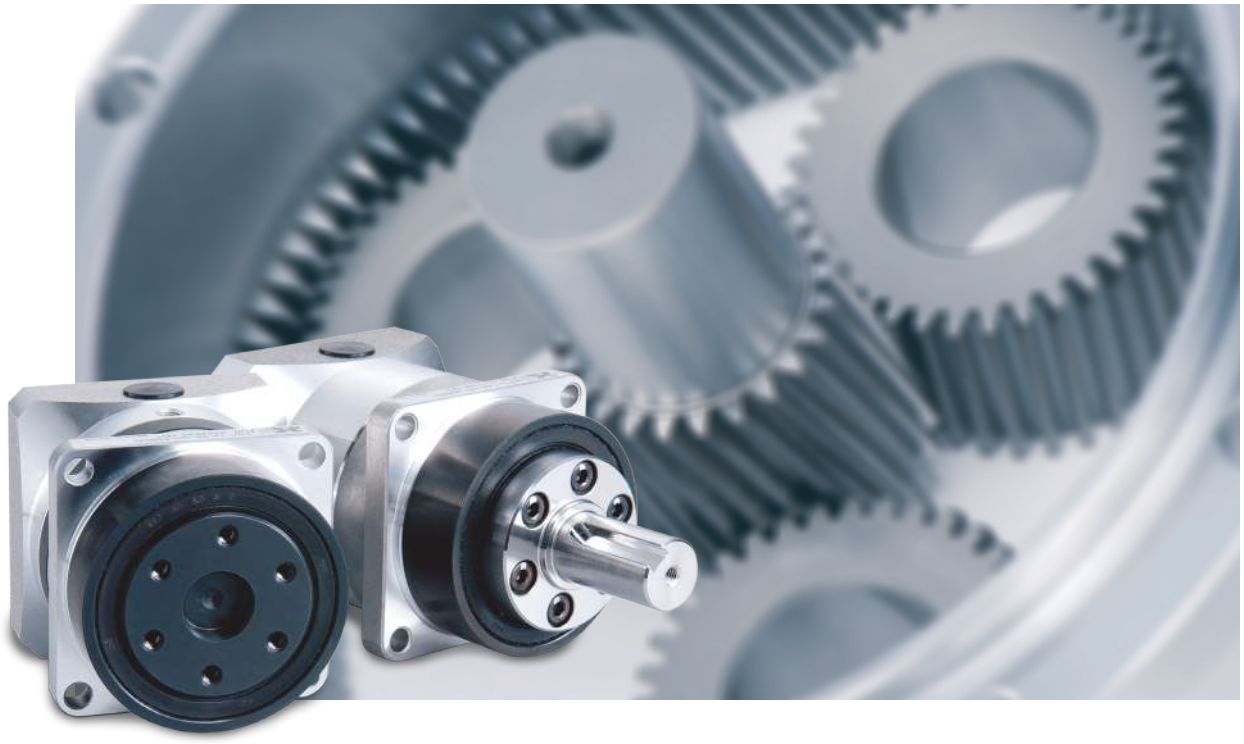
HarmonicDrive®
New Product News
Vol. 43

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

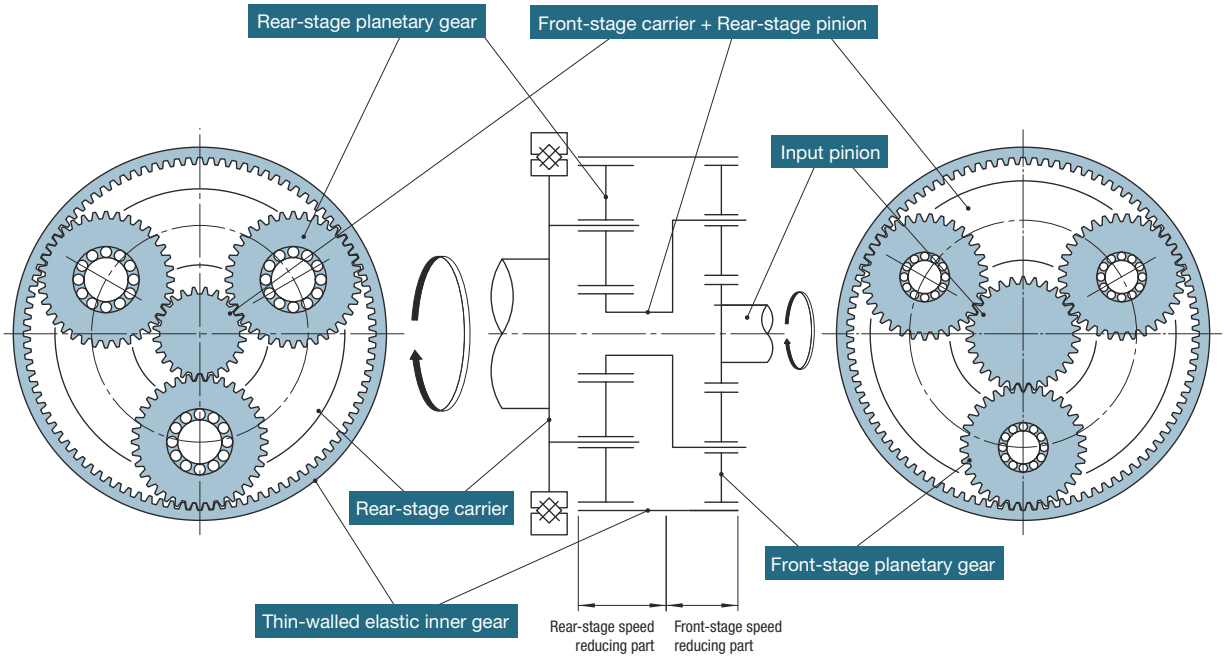
(1) (2) (3) (4) (5) (6) (7)

(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
		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)
		Sizes 14, 20, 32, 40	F0 : Flange output J2 : Straight shaft (without key) J6 : Straight shaft (with key and center tapped hole)

(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 https://hds-tech.jp/ecat/ogctj/index.html)
(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]

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.

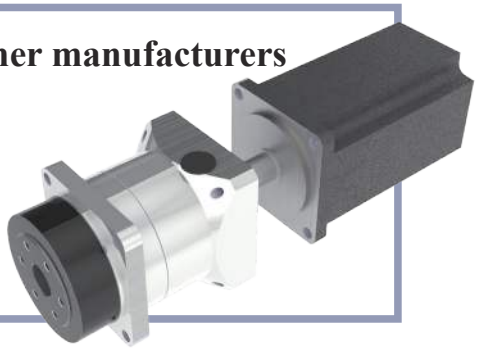
The rotation from the input pinion causes the orbital motion of the front-stage planetary gears that mesh with it. The orbital motion is transmitted to the front-stage carrier via the planetary shaft. The direction of rotation of the front-stage carrier is the same as the input direction.

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*1		Average load torque*2		Limit for repeated peak torque*3		Instantaneous maximum torque*4		Allowable average input speed*5	Maximum input speed*6	Moment of inertia (converted to input side)*7		Speed reducer unit weight*8	
												Shaft output	Flange output	Shaft output	Flange output
		N·m	kgf·m	N·m	kgf·m	N·m	kgf·m	N·m	kgf·m	r/min	r/min	×10⁻⁴kg·m²	×10⁻⁴kg·m²	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	13	1.3	20	2.0	3000	10000	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		
	50	6.0	0.61	13	1.3							0.00049	0.00047		
14	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	56	5.7		6000	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	30	3.1	56	5.7	3000	6000	0.028	0.028	0.92	0.82
	20	11	1.1	25	2.5							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		
20	3	11	1.1	25	2.6	90	9.2	124	13	3000	4000	0.64	0.53	1.7	1.3
	4	23	2.3	51	5.2	133	14	217	22		6000	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	133	14	217	22	3000	6000	0.24	0.23	2.8	2.4
	20	35	3.6	80	8.2							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		
32	3	50	5.1	110	11	290	30	507	52	3000	3600	3.5	2.8	4.5	3.1
	4	77	7.9	170	17	400	41	650	66		6000	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	400	41	650	66	3000	6000	1.1	1.1	7.2	5.8
	20	121	12	273	28							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		
40	3	200	20	450	46	600	61	1200	122	3000	4500	11	7.9	9.8	7.2
	4	300	31	675	69	900	92				6000	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	400	41	800	82	800	82	1200	122	3000	6000	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											0.55	0.53		
	40											0.41	0.39		
	45											0.32	0.31		
	50											0.27	0.26		

*1: Rated output is set with the value of Life: L_{10} = 20000 hours when the number of input rotations is 3000 r/min, which is the rated rotational speed of the typical servo motors.
*2: The average load torque is the limit for average torque that is calculated from the load torque pattern (refer to the High Performance Gear Head Series for Servo Motors catalog), and a life of 2000 hours is a rough indication when the gear is operated at the 2000 r/min number of input rotations.
*3: This is the allowable peak torque applied when starting up or stopping during the operation cycle.
*4: This is the allowable maximum value of impact torque applied in an emergency stop or applied externally. Exceeding this torque could damage the speed reducer.
*5: This is the allowable maximum value of the average input speed during the operation. Be careful not to exceed this value especially when the operation is almost continuous.
*6: The maximum input speed under the condition of non-continuous operation.
*7: The value for a single unit of the speed reducer.
*8: This indicates the mass of a single speed reducer. For more information on the values including input joint or motor flange, please contact us.

