

Harmonic Drive now offers a NEW lightweight version of our CSG-2UH Gear Units!

30% lighter than our standard CSG-2UH! 30% More Torque than the CSF Series!

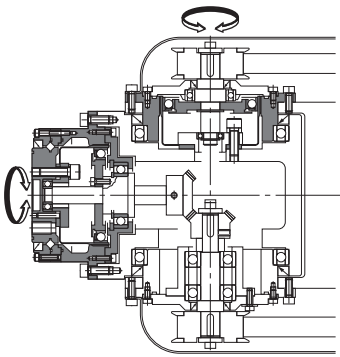
Using new lightweight materials and an optimized design, a 30% reduction in weight has been achieved without reducing the torque rating of the gear unit or significant changes to the interface dimensions. This weight reduction, combined with the CSG's high torque ratings, results in an exceptional "Torque Density" making it ideally suited for many applications including...

Industrial Robots – allowing operation with higher acceleration rates and payload capacity

Mobile Robots – allowing lower weight designs which improves battery life without sacrificing performance

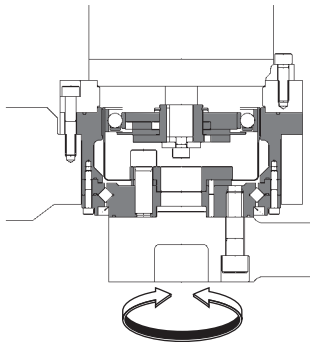
Application Examples

Robot Wrist



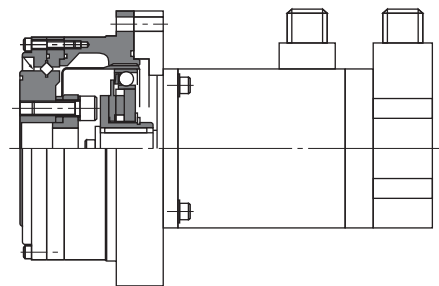
5th and 6th axis drive for the wrist of an Industrial Robot

