Harmonic Drive®

SHG/SHF-LW – Lightweight Hollow Shaft Gear Unit

Harmonic Drive now offers a NEW lightweight version of our SHG and SHF-2UH Hollow Shaft Gear Units!

20% lighter than our standard SHG and SHF-2UH gears!

Using new lightweight materials and an optimized design, a 20% reduction in weight has been achieved without reducing the torque rating of the gear unit or any changes to the interface dimensions. This weight reduction, combined with their 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

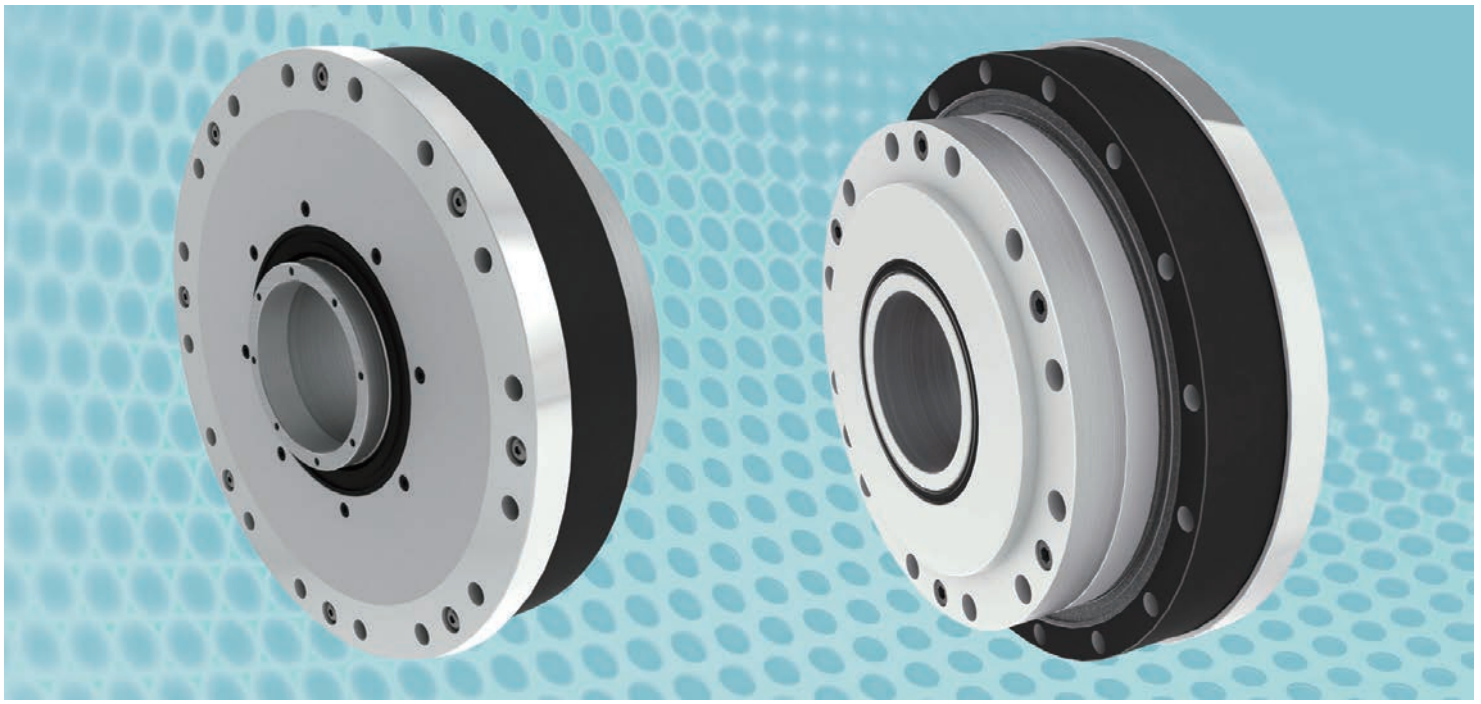
Mobile Robots – allowing lower weight designs which improves battery life without sacrificing performance