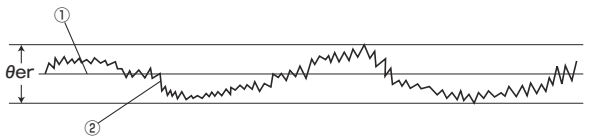
Performance Table

Table 4-1

Size	Reduction ratio	Rotational transmission error*1		Repeatability*2	Starting torque*3		Overdrive starting torque*4		No-load running torque*5	
		arc-min	$\times 10^{-4}$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

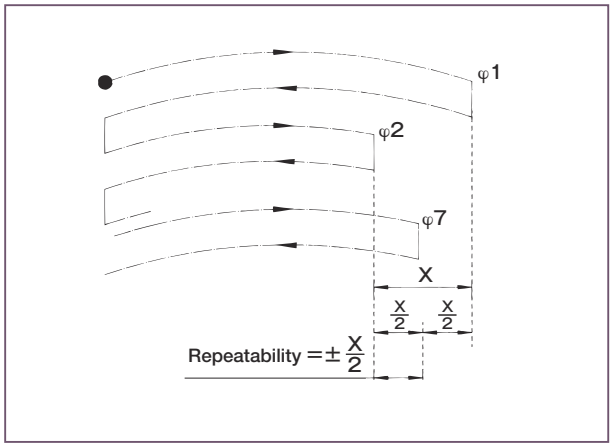


θer: Rotational transmission error
θ_1 : Input rotation angle
θ_2 : Actual output rotation angle
R : Reduction ratio of the HPG series

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

*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℃

*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℃

*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℃

Torque – Torsional Characteristics

Gear head type standard product

Table 6-1

Size	Reduction ratio	Backlash		Single-side torsional amount at T^R x 0.15		Torsional stiffness	
				D		A/B	
		arc-min	$\times 10^{-4}$rad	arc-min	$\times 10^{-4}$rad	kgf-m/arc-min	×100N-m/rad
11	4	3.0	8.7	2.5	7.3	0.065	22
	5						
	6						
	7						
	8						
	9						
	10						
	20	3.0	8.7	3.0	8.7	0.065	22
	25						
	30						
	35						
	40						
	45						
	50						
14	3	3.0	8.7	2.2	6.4	0.14	47
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	3.0	8.7	2.7	7.9	0.14	47
	20						
	25						
	30						
	35						
	40						
	45						
	50						
20	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						
	25						
	30						
	35						
	40						
	45						
	50						
32	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						
	25						
	30						
	35						
	40						
	45						
	50						
40	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						
	25						
	30						
	35						
	40						
	45						
	50						

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

Table 6-2

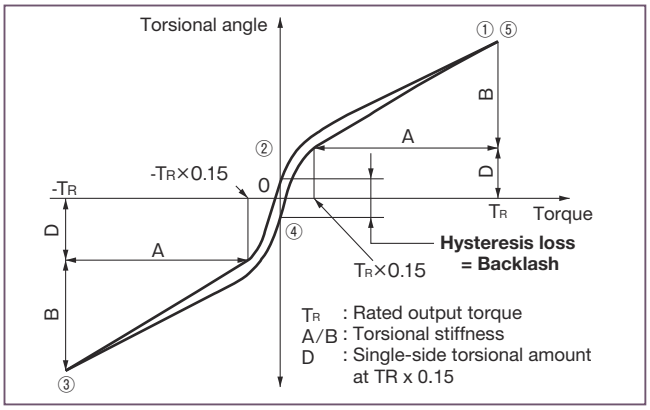
Size	Reduction ratio	Backlash		Single-side torsional amount at T^R x 0.15		Torsional stiffness	
				D		A/B	
		arc-min	$\times 10^{-4}$rad	arc-min	$\times 10^{-4}$rad	kgf-m/arc-min	×100N-m/rad
14	3	1.0	2.9	1.1	3.2	0.14	47
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	1.0	2.9	1.7	4.9	0.14	47
	20						
	25						
	30						
	35						
	40						
	45						
	50						
20	3	1.0	2.9	0.6	1.7	0.55	180
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	1.0	2.9	1.1	3.2	0.55	180
	20						
	25						
	30						
	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
	20						
	25						
	30						
	35						
	40						
	45						
	50						
40	3	1.0	2.9	0.5	1.5	4.8	1600
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	15	1.0	2.9	1.0	2.9	4.8	1600
	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

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

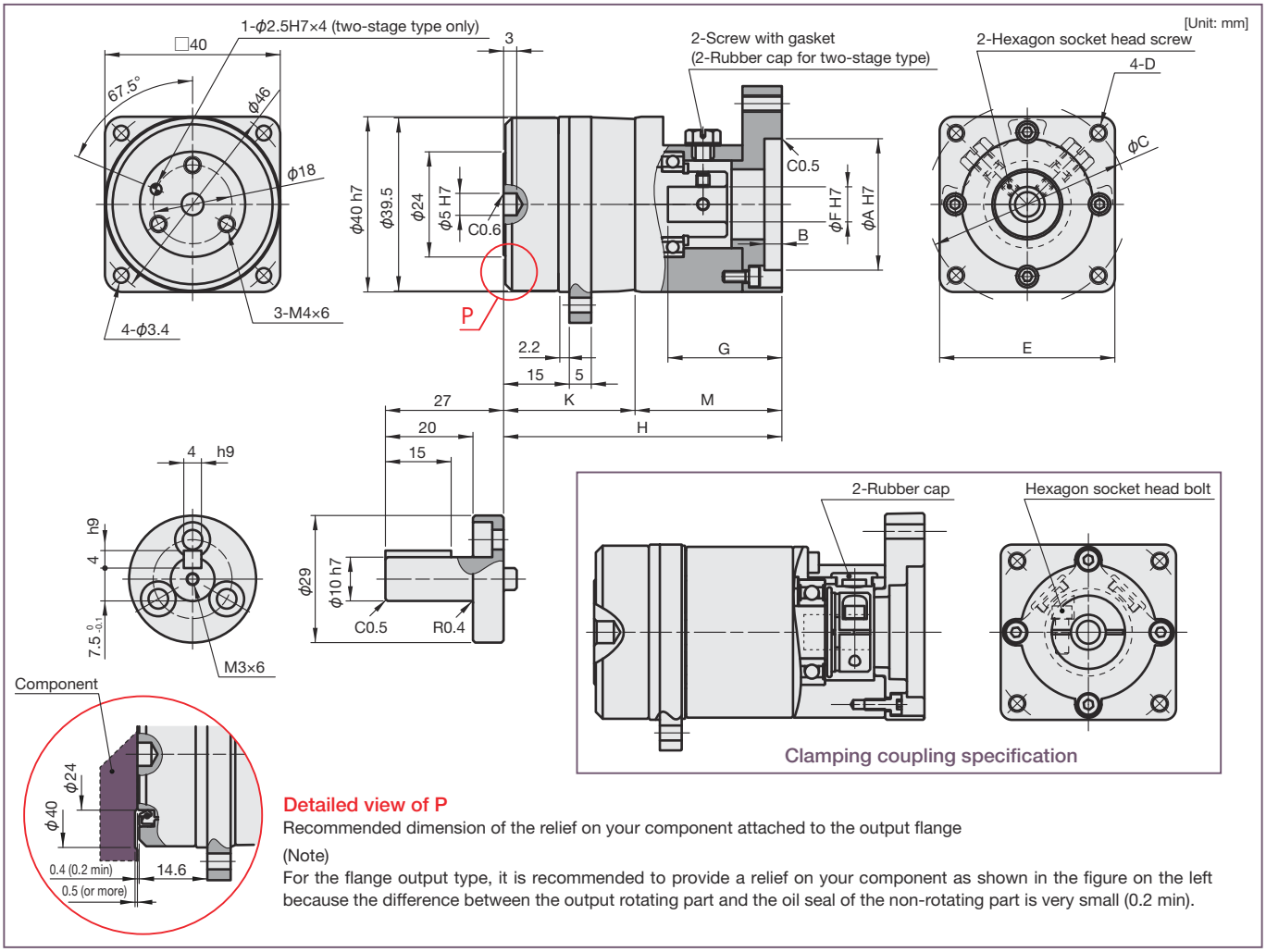
Symbols in calculation formula

θ	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×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