SCARA Robot Arm



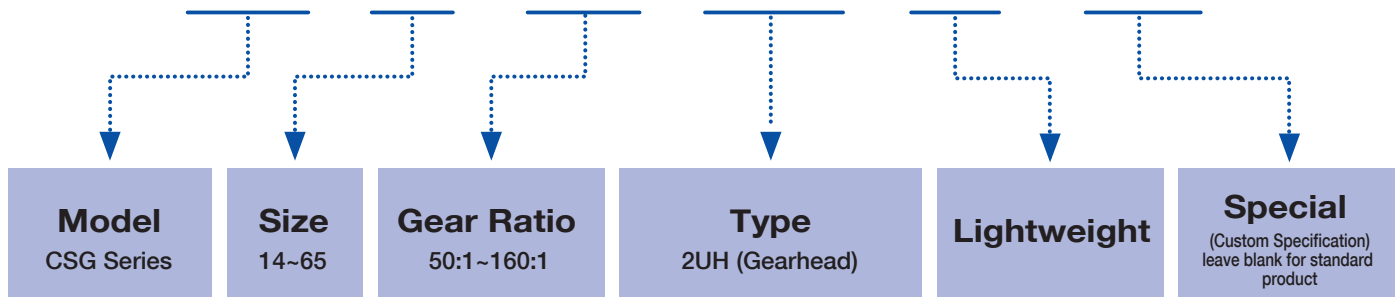
Drive for SCARA Robot

Direct Connection to a Servo Motor



Ordering Code

CSG - 25 - 100 - 2UH - LW - SP



Rating Table

Table 2-1

Size	Ratio	Rated Torque at 2000rpm		Limit for Repeated Peak Torque		Limit for Average Torque		Limit for Momentary Torque		Maximum Input Speed		Max. Average Input Speed		Moment of Inertia	
		Nm	lb-in	Nm	lb-in	Nm	lb-in	Nm	lb-in	Oil	Grease	Oil	Grease	$\times 10^{-4} \text{kgm}^2$	$\times 10^{-5} \text{kgfms}^2$
14	50	7.0	62	23	204	9	80	46	407	14,000	8,500	6,500	3,500	0.033	0.034
	80	10	89	30	266	14	124	61	540						
	100	10	89	36	319	14	124	70	620						
17	50	21	186	44	389	34	301	91	805	10,000	7,300	6,500	3,500	0.079	0.081
	80	29	257	56	496	35	310	113	1,000						
	100	31	274	70	620	51	451	143	1,266						
	120	31	274	70	620	51	451	112	991						
20	50	33	292	73	646	44	389	127	1,124	10,000	6,500	6,500	3,500	0.193	0.197
	80	44	389	96	850	61	540	165	1,460						
	100	52	460	107	947	64	566	191	1,690						
	120	52	460	113	1,000	64	566	191	1,690						
25	160	52	460	120	1,062	64	566	191	1,690	7,500	5,600	5,600	3,500	0.413	0.421
	50	51	451	127	1,124	72	637	242	2,142						
	80	82	726	178	1,575	113	1,000	332	2,938						
	100	87	770	204	1,806	140	1,239	369	3,266						
	120	87	770	217	1,921	140	1,239	382	3,496						
32	160	87	770	229	2,027	140	1,239	382	3,611	7,000	4,800	4,600	3,500	1.69	1.72
	50	99	876	281	2,487	140	1,239	497	4,399						
	80	153	1,354	395	3,496	217	1,921	738	6,532						
	100	178	1,575	433	3,832	281	2,487	841	7,443						
	120	178	1,575	459	4,062	281	2,487	842	7,895						
40	160	178	1,575	484	4,284	281	2,487	842	7,895	5,600	4,000	3,600	3,000	4.50	4.59
	50	178	1,575	523	4,629	255	2,257	892	7,895						
	80	268	2,372	675	5,974	369	3,266	1,270	11,240						
	100	345	3,054	738	6,532	484	4,284	1,400	12,391						
	120	382	3,381	802	7,098	586	5,187	1,488	13,542						
45	160	382	3,381	841	7,443	586	5,187	1,488	13,542	5,000	3,800	3,300	3,000	8.68	8.86
	50	229	2,027	650	5,753	345	3,054	1,235	10,931						
	80	407	3,602	918	8,125	507	4,487	1,651	14,613						
	100	459	4,062	982	8,691	650	5,753	2,041	18,064						
	120	523	4,629	1,070	9,470	806	7,134	2,288	20,250						
50	160	523	4,629	1,147	10,152	819	7,249	2,483	21,976	4,500	3,500	3,000	2,500	12.5	12.8
	80	484	4,284	1,223	10,824	675	5,974	2,418	21,401						
	100	611	5,408	1,274	11,276	866	7,665	2,678	23,702						
	120	688	6,089	1,404	12,426	1,057	9,355	2,678	23,702						
58	160	688	6,089	1,534	13,577	1,096	9,700	3,185	28,190	4,000	3,000	2,700	2,200	27.3	27.9
	80	714	6,319	1,924	17,029	1,001	8,860	3,185	28,190						
	100	905	8,010	2,067	18,294	1,378	12,196	4,134	36,589						
	120	969	8,576	2,236	19,790	1,547	13,692	4,329	38,315						
65	160	969	8,576	2,392	21,171	1,573	13,922	4,459	39,465	3,500	2,800	2,400	1,900	46.8	47.8
	80	969	8,576	2,743	24,278	1,352	11,966	4,836	42,802						
	100	1,236	10,940	2,990	26,464	1,976	17,489	6,175	54,653						
	120	1,236	10,940	3,263	28,880	2,041	18,064	6,175	54,653						
65	160	1,236	10,940	3,419	30,261	2,041	18,064	6,175	54,653						

1. Moment of Inertia: $I = 1/4GD^2$

2. Please refer to the CSF/CSG Series catalog for an explanation of terms and technical information not included in this brochure.

No Load Running Torque

No-load running torque is the input torque (high speed shaft) which is required to rotate the Harmonic Drive® gear with no load applied to the output.

Measurement condition

3-1

Ratio: 100			
Lubricant	Grease	Name	Harmonic Grease SK-1A
		Grease quantity	Harmonic Grease SK-2
			Recommended quantity
Torque value is measured after 2 hour run-in at 2000 rpm input. Please contact HDLLC if you are using oil lubricant.			