Application Examples

Robot End Effector

Robot Joints

Wafer Transfer Robot



Ordering Code

SHG - 25 - 100 - 2UH - LW - SP

Model	Size	Gear Ratio	Type	Lightweight	Special
SHG Series SHF Series	14~65 14~58	50:1~160:1 30:1~160:1	2UH (Gearhead)		(Custom Specification) leave blank for standard product

Rating Table

SHG Series

Table 2-1

Size	Ratio	Rated Torque at 2000rpm		Limit for Repeated Peak Torque		Limit for Average Torque		Limit for MomentoryTorque		Maximum Input Speed		Max. Average Input Speed	
		Nm	lb-in	Nm	lb-in	Nm	lb-in	Nm	lb-in	Oil	Grease	Oil	Grease
14	50	7.0	62	23	204	9	80	46	407	14,000	8,500	6,500	3,500
	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
	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
	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				
	160	52	460	120	1,062	64	566	191	1,690				
25	50	51	451	127	1,124	72	637	242	2,142	7,500	5,600	5,600	3,500
	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	395	3,496				
	160	87	770	229	2,027	140	1,239	408	3,611				
32	50	99	876	281	2,487	140	1,239	497	4,399	7,000	4,800	4,600	3,500
	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	892	7,895				
	160	178	1,575	484	4,284	281	2,487	892	7,895				
40	50	178	1,575	523	4,629	255	2,257	892	7,895	5,600	4,000	3,600	3,000
	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	1,530	13,542				
	160	382	3,381	841	7,443	586	5,187	1,530	13,542				
45	50	229	2,027	650	5,753	345	3,054	1,235	10,931	5,000	3,800	3,300	3,000
	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				
	160	523	4,629	1,147	10,152	819	7,249	2,483	21,976				
50	80	484	4,284	1,223	10,824	675	5,974	2,418	21,401	4,500	3,500	3,000	2,500
	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				
	160	688	6,089	1,534	13,577	1,096	9,700	3,185	28,190				
58	80	714	6,319	1,924	17,029	1,001	8,860	3,185	28,190	4,000	3,000	2,700	2,200
	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				
	160	969	8,576	2,392	21,171	1,573	13,922	4,459	39,465				
65	80	969	8,576	2,743	24,278	1,352	11,966	4,836	42,802	3,500	2,800	2,400	1,900
	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				
	160	1,236	10,940	3,419	30,261	2,041	18,064	6,175	54,653				

Rating Table

SHF Series

Table 2-1

Size	Ratio	Rated Torque at 2000rpm		Limit for Repeated Peak Torque		Limit for AverageTorque		Limit for Momentory Peak Torque		Maximum Input Speed		Limit for Average Input Speed	
		Nm	lb-in	Nm	lb-in	Nm	lb-in	Nm	lb-in	Oil	Grease	Oil	Grease
14	30	4.0	35	9.0	80	6.8	60	17	150	14,000	8,500	6,500	3,500
	50	5.4	48	18	159	6.9	61	35	310				
	80	7.8	69	23	204	11	97	47	416				
	100	7.8	69	28	248	11	97	54	478				
17	30	8.8	78	16	142	12	106	30	266	10,000	7,300	6,500	3,500
	50	16	142	34	301	26	230	70	620				
	80	22	195	43	381	27	239	87	770				
	100	24	212	54	478	39	345	110	973				
	120	24	212	54	478	39	345	86	761				
20	30	15	133	27	239	20	177	50	443	10,000	6,500	6,500	3,500
	50	25	221	56	496	34	301	98	867				
	80	34	301	74	655	47	411	127	1,124				
	100	40	354	82	726	49	434	147	1,301				
	120	40	354	87	770	49	434	147	1,301				
	160	40	354	92	814	49	434	147	1,301				
25	30	27	239	50	443	38	336	95	841	7,500	5,600	5,600	3,500
	50	39	345	98	867	55	487	186	1,646				
	80	63	558	137	1,213	87	770	255	2,257				
	100	67	593	157	1,390	108	956	284	2,514				
	120	67	593	167	1,478	108	956	304	2,691				
	160	67	593	176	1,558	108	956	314	2,779				
32	30	54	478	100	885	75	664	200	1,770	7,000	4,800	4,600	3,500
	50	76	673	216	1,912	108	956	382	3,381				
	80	118	1,044	304	2,691	167	1,478	568	5,027				
	100	137	1,212	333	2,947	216	1,912	647	5,726				
	120	137	1,212	353	3,124	216	1,912	686	6,072				
	160	137	1,212	372	3,292	216	1,912	686	6,072				
40	50	137	1,212	402	3,558	196	1,735	686	6,072	5,600	4,000	3,600	3,000
	80	206	1,823	519	4,594	284	2,514	980	8,674				
	100	265	2,345	568	5,027	372	3,292	1,080	9,559				
	120	294	2,602	617	5,461	451	3,992	1,180	10,444				
	160	294	2,602	647	5,726	451	3,992	1,180	10,444				
45	50	176	1,558	500	4,425	265	2,345	950	8,408	5,000	3,800	3,300	3,000
	80	313	2,770	706	6,249	390	3,452	1,270	11,240				
	100	353	3,124	755	6,682	500	4,425	1,570	13,896				
	120	402	3,558	823	7,284	620	5,487	1,760	15,577				
	160	402	3,558	882	7,806	630	5,576	1,910	16,905				
50	50*	123	1,084	715	6,328	175	1,549	1,430	12,657	4,500	3,500	3,000	2,500
	80	372	3,292	941	8,329	519	4,594	1,860	16,462				
	100	470	4,160	980	8,674	666	5,895	2,060	18,233				
	120	529	4,682	1,080	9,559	813	7,196	2,060	18,233				
	160	529	4,682	1,180	10,444	843	7,461	2450	21,684				
58	50*	177	1,562	1,020	9,028	260	2,301	1,960	17,347	4,000	3,000	2,700	2,200
	80	549	4,859	1,480	13,099	770	6,815	2,450	21,684				
	100	696	6,160	1,590	14,073	1,060	9,382	3,180	28,145				
	120	745	6,594	1,720	15,223	1,190	10,532	3,330	29,473				
	160	745	6,594	1,840	16,285	1,210	10,709	3,430	30,358				