Detailed view of P

Recommended dimension of the relief on your component attached to the output flange

(Note)
For the flange output type, it is recommended to provide a relief on your component as shown in the figure on the left because the difference between the output rotating part and the oil seal of the non-rotating part is very small (0.2 min).

* 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 Note 1	A (H7)	B	C	D	E	F (H7) Min	F (H7) Max	G	K	H	M	Weight (kg) Note 2 Shaft output	Weight (kg) Note 2 Flange output
Single-stage (Note) 3	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							0.33	0.28
	RAA□	28		33	M2.5X5	ϕ40			16.5		45.5	24.5	0.31	0.26
	RAD□	30	4	46	M4X9	□40			25.5		54.5	33.5	0.35	0.30
	RAE□			45	M3X9									
	RAN□	34		48										
	RAF□	50		70	M4X9	□60							0.40	0.35
	RAG□				M5X9									
	RAH□			60	M4X9									
Two-stage (Note) 3	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
							8*	8*	27.5					
	SE□			45	M3X9		6	7	26.4					
							8*	8*	27.5					
	SF□	50	5	70	M4X9	□60	6	7	26.4				0.63	0.58
							8*	8*	27.5					
	SG□				M5X9		6	7	26.4					
							8*	8*	27.5					

* Clamping coupling specification.

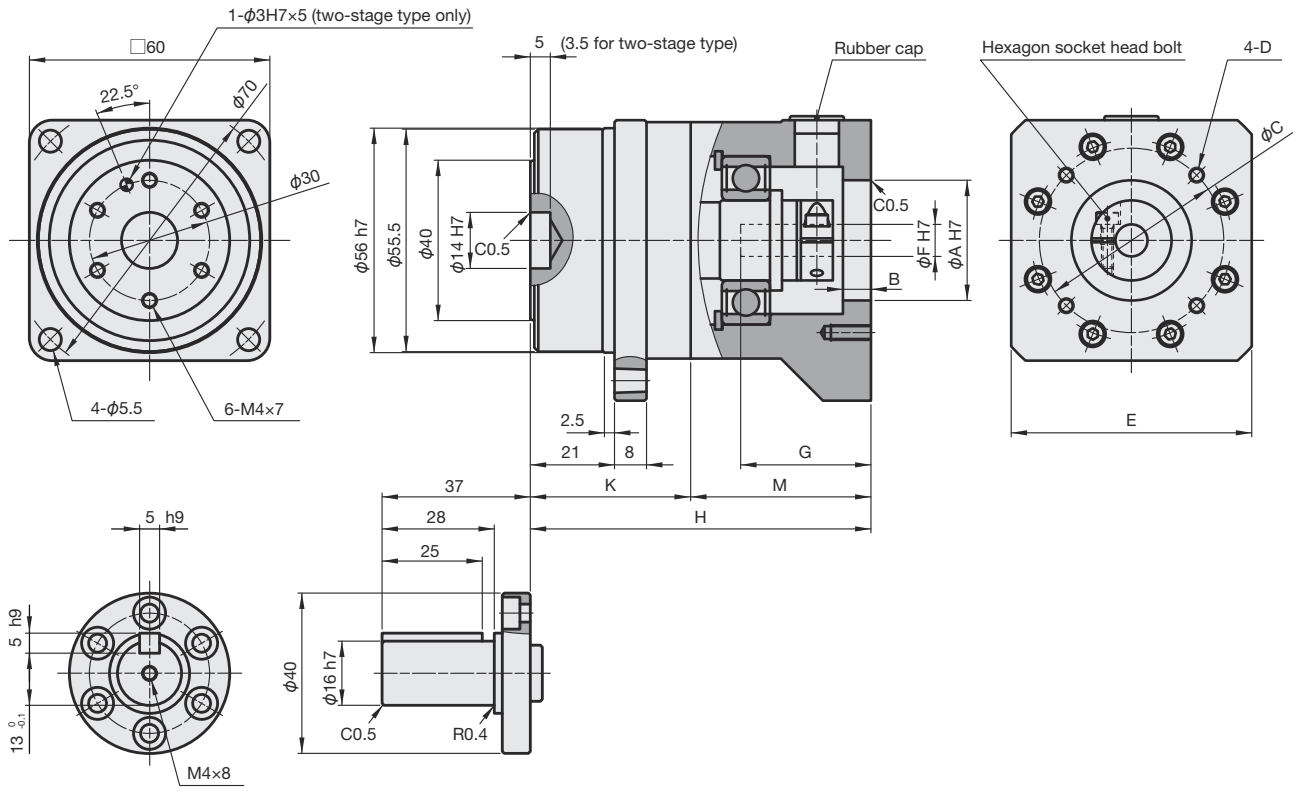
The dimension table above shows the values of typical products. For products not listed above, please contact us.
For more information on the details of dimensions and shapes, refer to our delivery specification drawings.
When installing the speed reducer as a single unit or in a special manner, please 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

[Unit: mm]



* 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) Min	F (H7) Max	G	K	H	M	Weight (kg) Note 2 Shaft output	Weight (kg) Note 2 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□	34		48	M3X8									
	AC□	50	6.5	70	M5X12									
	AD□				M4X10									
	AE□			60										
	RAX□			70			9	14					1.07	0.97
	RAY□			60										
	RAZ□			70	M5X12									
	RDA□	70	7	90	M6X12	□80	11		33		86	46		
	RDB□				M5X12									
Two-stage (Note) 3	MA□	30	7	45	M3X8	□60	6	8	32.5	58.5	85	26.5	1.20	1.10
	MB□			46	M4X10									
	MD□	50		70	M5X12									
	ME□				M4X10									
	NA□		6.5				9	14						
	NB□				M5X12									
	LA□	70	7	90	M6X12	□80	11		33.5		86	27.5	1.24	1.14
	LB□				M5X12									