Compensation Value for Each Ratio

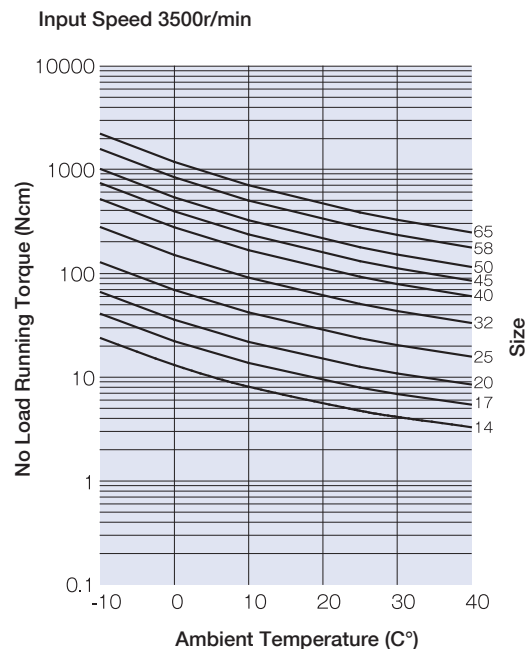
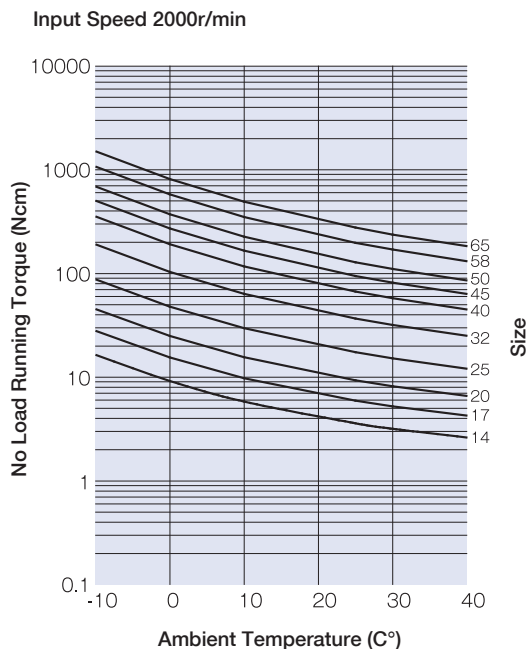
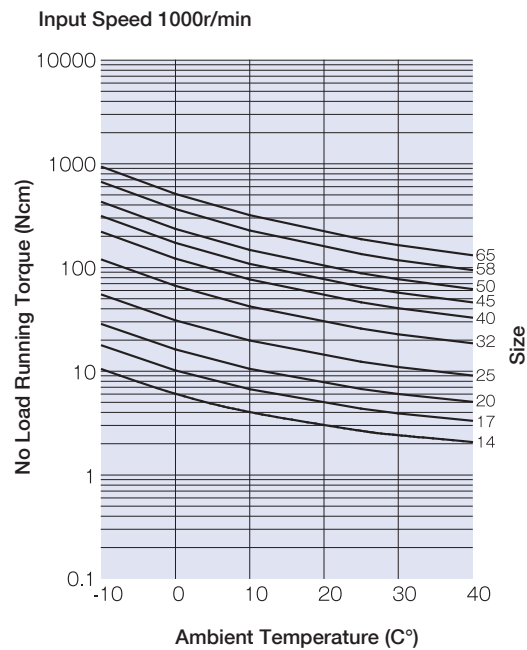
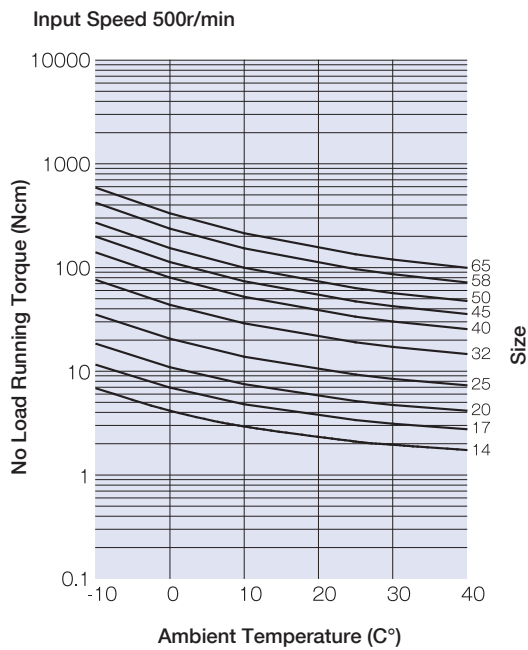
The no load running torque of Harmonic Drive gears varies with the gear ratio. The graphs indicate a value for ratio 100. For other gear ratios, add the compensation value from table 3-2.