1. * The rated torque for gear units size 50 and larger with a gear ratio of 50:1 can be doubled if oil lubrication is used instead of standard grease lubrication. Contact a sales engineer to discuss this special modification.
2. Please refer to the SHG/SHF 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 Table 4-1

Ratio: 100			
Lubricant	Grease	Name	Harmonic grease SK-1A
			Harmonic grease SK-2
		Grease quantity	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

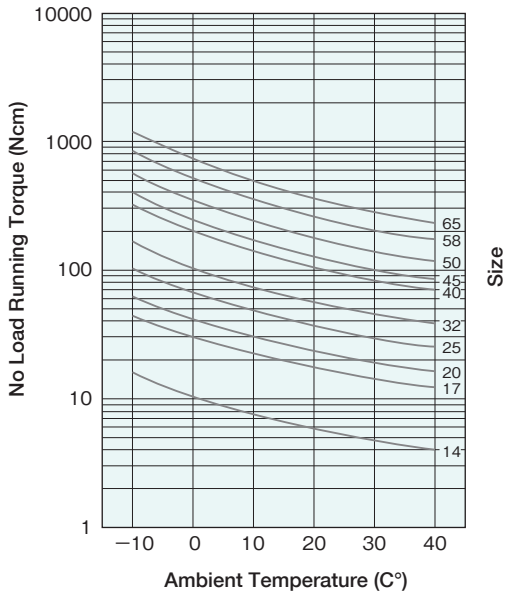
The no load running torque of Harmonic Drive gears varies with the gear ratio. The graphs indicate a value for ratio 100. For other gear ratios, add the compensation value from table 3-2.