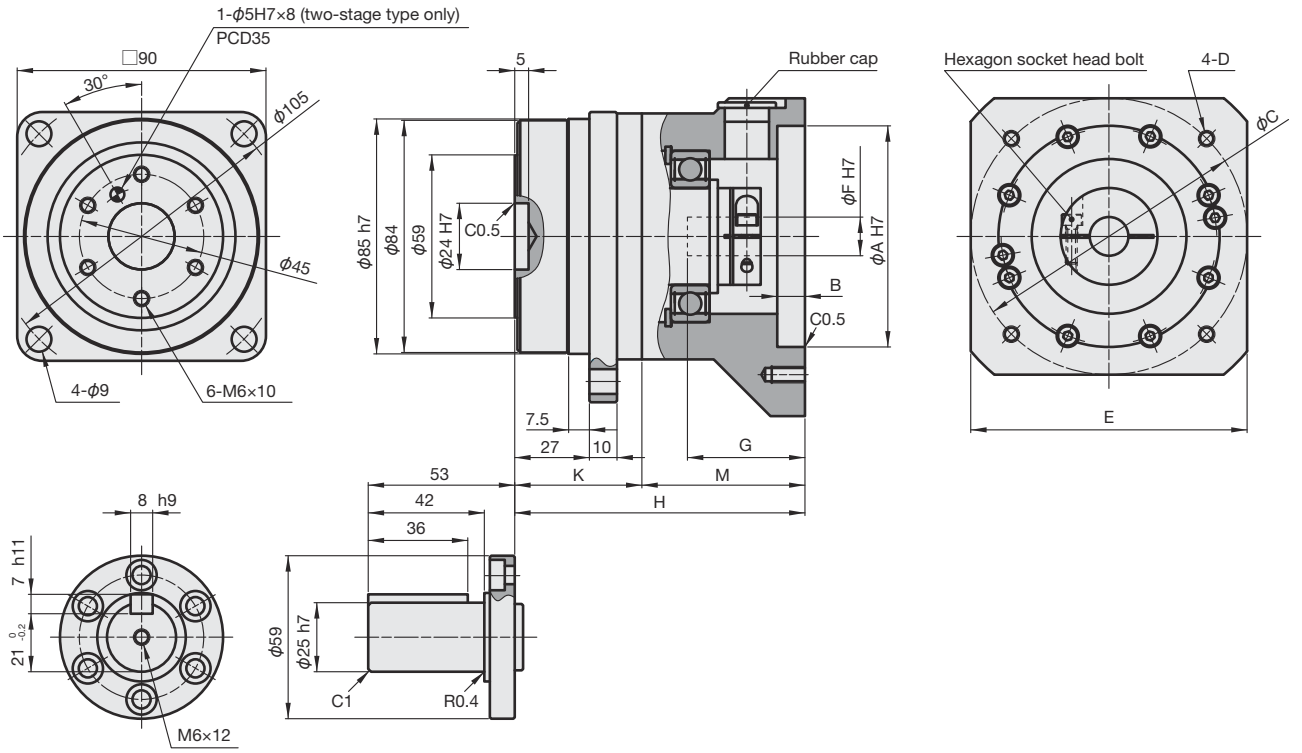
The dimension table above shows the values of typical products. For products not listed above, please contact us.
For more information on the details of dimensions and shapes, refer to our delivery specification drawings.
When installing the speed reducer as a single unit or in a special manner, please 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

[Unit: mm]



* 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) Min	F (H7) Max	G	K	H	M	Weight (kg) Note 2 Shaft output	Weight (kg) Note 2 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			45		105	59	3.0	2.6
	PFE□				M6X12									
	PHC□	80	20	100		□100								
	PHD□	95	6	115	M8X16									
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	3.3	2.9
	YB□				M4X10									
	WA□	70	7	90	M6X12	□80			42		105	35		
	WB□				M5X12									
	XA□	80	10	100	M6X12									
	XB□	95	6	115	M8X16	□100								
	XC□				M6X12									
	TA□	110	6.5	145	M8X25	□130	19	24	71		134	64	4.3	3.9
	UA□		7		M8X16	□120			65		128	58	3.8	3.4
	VA□		6.5		M8X25	□130			59		122	52	4.1	3.7
	VB□	114.3		200	M12X25	□180								

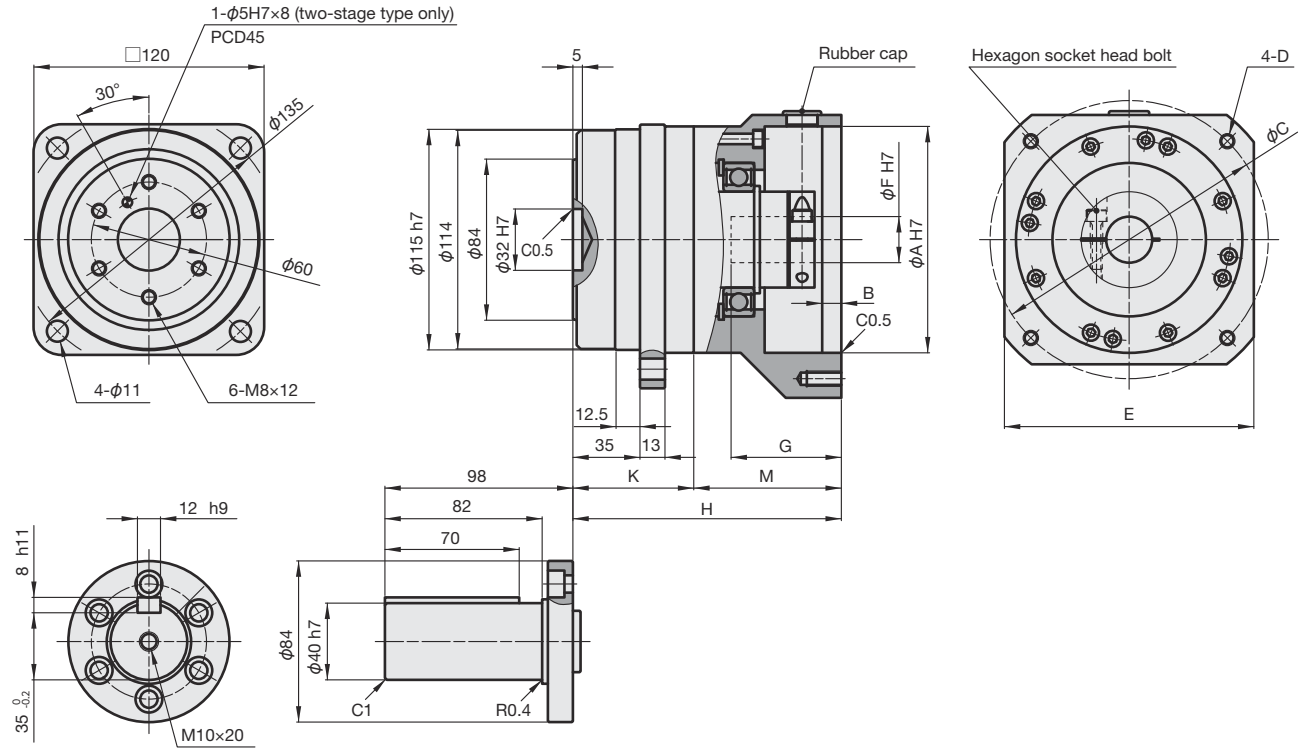
The dimension table above shows the values of typical products. For products not listed above, please contact us.
For more information on the details of dimensions and shapes, refer to our delivery specification drawings.
When installing the speed reducer as a single unit or in a special manner, please 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

[Unit: mm]