3-2

Unit: Ncm

Size	Ratio	30	50	80	120	160
14		2.5	1.1	0.2	—	—
17		3.8	1.6	0.3	-0.2	—
20		5.4	2.3	0.5	-0.3	-0.8
25		8.8	3.8	0.7	-0.5	-1.2
32		16	7.1	1.3	-0.9	-2.2
40		—	12	2.1	-1.5	-3.5
45		—	16	2.9	-2.1	-4.9
50		—	21	3.7	-2.6	-6.2
58		—	30	5.3	-3.8	-8.9
65		—	41	7.2	-5.1	-12

No Load Running Torque for Ratio 100

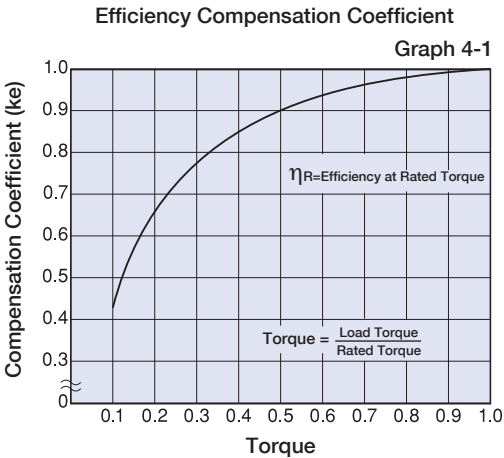


Efficiency

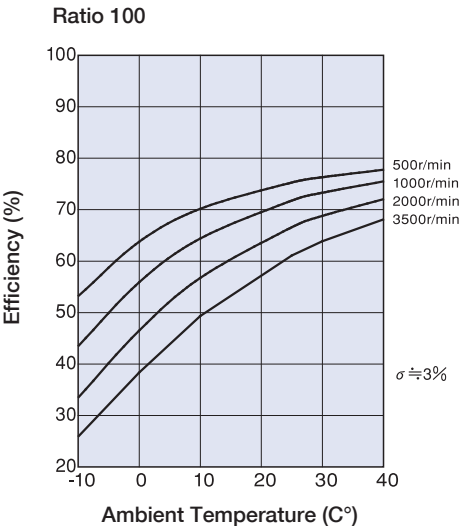
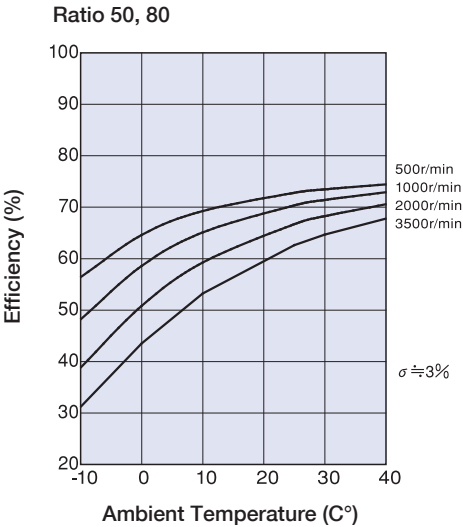
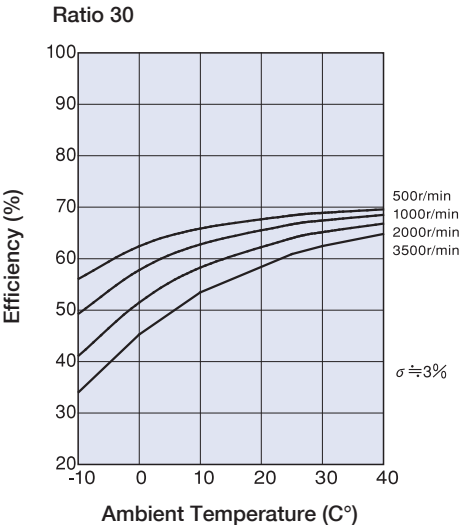
The gear efficiency is affected by many factors. Efficiency depends on the gear ratio, input speed, load torque, temperature, quantity of lubricant and type of lubricant. Efficiency values shown in the tables shown below are for rated torque. If the actual load torque is below rated torque, a compensation factor must be used.

Load Torque ≥ Rated Torque : Efficiency = Efficiency from Graph
 Load Torque < Rated Torque : Efficiency = Efficiency from Graph x Compensation Coefficient from Graph 4-1.