Table 4-2
Unit: Ncm

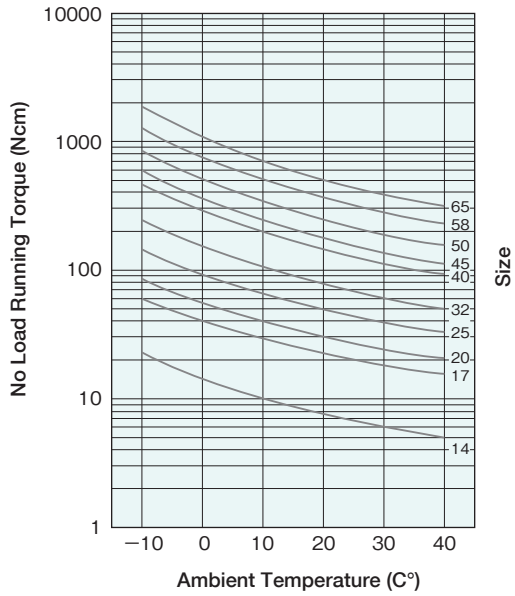
Size \ Ratio	30	50	80	120	160
14	+2.6	+1.1	+0.2	—	—
17	+4.1	+1.8	+0.4	-0.2	—
20	+5.9	+2.6	+0.5	-0.4	-0.8
25	+9.6	+4.2	+0.8	-0.6	-1.3
32	+18.3	+8.0	+1.5	-1.1	-2.5
40	—	+13.3	+2.4	-1.7	-4.0
45	—	+18.2	+3.3	-2.4	-5.5
50	—	+23.9	+4.3	-3.1	-7.2
58	—	+34.6	+6.2	-4.4	-10.3
65	—	—	+8.1	-5.8	-13.7

No Load Running Torque for Ratio 100

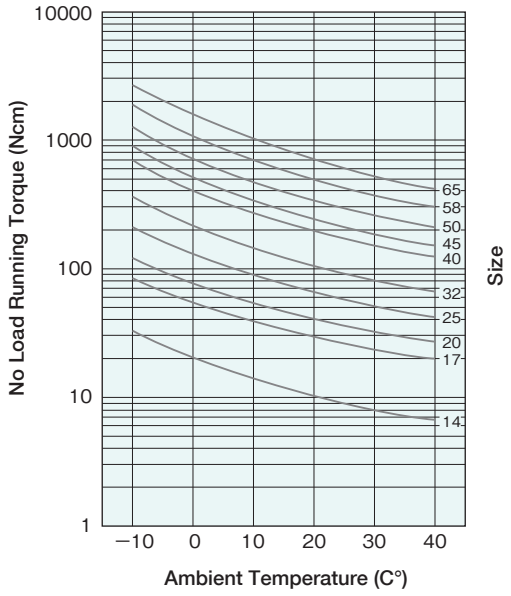
Input Speed 500r/min



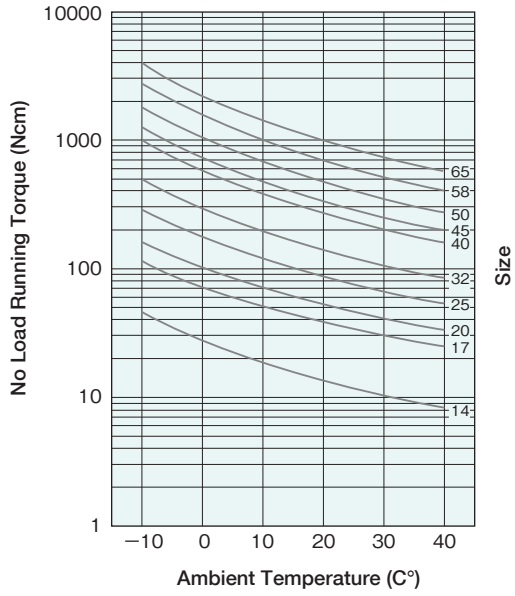
Input Speed 1000r/min



Input Speed 2000r/min



Input Speed 3500r/min



Efficiency

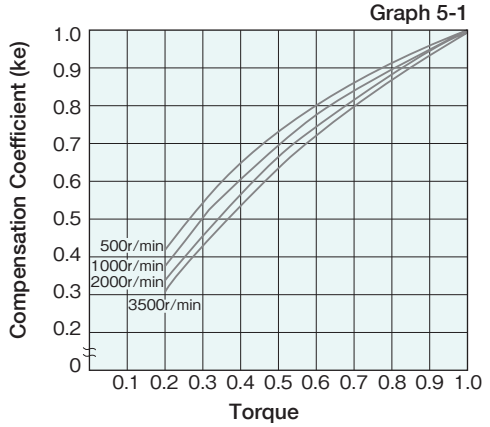
The gear efficiency is affected by many factors. Efficiency depends on the gear ratio, input speed, load torque, temperature, quantity of lubricant and type of lubricant. Efficiency values shown in the tables shown below are for rated torque. If the actual load torque is below rated torque, a compensation 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 5-1