* 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

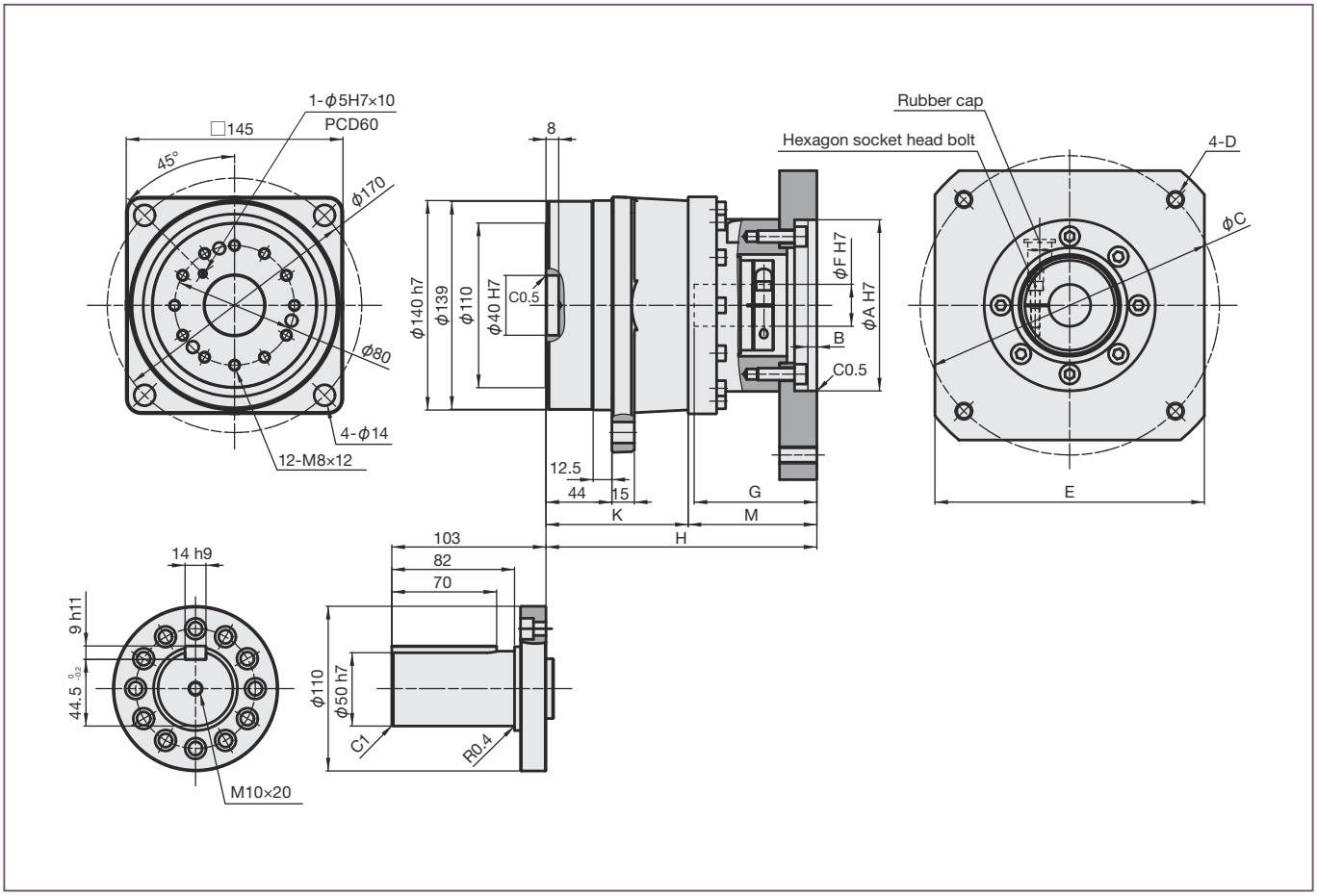
	Configuration symbol Note 1	A (H7)	B	C	D	E	F (H7) Min	F (H7) Max	G	K	H	M	Weight (kg) Note 2 Shaft output	Weight (kg) Note 2 Flange output
Single-stage (Note) 3	PNG□	70	4	90	M6X12	ϕ122	10	24	38	63	139	76	7.5	6.1
	PNA□		7		M5X12				56					
	PNC□				M6X12									
	PNB□	80		100										
	PNF□	95	6	115	M8X10	ϕ135			62		145	82	7.6	6.2
	PNJ□				M6X10									
	PMC□	110	10	145	M8X18	□135	16	35	59		142	79	7.5	6.1
	PPA□		6.5		M8X25				81		164	101	8.1	6.7
	PPB□	114.3		200	M12X25	□180							9.1	7.7
	PQP□												14.7	13.3
	PPC□	200		235		□220							9.2	7.8
Two-stage (Note) 3	LA□	50	10	70	M5X12	ϕ80	10	19	39.5	97	135	38	8.3	6.9
	LB□				M4X10									
	KA□	70	7	90	M5X12	ϕ122		24	56		139	42	8.8	7.4
	KB□				M6X12									
	KC□	80		100										
	JJ□	95	6	115	M6X10	ϕ135			62		145	48	8.9	7.5
	JF□				M8X10									
	HA□	110	10	145	M8X18	□130	16	35	59		142	45	9.0	7.6
	GA□		6.5		M8X25				81		164	67	9.4	8.0
	GB□	114.3		200	M12X25	□180							10.4	9.0
	GF□	130		165	M10X25								10.3	8.9
	GC□	200		235	M12X25	□220							10.5	9.1

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	95	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		164	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	124	180	56	17.0	14.4
	EA□	70	7	90	M5x12	Φ145	14	24	61		177	53	16.6	14.0
	EB□	70	7	90	M6x12	Φ145							16.6	14.0
	EC□	80	7.5	100	M6x12	Φ145							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.
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 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/ogctj/index.html).
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.

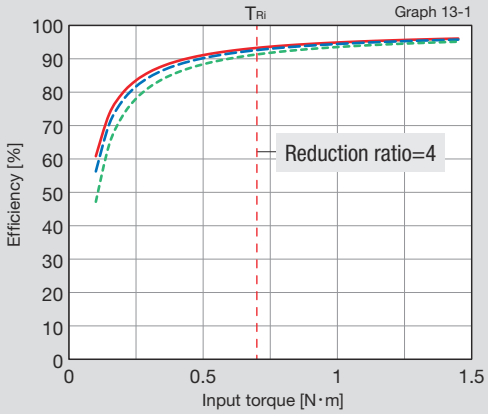
Measuring conditions

Table 13-1

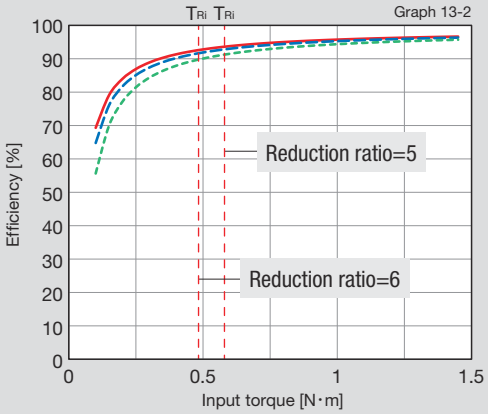
Input speed	3000 r/min
Ambient temperature	25℃
Lubrication agent	Refer to page 18 of this document.

Efficiency characteristics graph - Size 11

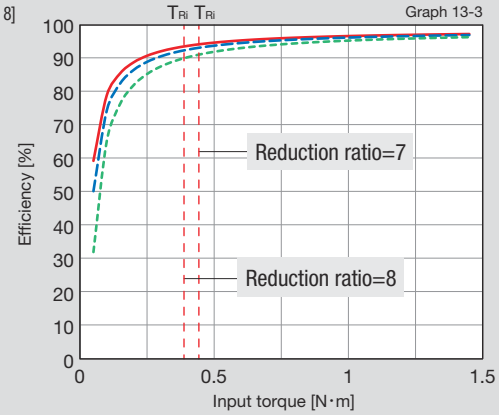
[Reduction ratio=4]



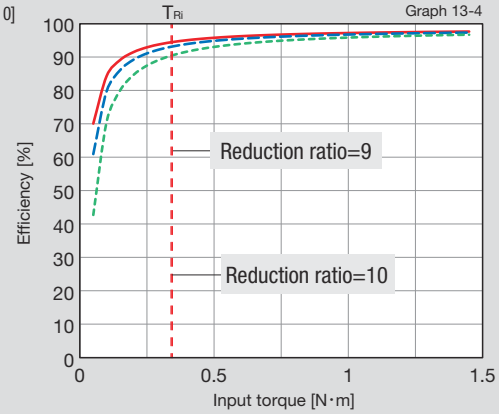
[Reduction ratio=5, 6]



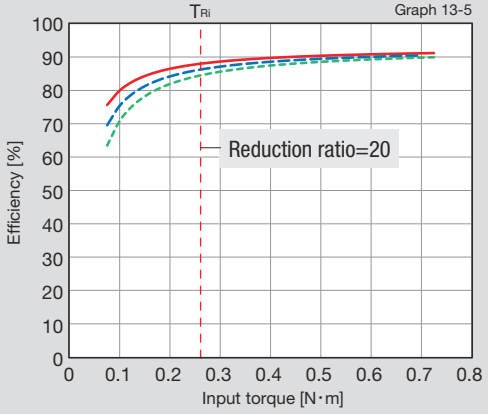
[Reduction ratio=7, 8]



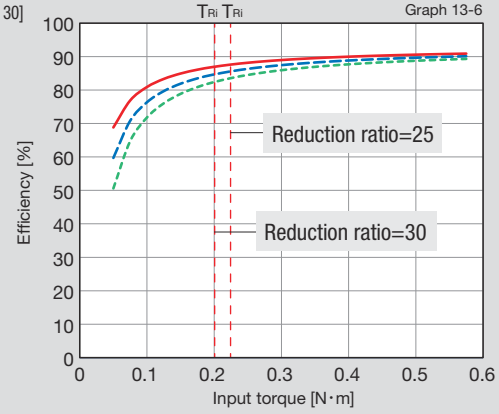
[Reduction ratio=9, 10]



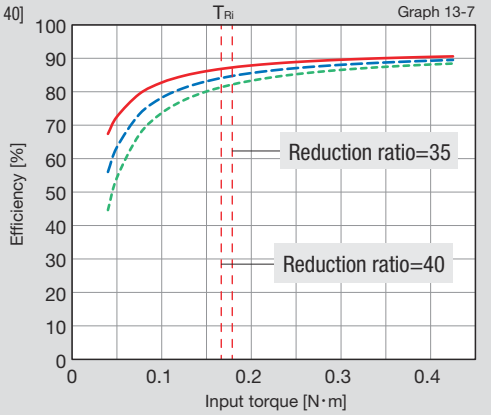
[Reduction ratio=20]