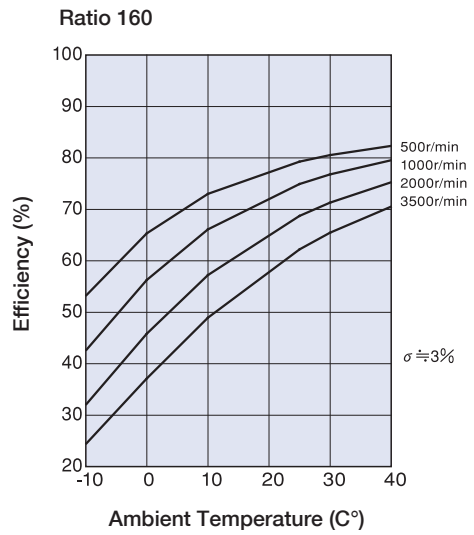
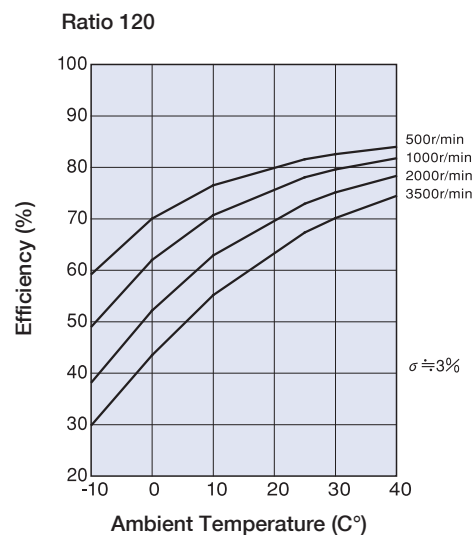
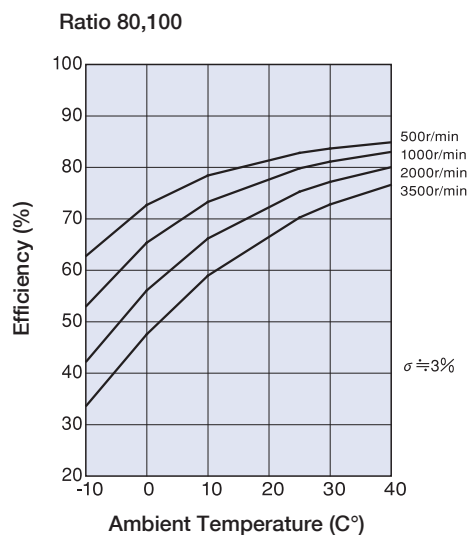
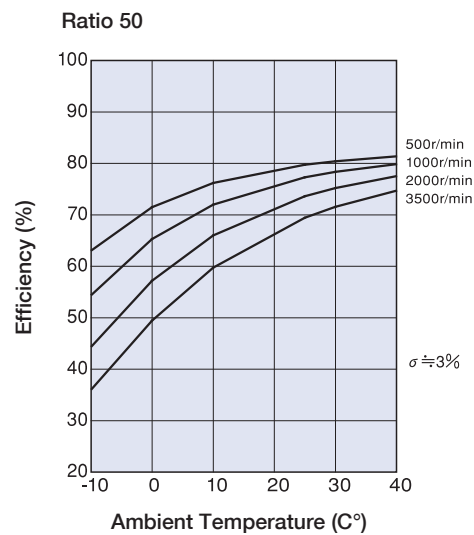
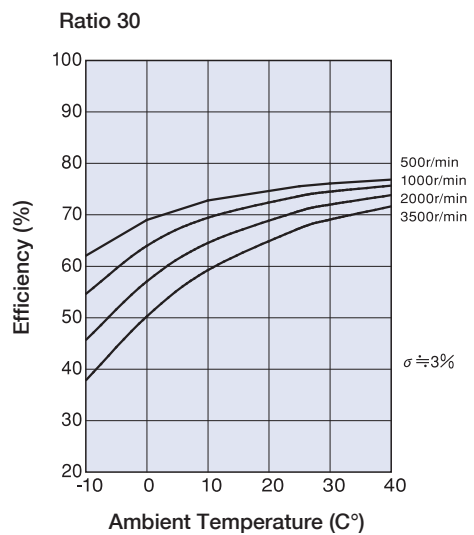
Measurement condition				Table 4-1
Installation	Based on recommended tolerance			
Load torque	Rated torque			
Lubricant	Grease	Name	Harmonic Grease SK-1A	
			Harmonic Grease SK-2	
		Grease quantity	Recommended quantity	