Measurement condition Table 5-1

Installation	Based on recommended tolerance		
Load torque	Rated torque		
Lubricant	Grease	Name	Harmonic grease SK-1A
			Harmonic grease SK-2
		Grease quantity	Recommended quantity

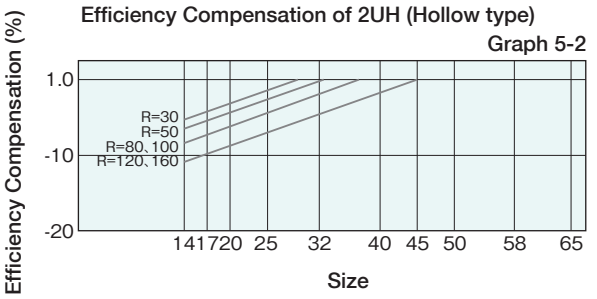
Efficiency Compensation Coefficient
Graph 5-1



Input Efficiency Compensation by Size

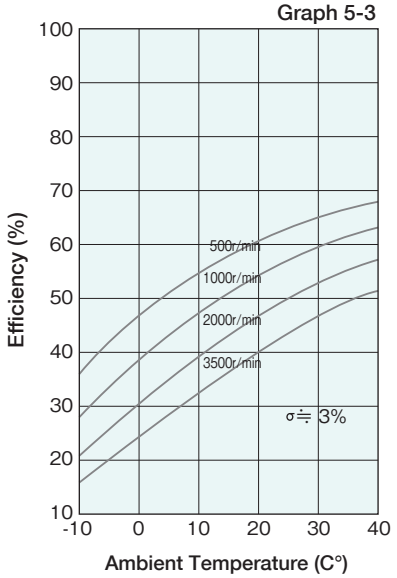
Hollow shaft gear units use support bearings and oil seals on the input side. A compensation factor must be applied to the efficiency calculation based on the size and gear ratio. Find the Efficiency Compensation value (ηe) on the Graph 5-2.

Efficiency Compensation of 2UH (Hollow type)
Graph 5-2

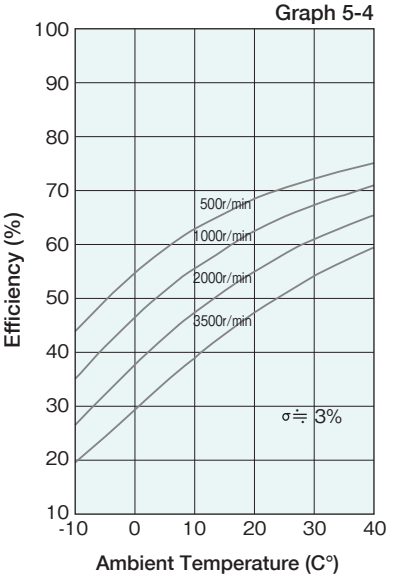


Efficiency at Rated Torque (Sizes 14-65)