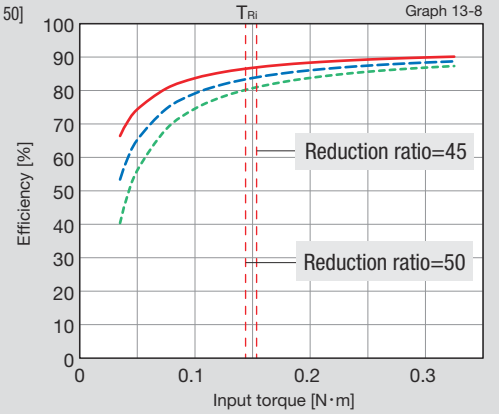
[Reduction ratio=25, 30]



[Reduction ratio=35, 40]



[Reduction ratio=45, 50]

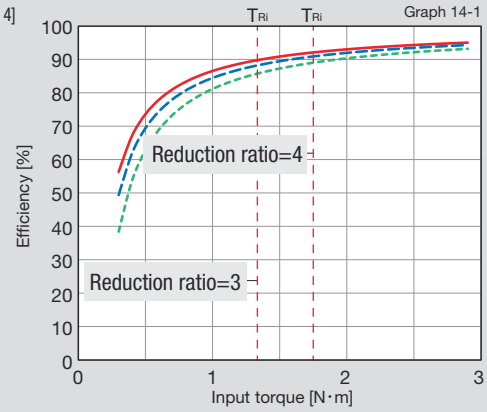


TRi Input torque corresponding to the rated output torque

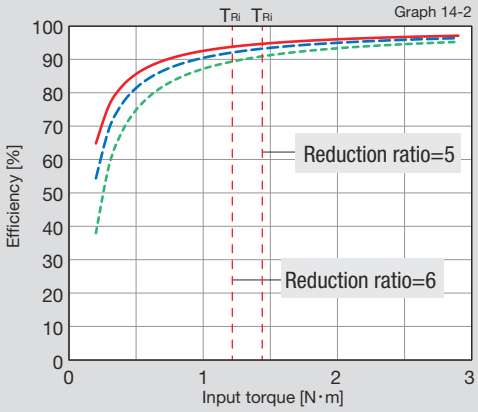
Speed reducer unit — Gear head type (standard product) - - - When a DDU bearing (with rubber contact seals on both sides) is built into the input side of the gear head type (special product) - - -

Efficiency characteristics graph - Size 14

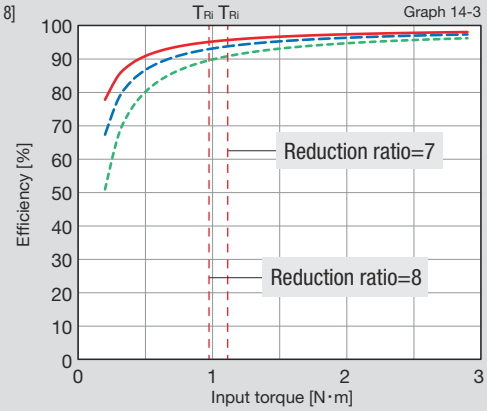
[Reduction ratio=3, 4]



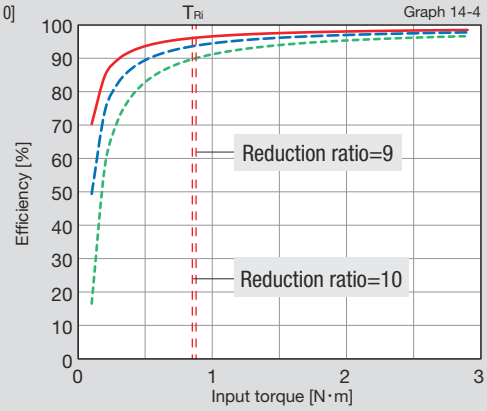
[Reduction ratio=5, 6]



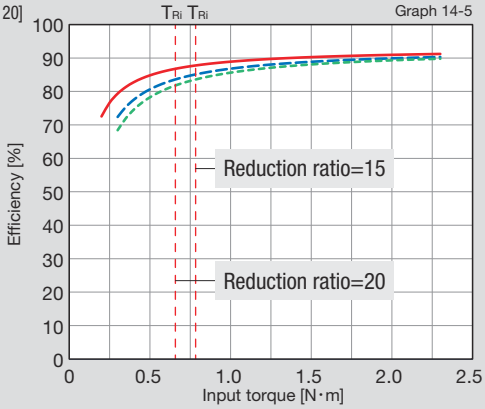
[Reduction ratio=7, 8]



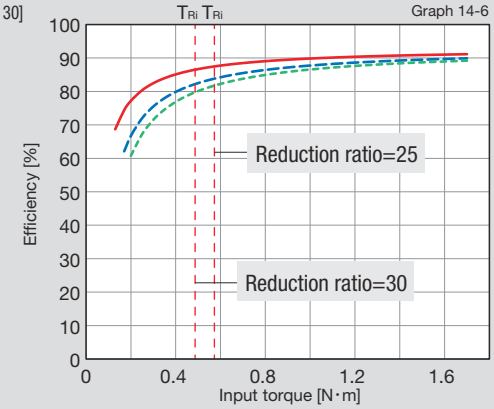
[Reduction ratio=9, 10]



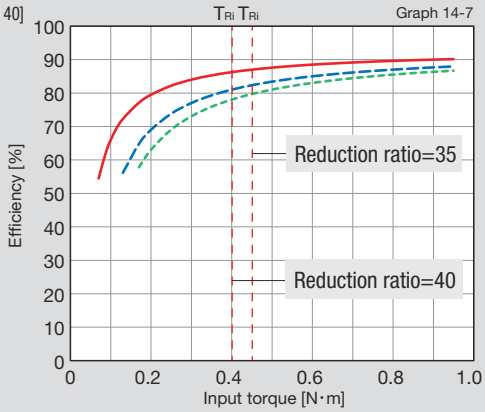
[Reduction ratio=15, 20]



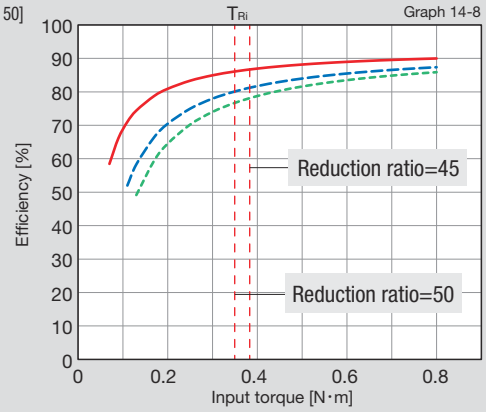
[Reduction ratio=5, 30]



[Reduction ratio=35, 40]



[Reduction ratio=45, 50]

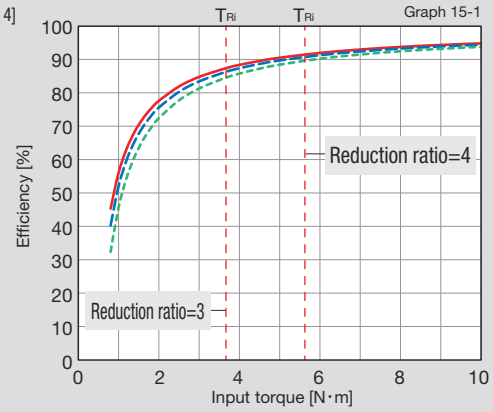


TRi Input torque corresponding to the rated output torque

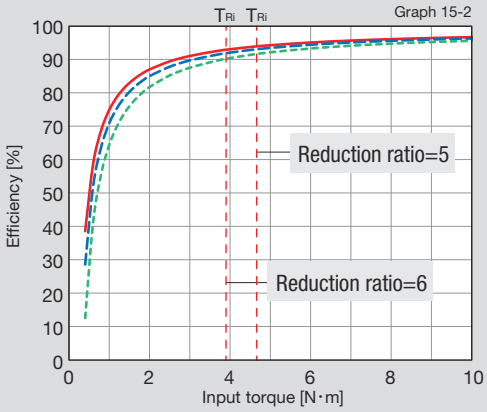
Speed reducer unit — Gear head type (standard product) - - - When a DDU bearing (with rubber contact seals on both sides) is built into the input side of the gear head type (special product) - - -