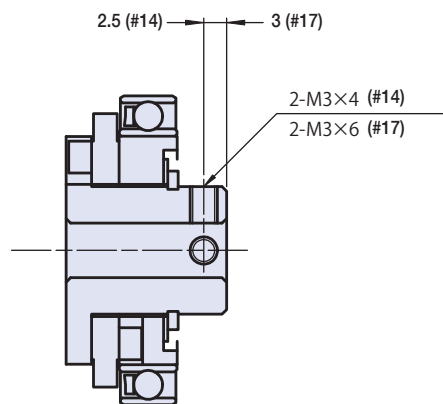
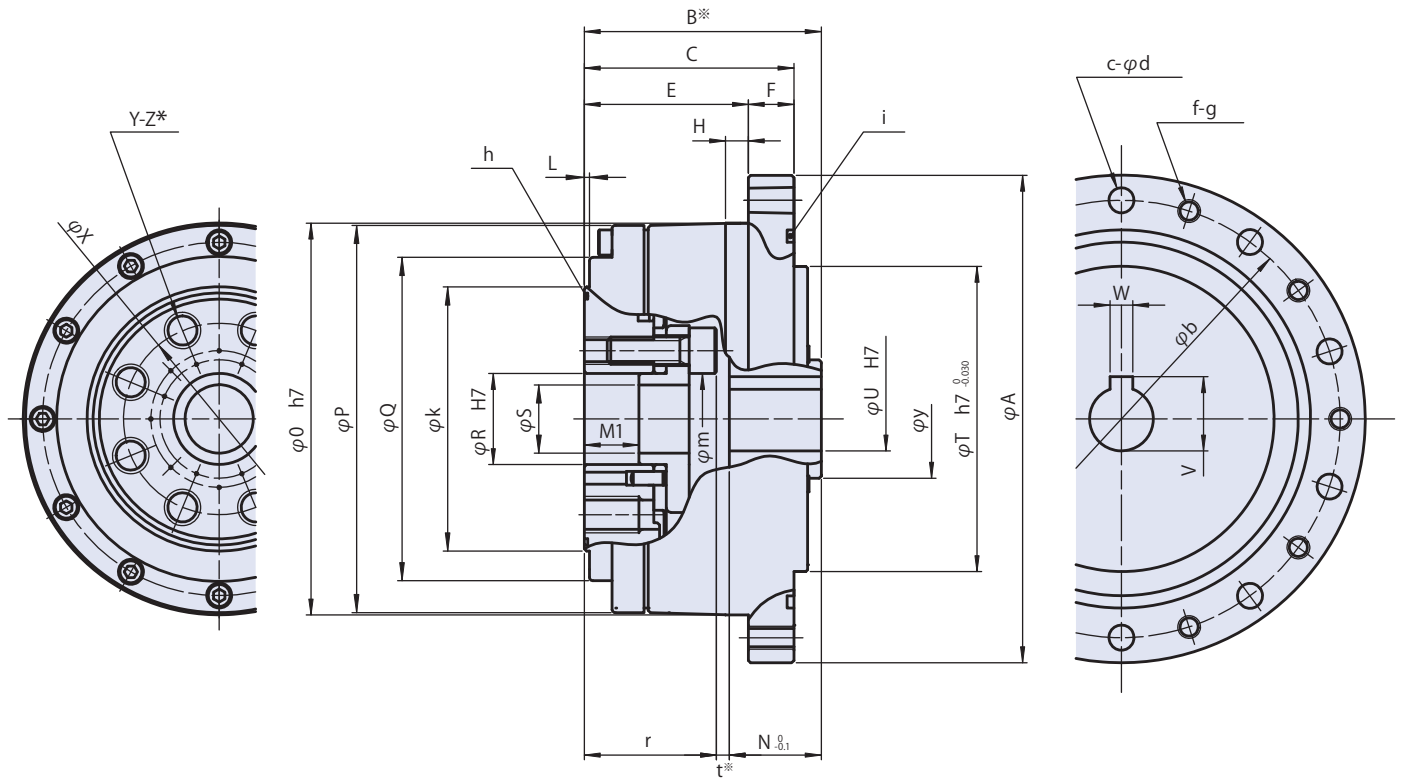
Efficiency at Rated Torque (Size 14)



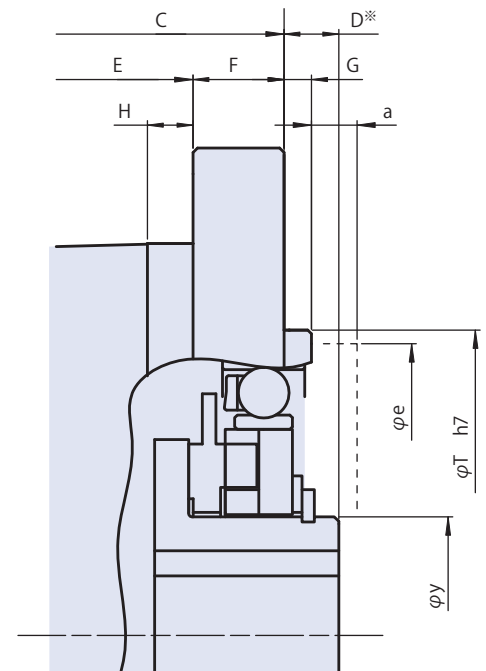
Efficiency at Rated Torque (Sizes 17-65)



External Dimensions



No key on WG hub for #14, #17



Detailed drawing for input side

Please contact Harmonic Drive LLC for installation drawings.

