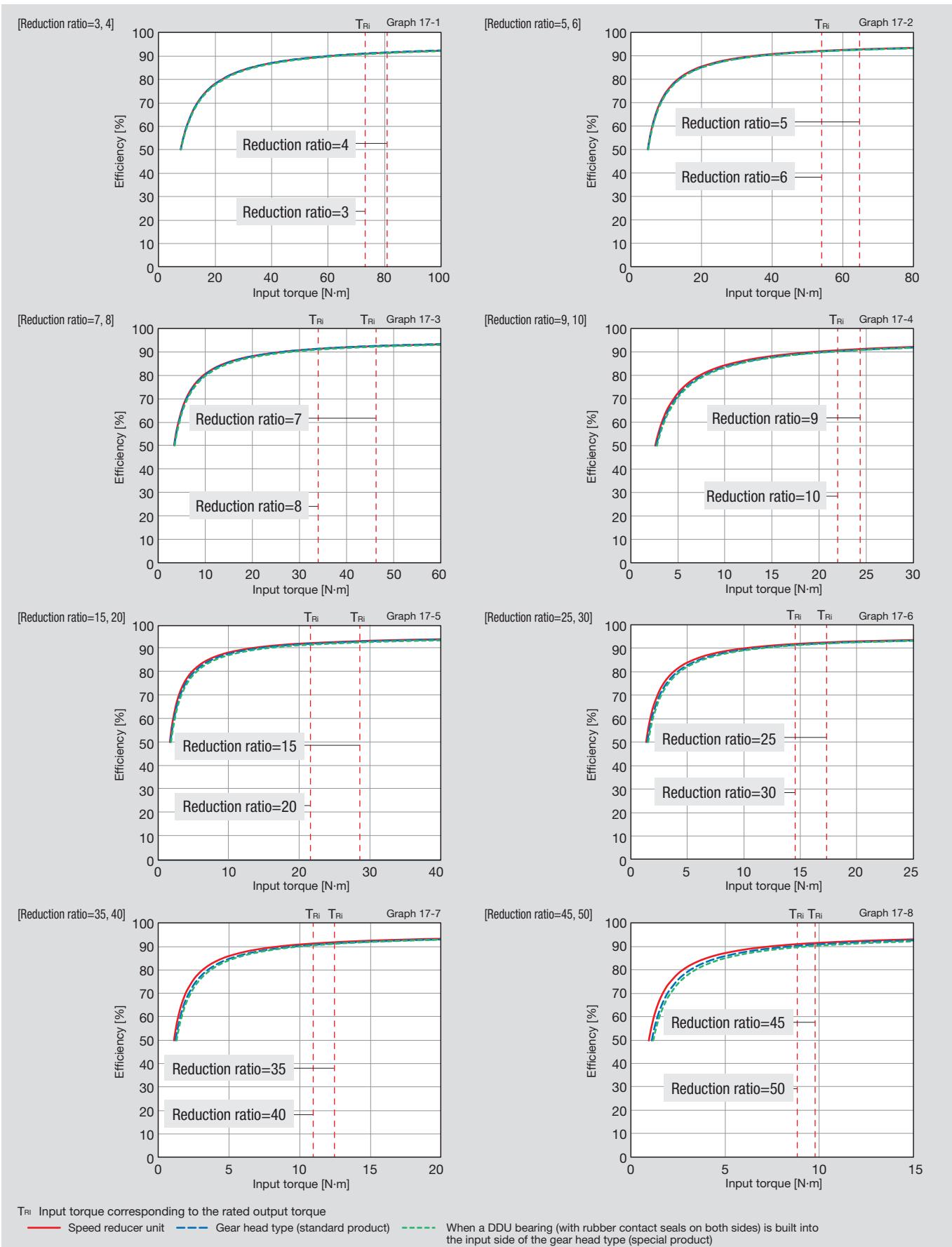
— Speed reducer unit    - - Gear head type (standard product)

- - - When a DDU bearing (with rubber contact seals on both sides) is built into the input side of the gear head type (special product)

## Efficiency characteristics graph - Size 32



## Efficiency characteristics graph - Size 40



## ■ Allowable load on the main bearing

The allowable radial load and allowable axial load indicate values that satisfy a LB10 lifetime of 20000 hours of the output bearing at the allowable average input speed in the "Rating Table" when only the pure radial load or axial load (with no bending moment) is exerted on the output shaft. When any bending moment is involved or complex load is exerted, confirm the values by calculation by referring to the technical data "Specifications and check procedure of the output bearing" in the catalog.