Efficiency characteristics graph - Size 20

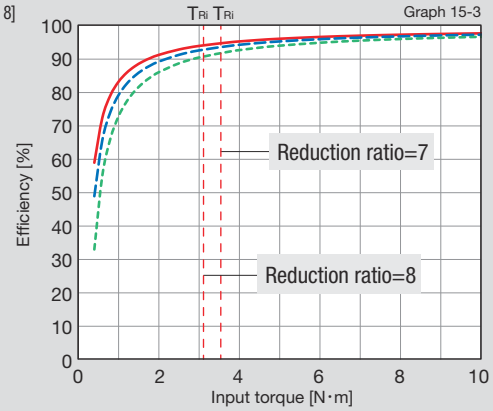
[Reduction ratio=3, 4]



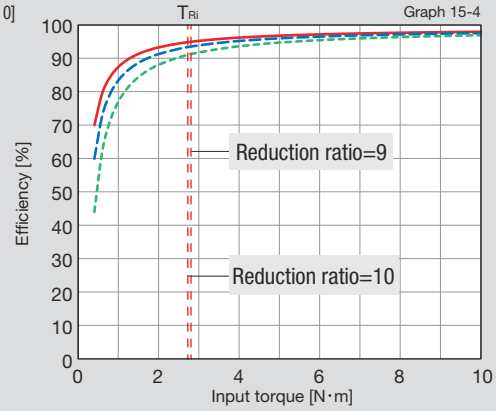
[Reduction ratio=5, 6]



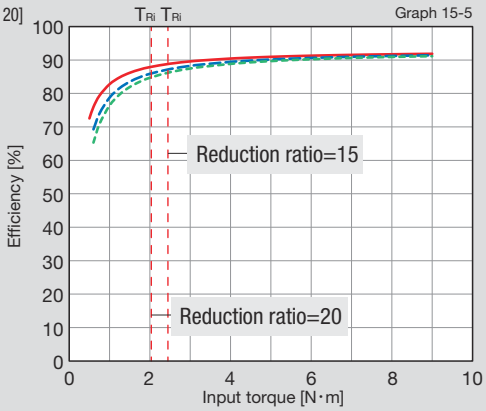
[Reduction ratio=7, 8]



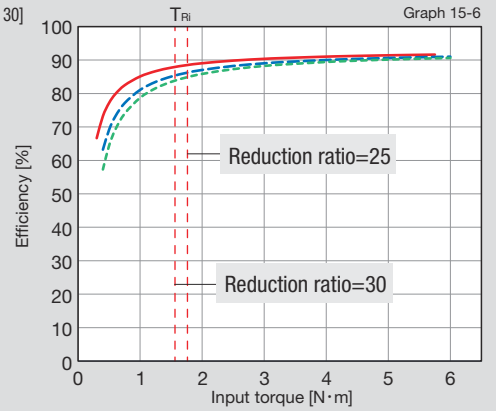
[Reduction ratio=9, 10]



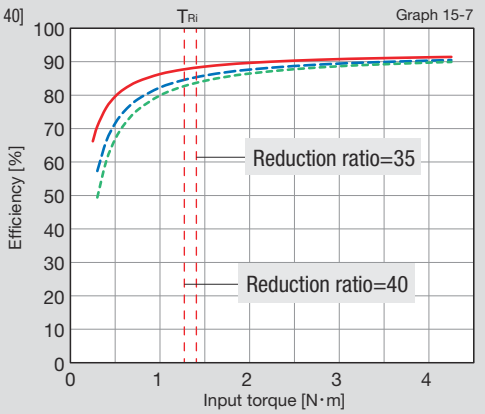
[Reduction ratio=15, 20]



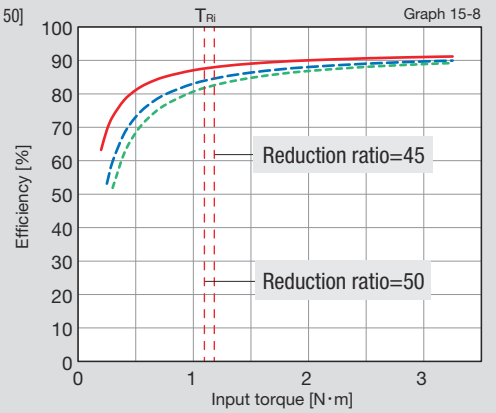
[Reduction ratio=25, 30]



[Reduction ratio=35, 40]



[Reduction ratio=45, 50]

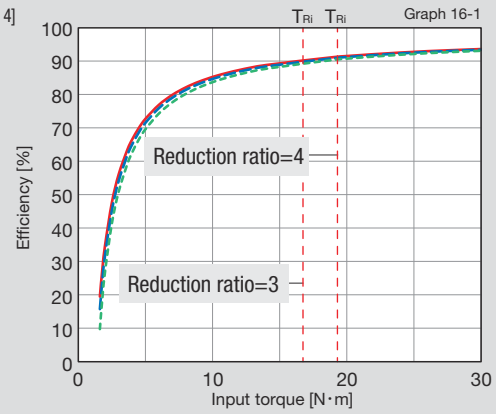


TRi Input torque corresponding to the rated output torque

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

[Reduction ratio=3, 4]



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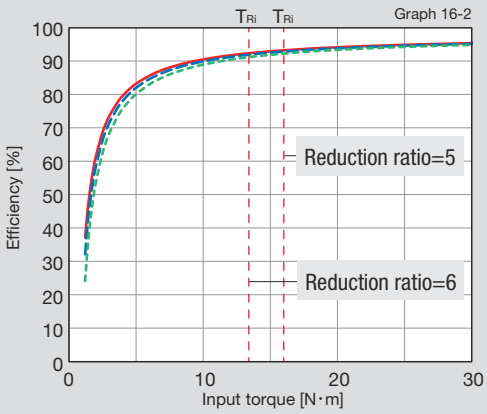
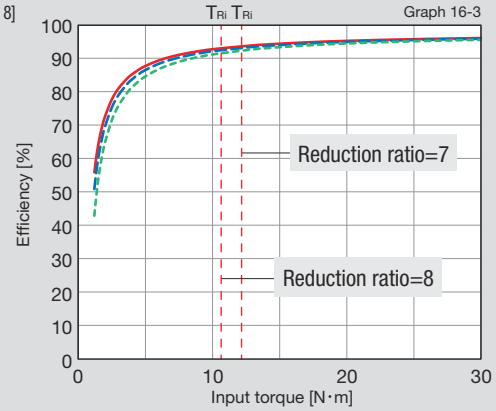
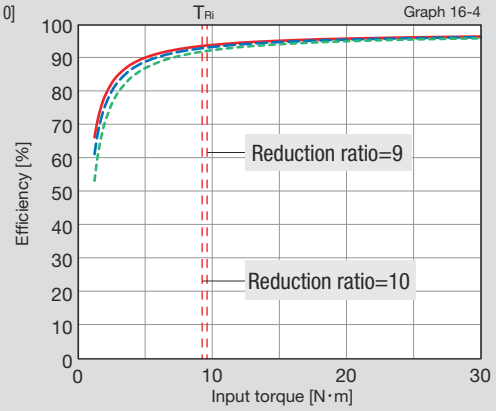


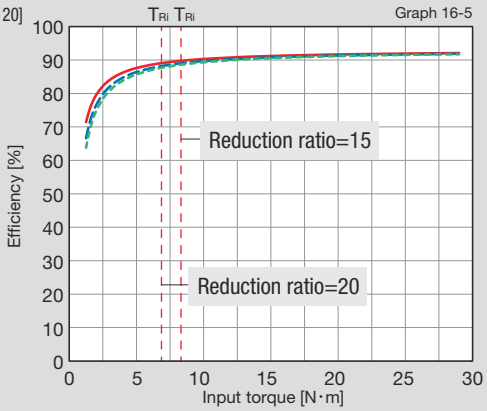
[Reduction ratio=7, 8]