* Please Note: The bolts must not extend beyond the length of the threaded hole. If the length of thread engagement exceeds dimension 'Z' , damage to the flexspine may occur. Please refer to installation drawing.

Dimension Table

Table 7-1
Unit: mm

Symbol \ Size	14	17	20	25	32	40	45	50	58	65
φA	73	79	93	107	138	160	180	190	226	260
B*	41 ⁰ _{-0.9}	45 ⁰ _{-0.9}	45.5 ⁰ _{-1.0}	52 ⁰ _{-1.0}	62 ⁰ _{-1.1}	72.5 ⁰ _{-1.1}	79.5 ⁰ _{-1.2}	90 ⁰ _{-1.3}	104.5 ⁰ _{-1.3}	115 ⁰ _{-1.3}
C	34	37	38	46	57	66.5	74	85	97	108.5
D*	7 ⁰ _{-0.4}	8 ⁰ _{-0.4}	7.5 ⁰ _{-0.4}	6 ⁰ _{-0.5}	5 ⁰ _{-0.6}	6 ⁰ _{-0.6}	5.5 ⁰ _{-0.6}	5 ⁰ _{-0.6}	7.5 ⁰ _{-0.6}	6.5 ⁰ _{-0.6}
E	27	29	28	36	45	50.5	58	69	77	84.5
F	7	8	10	10	12	16	16	16	20	24
G	2	2	3	3	3	4	4	4	5	5
H	4	4	5	5	4.5	4.5	6	6	6	6
L	1.1	1.1	1.1	1.1	1.2	1.6	1.6	1	1.5	1.5
M1	9.4	9.5	9	12	15	5	6	8	10	10
M2	-	-	-	-	-	-	-	-	-	4
N ⁰ _{-0.1}	18.5	20.7	21.5	21.6	23.6	29.7	30.5	34.8	38.3	44.6
$\varphi O h7$	56	63	72	86	113	127	148	158	186	212
φP	54.6	59.5	70	84.6	110	124.5	143	155	183	208
φQ	40.5	47.5	55.5	71	91.1	103	123	130	155	180
$\varphi R1 H7$	11	10	14	20	26	32	32	40	46	52
$\varphi R2 H7$	-	-	-	-	-	-	-	-	-	142
φS	8	7	10	15	20	24	25	32	38	44
$\varphi T h7$	38	48	56	67(68)	90	110	124	135	156	177
$\varphi U H7$	6	8	12	14	14	14	19	19	22	24
V	-	-	13.8	16.3	16.3	16.3	21.8	21.8	24.8	27.3
W Js9	-	-	4	5	5	5	6	6	6	8
φX	23	27	32 ^{+0.1} ₀	42 ^{+0.1} ₀	55 ^{+0.1} ₀	68 ^{+0.1} ₀	82 ^{+0.1} ₀	84 ^{+0.1} ₀	100 ^{+0.1} ₀	110 ^{+0.2} ₀
Y	6	6	8	8	8	8	8	8	8	8
Z	M4×8	M5×10	M6×9	M8×12	M10×15	M10×15	M12×18	M14×21	M16×24	M16×24
a	1	1	1.5	1.5	1.5	2	2	2	2.5	2.5
φb	65	71	82	96	125	144	164	174	206	236
c	6	8	8	10	14	10	16	18	16	12
φd	4.5	4.5	5.5	5.5	6.6	9	9	9	11	14
φe	38	45	53	66	86	106	119	133	154	172
f	6	8	8	10	14	10	16	18	16	12
g	M4	M4	M5	M5	M6	M8	M8	M8	M10	M12
h	29.0×0.50	34.5×0.80	40.64×1.14	53.28×0.99	S71	AS568-042	S100	S105	S125	S135
i	S50	S56	S67	S80	S105	S125	S145	S155	S180	S205
φk	31	38	45	58	78	90	107	112	135	155
φm	10	10.5	15.5	20	27	34	36	39	46	56
r	21.4	23.5	23	29	37	39.5	45.5	53	62.8	66.5
t*	1.1	0.8	1	1.4	1.4	3.3	3.5	2.2	3.4	3.9
φy	14	18	21	26	26	32	32	32	40	48
Weight (kg)	0.32	0.46	0.64	1.1	2.2	3.5	5.1	7.0	11.3	16.2

Note 1: Dimensions in parentheses indicates values for 30:1 gear ratio.