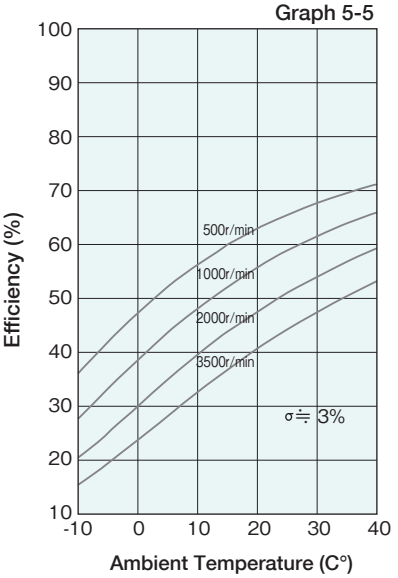
Ratio 30
Graph 5-3



Ratio 50, 80, 100, 120
Graph 5-4



Ratio 160
Graph 5-5



Efficiency Compensation Equation

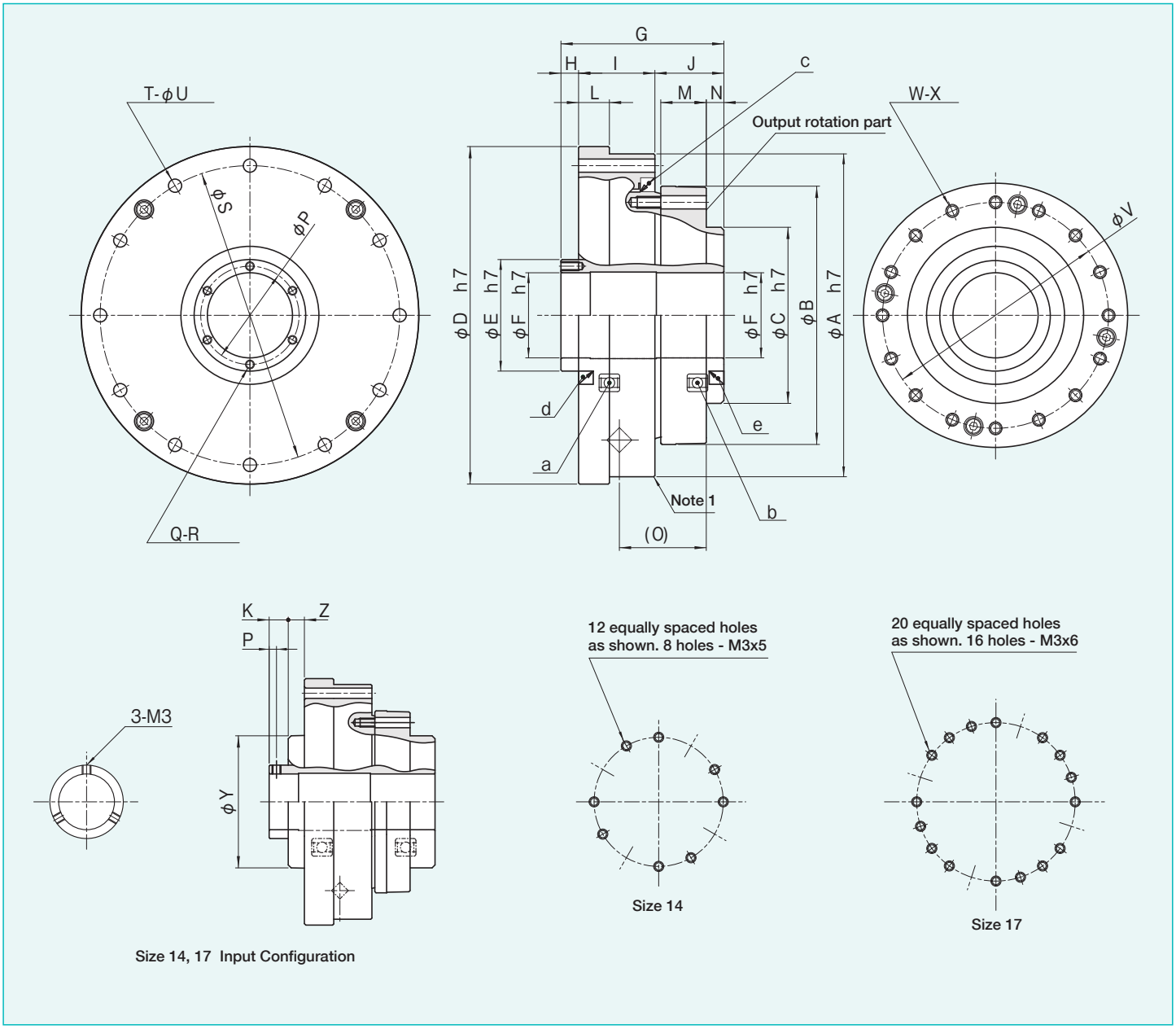
$$\text{Efficiency } (\eta) = Ke \times (\eta R) + \eta e)$$

Table 5-2

η	Efficiency	———
Ke	Efficiency Compensation Coefficient	Graph 5-1
ηR	Efficiency at rated Torque	Graph 5-3–5-5
ηe	Efficiency Compensation Quantity	Graph 5-2

External Dimensions

Drawing 6-1



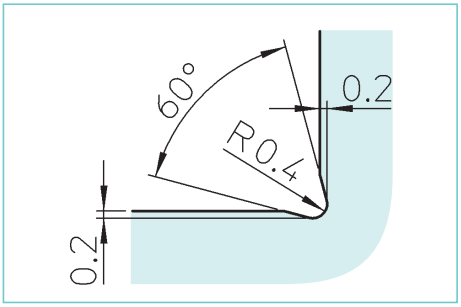
Size 14, 17 Input Configuration

Note 1: To prevent interference between the cross roller bearing corner (Note 1 shown in the drawing) and the customer's housing, an undercut in the housing is recommended per drawing 6-2 below.
* Detailed drawing are available upon request.