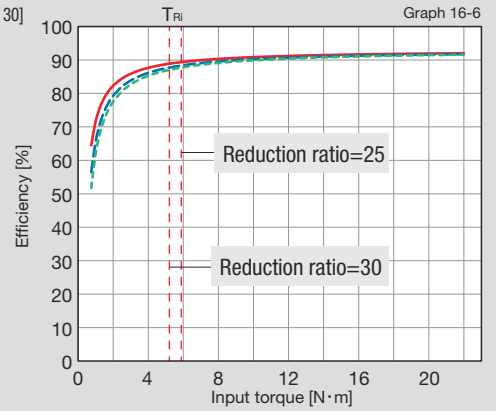
[Reduction ratio=9, 10]



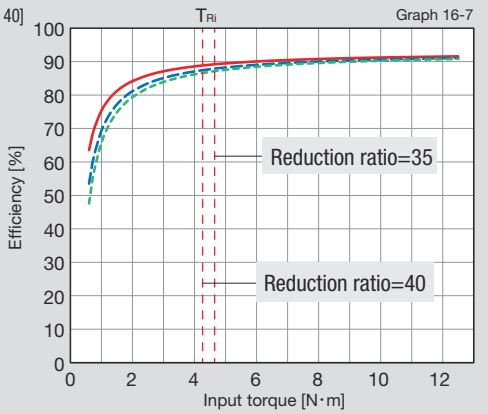
[Reduction ratio=15, 20]



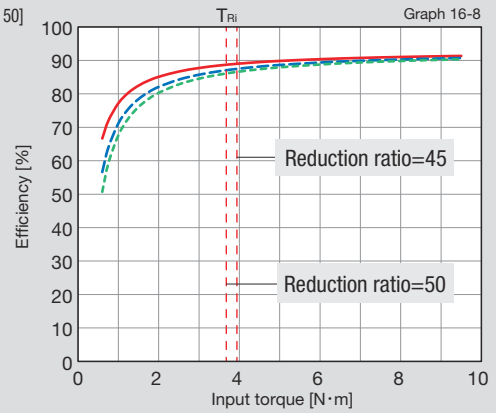
[Reduction ratio=25, 30]



[Reduction ratio=35, 40]



[Reduction ratio=45, 50]

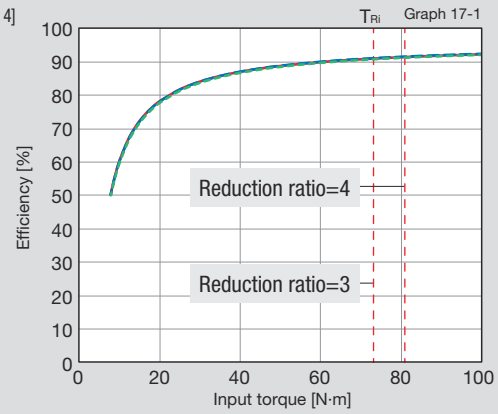


TRi Input torque corresponding to the rated output torque

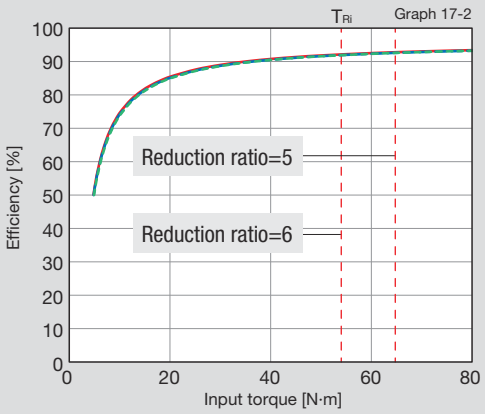
Speed reducer unit — Gear head type (standard product) - - - When a DDU bearing (with rubber contact seals on both sides) is built into the input side of the gear head type (special product)

Efficiency characteristics graph - Size 40

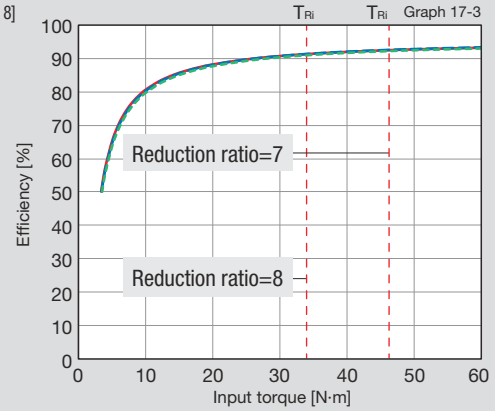
[Reduction ratio=3, 4]



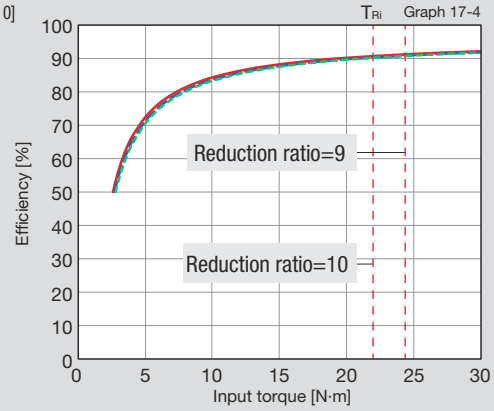
[Reduction ratio=5, 6]



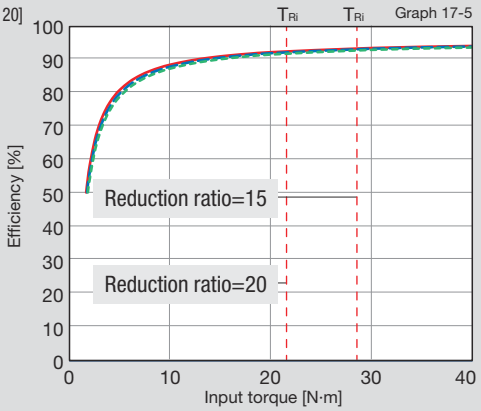
[Reduction ratio=7, 8]



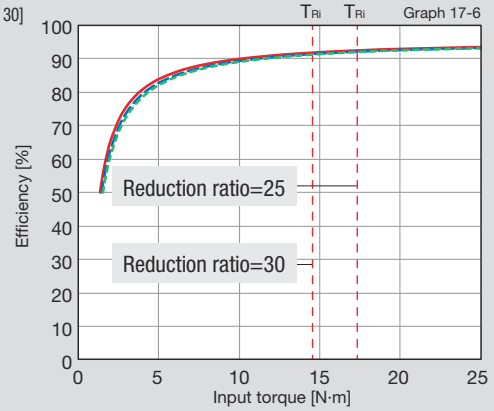
[Reduction ratio=9, 10]



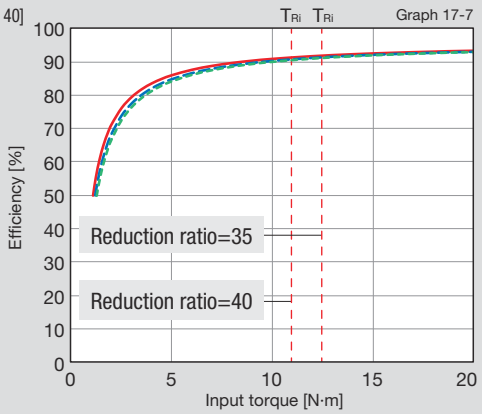
[Reduction ratio=15, 20]



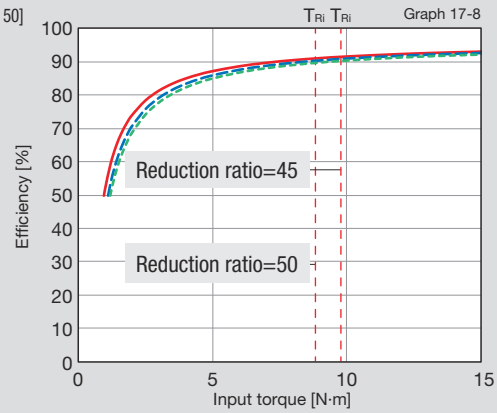
[Reduction ratio=25, 30]



[Reduction ratio=35, 40]



[Reduction ratio=45, 50]



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)

■ 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
14	3	400	600
	4	440	660
	5	470	700
	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
20	3	840	1250
	4	910	1370
	5	980	1460
	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
40	3	3160	4720
	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.

■ 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.

■ 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

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							
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							
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

Harmonic Drive Systems Inc.

■ **Please contact our sales department with any questions.**

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