Note 2: * Dimensions B, D and t indicate the location and tolerance of the wave generator flexspline and circular spline. Please strictly comply with these dimensions since it influences performance and strength of the gear.

Weight Comparison

Unit: kg

Size	14	17	20	25	32	40	45	50	58	65
CSG Series standard unit	0.52	0.68	0.98	1.5	3.2	5.0	7.0	8.9	14.6	20.9
CSG Series LW unit	0.32	0.46	0.64	1.1	2.2	3.5	5.1	7.0	11.3	16.2
Weight ratio	62 %	68 %	65 %	73 %	69 %	70 %	73 %	79 %	77 %	78 %

Specification for Crossroller Bearing

Size	Pitch Circle dp	Offset R	Basic Dynamic Load Rating C		Basic Static Load Rating Co		Allowable Moment Load Mc		Moment Stiffness Km	
	m	m	x10 ² N	lb	x10 ² N	lb	Nm	lb-in	x10 ⁴ Nm/rad	x10 ⁴ lb-in/rad
14	0.035	0.0093	47.0	1,057	60.7	1,365	33.6	297	3.6	32
17	0.0425	0.0091	52.9	1,189	75.5	1,697	52.5	465	6.4	57
20	0.05	0.0098	57.8	1,299	90.0	2,023	74.6	660	10.5	93
25	0.064	0.0118	96.0	2,158	151	3,395	128	1,133	19.8	175
32	0.083	0.0133	150	3,372	250	5,620	257	2,275	44.2	391
40	0.096	0.0148	213	4,788	365	8,206	369	3,266	74.6	660
45	0.111	0.0158	230	5,171	426	9,577	563	4,983	116	1,027
50	0.119	0.0180	348	7,823	602	13,534	622	5,505	140	1,239
58	0.141	0.0205	518	11,645	904	20,323	838	7,417	201	1,779
65	0.16	0.0185	556	12,499	1,030	23,155	1,525	13,497	331	2,930

Installation and Transmission Torque

Bolt connection to output flange and resulting transmission torque

Size		14	17	20	25	32	40	45	50	58	65
Number of screws		6	6	8	8	8	8	8	8	8	8
Size of screws		M4	M5	M6	M8	M10	M10	M12	M14	M16	M16
Pitch circle diameter	mm	23	27	32	42	55	68	82	84	100	110
Screw Tightening Torque	Nm	5.4	10.8	18.4	45	89	89	154	246	383	383
	lb-in	48	96	163	398	788	788	1,363	2,177	3,390	3,390
Torque transmitting capacity	Nm	58	109	245	580	1,220	1,510	2,624	3,690	5,981	6,579
	lb-in	513	965	2,168	5,133	10,798	13,365	23,224	32,659	52,936	58,229

Bolt connection to housing and resulting transmission torque

Size		14	17	20	25	32	40	45	50	58	65
Number of screws		6	8	8	10	12	10	16	18	16	12
Size of screws		M4	M4	M5	M5	M6	M8	M8	M8	M10	M12
Pitch circle diameter	mm	65	71	82	96	125	144	164	174	206	236
Screw Tightening Torque ⁵	Nm	3.2	3.2	6.4	6.4	10.8	26.5	26.5	26.5	51.9	90
	lb-in	28	28	57	57	96	235	235	235	459	797
Torque transmitting capacity	Nm	98	143	261	382	842	1,488	2,712	3,237	5,350	6,649
	lb-in	867	1,266	2,310	3,381	7,452	13,170	24,003	28,650	47,351	58,849

1. Recommended bolt : JIS B 1176 socket head cap screw strength range : JIS B 1051 over 12.9

2. Torque coefficient : K=0.2

3. Clamp coefficient A=1.4

4. Coefficient of friction: 0.15

5. Strict compliance to the recommended screw tightening torques is especially important for the lightweight aluminum housing flange. Exceeding the recommended values (over tightening) can cause deformation of the housing flange under the bolt heads. This will result in the housing slipping under full torque loads. (Please contact a Sales Engineer for more information.)

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