Table 18-1

Size	Reduction ratio	Allowable radial load	Allowable axial load
		N	N
11	4	260	400
	5	280	430
	6	300	450
	7	310	470
	8	330	490
	9	340	510
	10	350	530
	20	430	650
	25	460	690
	30	490	730
	35	510	770
	40	530	800
	45	550	830
	50	570	860
	3	400	600
	4	440	660
	5	470	700
14	6	490	740
	7	520	780
	8	540	810
	9	560	840
	10	580	860
	15	650	980
	20	710	1070
	25	760	1140
	30	810	1200
	35	840	1260
	40	880	1310
	45	910	1360
	50	940	1410
	3	840	1250
	4	910	1370
	5	980	1460
20	6	1030	1540
	7	1080	1620
	8	1130	1680
	9	1170	1740
	10	1200	1800
	15	1360	2030
	20	1480	2220
	25	1590	2370
	30	1680	2510
	35	1760	2620
	40	1830	2730
	45	1890	2830
	50	1950	2920

Table 18-2

Size	Reduction ratio	Allowable radial load	Allowable axial load
		N	N
32	3	1630	2430
	4	1770	2650
	5	1900	2830
	6	2000	2990
	7	2100	3130
	8	2180	3260
	9	2260	3380
	10	2330	3480
	15	2640	3940
	20	2880	4300
	25	3080	4590
	30	3250	4850
	35	3400	5080
	40	3540	5290
	45	3670	5480
	50	3790	5660
	3	3160	4720
40	4	3440	5140
	5	3680	5500
	6	3890	5810
	7	4070	6080
	8	4240	6330
	9	4390	6560
	10	4530	6770
	15	5120	7640
	20	5580	8330
	25	5970	8910
	30	6310	9410
	35	6600	9860
	40	6870	10200
	45	7120	10600
	50	7350	10900

## Notices on Handling Products

### ■ Size selection

To achieve the full performance of the HarmonicPlanetary® HPG series, make sure to check the operating conditions and select a size by referring to the flow chart.

For more information, please refer to "Size selection" in our gear head series catalog.

### ■ Handling instruction

To achieve the full performance of the gear head series, perform installation and mounting correctly.

Follow our recommendation on bolts to use and tightening torque.

For more information, please refer to "Handling instruction" in our gear head series catalog.

### ■ Lubricant names

Multemp AC-P specification (HPG helical gear type 11R, 14R, 20R, 32R, single-stage)  
Manufacturer: KYODO YUSHI CO., LTD.

Base oil: Composite hydrocarbon oil and diester	Consistency: 280 (at 25°C)
Thickener: Lithium soap	Drop point: 200°C or above
Additives: Extreme-pressure additive and others	Appearance: Black

Harmonic Grease® PAL-1 specification (HPG helical gear type 40R, single-stage/11R, 14R, 20R, 32R, 40R, two-stage)  
Manufacturer: Harmonic Drive Systems Inc.

Base oil: Mineral oil/synthetic oil	Consistency: 295-325 (at 25°C)
Thickener: Lithium complex	Drop point: 230°C or above
Additives: Extreme-pressure additive and others	Appearance: Light yellow

### ■ Specifications and check procedure of the output bearing

A high-precision cross roller bearing is built in for directly supporting the external load (output flange part).

To achieve the full performance, check the maximum moment load, life of the cross roller bearing, and static safety coefficient.

For more information, please refer to the "Specifications and check procedure of the output bearing" in our gear head series catalog.

## Motor Capacity / Size Matching Table

The matching table is a guide for the combinations with the standard motors.

For information on the combination with specific motors, please contact our sales office.

Motor capacity	Motor rated speed	Reduction ratio								
		3	4	5	6	7	8	9	10	
W	r/min	3	4	5	6	7	8	9	10	
50	3000		11	11	11	11	11	11	11	
100	3000		11	11	11	11	14	14	14	
150	3000		11	11	11	14	14	14	14	
200	3000	14	14	14	14	14	14	20	20	
400	3000	14	14	14	14	20	20	20	20	
600	3000	20	20	20	20	20	20	20	20	
750	3000	20	20	20	20	20	20	20	32	
1000	3000	20	20	20	20	20	20	32	32	
1500	3000	32	32	32	32	32	32	32	32	
2000	3000	32	32	32	32	32	32	32	32	
2500	3000	32	32	32	32	32	32	32	40	
3000	3000	32	32	32	32	32	32	40	40	
4000	3000	32	32	32	32	32	40	40	40	
5000	3000	32	32	32	40	40	40	40		
7000	3000	40	40	40	40	40	40			

Motor capacity	Motor rated speed	Reduction ratio								
		15	20	25	30	35	40	45	50	
W	r/min	15	20	25	30	35	40	45	50	
50	3000		11	11	14	14	14	14	14	
100	3000	14	14	14	14	20	20	20	20	
150	3000	14	14	20	20	20	20	20	20	
200	3000	14	20	20	20	20	20	20	20	
400	3000	20	20	20	20	32	32	32	32	
600	3000	20	20	32	32	32	32	32	32	
750	3000	20	32	32	32	32	32	32	32	
1000	3000	32	32	32	32	32	32	40	40	
1500	3000	32	32	32	32	40	40	40	40	
2000	3000	32	32	40	40	40	40	40	40	
2500	3000	32	40	40	40	40	40			
3000	3000	40	40	40	40	40				
4000	3000	40	40	40						
5000	3000	40	40							
7000	3000	40								

The values in the table above show the sizes of the speed reducers. The mounting angle sizes for the respective sizes of speed reducer are shown below:

11:40mm

14:60mm

20:90mm

32:120mm

40:145mm



■ Please contact our sales department with any questions.

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The academic or generic term of our "HarmonicDrive" products is "strain wave gearing".