Recommended Housing Undercut

Customer Housing

Drawing 6-2
Unit: mm



Dimension Table

Table 7-1
Unit: mm

Symbol \ Size	14	17	20	25	32	40	45	50	58	65
ϕA h7	70	80	90	110	142	170	190	214	240	276
ϕB	52	62	73	88	115	140	160	168	195	213
ϕC h7	36	45	50	60	85	100	120	130	150	160
ϕD h7	74	84	95	115	147	175	195	220	246	284
ϕE h7	20	25	30	38	45	59	64	74	84	96
ϕF H7	14	19	21	29	36	46	52	60	70	80
G	52.5	56.5	51.5	55.5	65.5	79	85	93	106	128
H	12	12	5	6	7	8	8	9	10	14
I	20.5	23	25	26	32	38	42	45	52	56.5
J	20	21.5	21.5	23.5	26.5	33	35	39	44	57.5
K	6.5	6.5	-	-	-	-	-	-	-	-
L	9	10	10.5	10.5	12	14	15	16	17	18
M	11.5	12	13.5	15.5	20.5	25	27	30	35	42.5
N	7.5	8.5	7	6	5	7	7	7	7	12
O	21.7	23.9	25.5	29.6	36.4	44	47.5	52.5	62.2	72
ϕP(P)	(2.5)	(2.5)	25.5	33.5	40.5	52	58	67	77	88
Q	3	3	6	6	6	6	6	6	8	6
R	M3	M3	M3×6	M3×6	M3×6	M4×8	M4×8	M4×8	M4×8	M5×10
ϕS	64	74	84	102	132	158	180	200	226	258
T	8	12	12	12	12	12	18	12	16	16
ϕU	3.5	3.5	3.5	4.5	5.5	6.6	6.6	9	9	11
ϕV	44	54	62	77	100	122	140	154	178	195
W	12x8	20x16	16	16	16	16	12	16	12	16
X	M3×5	M3×6	M3×6	M4×7	M5×8	M6×10	M8×10	M8×11	M10×15	M10×15
	ϕ3.5×11.5	ϕ3.5×12	ϕ3.5×13.5	ϕ5×15.5	ϕ6×20.5	ϕ7×25	ϕ9×27	ϕ9×30	ϕ11×35	ϕ11×42.5
ϕY	36	45	-	-	-	-	-	-	-	-
Z	5.5	5.5	-	-	-	-	-	-	-	-
a	6804ZZ	6805ZZ	6806ZZ	6808ZZ	6909ZZ	6912ZZ	6913ZZ	6915ZZ	6917ZZ	6920ZZ
b	6804ZZ	6805ZZ	6806ZZ	6808ZZ	6809ZZ	6812ZZ	6812ZZ	6815ZZ	6817ZZ	6820ZZ
c	D49585	D59685	D69785	D84945	D1101226	D1321467	D1521707	D1681868	D1932129	D21623811
d	S20304.5	S25356	S30405	S38475	S45607	S60789	S657810	S759510	S8511012	S10012513
e	S20304.5	S25356	S30405	S38475	S45555	S59685	S59685	S69785	S84945	S961128
Weight (kg)	0.55	0.8	1.1	1.6	3.6	6.2	8	11.8	16.4	23.3

Weight Comparison

Table 7-2
Unit: kg

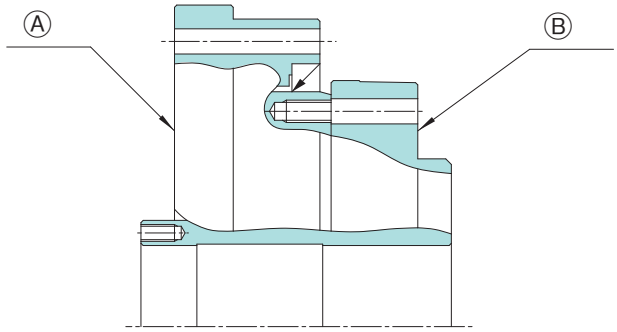
Size	14	17	20	25	32	40	45	50	58	65
SHG/SHF Series standard unit type	0.71	1	1.38	2.1	4.5	7.7	10	14.5	20	28.5
SHG/SHF Series LW unit type	0.55	0.8	1.1	1.6	3.6	6.2	8	11.8	16.4	23.3
Weight Ratio	77%	80%	80%	76%	80%	81%	80%	82%	82%	82%

Specification for cross roller bearing

Table 7-3

Size	Pitch Circle	Offset	Basic Dynamic Load Rating		Basic Static Load Rating		Allowable Moment Load		Moment Stiffness Km	
	dp	R	C		Co		Mc		×10⁴ Nm/rad	×10⁴ lb-in/rad
	m	m	×10²N	lb	×10²N	lb	Nm	lb-in		
14	0.050	0.0217	58	1,304	86	1,933	* 74	655	8.5	75
17	0.060	0.0239	104	2,338	163	3,664	* 124	1,097	15.4	136
20	0.070	0.0255	146	3,282	220	4,946	* 187	1,655	25.2	223
25	0.085	0.0296	218	4,901	358	8,048	258	2,283	39.2	347
32	0.111	0.0364	382	8,588	654	14,703	580	5,133	100	885
40	0.133	0.0440	433	9,734	816	18,344	849	7,514	179	1,584
45	0.154	0.0475	776	17,445	1,350	30,349	1,127	9,975	257	2,275
50	0.170	0.0525	816	18,344	1,490	33,497	1,487	13,161	351	3,107
58	0.195	0.0622	874	19,648	1,710	38,442	2,180	19,295	531	4,700
65	0.218	0.0720	1,300	29,225	2,230	50,132	2,740	24,251	741	6,558

* The moment stiffnesses are mean values.



Installation and Transmission Torque

Bolt connection to housing and resulting transmission torque (A)

Size		14	17	20	25	32	40	45	50	58	65
Number of screws		8	12	12	12	12	12	18	12	16	16
Size of screws		M3	M3	M3	M4	M5	M6	M6	M8	M8	M10
Pitch Circle Diameter	mm	64	74	84	102	132	158	180	200	226	258
Screw Tightening Torque	Nm	2.4 (2.0)	2.4 (2.0)	2.4 (2.0)	5.4 (4.5)	10.8 (9.0)	18.4 (15.3)	18.4 (15.3)	44 (37)	44 (37)	74
	lb-in	21 (18)	21 (18)	21 (18)	48 (40)	96 (80)	163 (135)	163 (135)	389 (327)	389 (327)	655
Torque Transmitting Capacity	Nm	128 (108)	222 (186)	252 (206)	516 (431)	1,069 (892)	1,813 (1,509)	3,098 (2,578)	4,163 (3,489)	6,272 (5,263)	9,546
	lb-in	1,133 (956)	1,965 (1,646)	2,230 (1,823)	4,567 (3,815)	9,461 (7,895)	16,046 (13,356)	27,420 (22,817)	36,846 (30,880)	55,512 (46,581)	84,489

Bolt connection to output flange and resulting transmission torque (B)

Size		14	17	20	25	32	40	45	50	58	65
Number of screws		8	16	16	16	16	16	12	16	12	16
Size of screws		M3	M3	M3	M4	M5	M6	M8	M8	M10	M10
Pitch Circle Diameter	mm	44	54	62	77	100	122	140	154	178	195
Screw Tightening Torque Note 1	Nm	2.4 (2.0)	2.4 (2.0)	2.4 (2.0)	5.4 (4.5)	10.8 (9.0)	18.36 (15.3)	44 (37)	44 (37)	89 (74)	89
	lb-in	21 (18)	21 (18)	21 (18)	48 (40)	96 (80)	163 (135)	389 (327)	389 (327)	788 (655)	788
Torque Transmitting Capacity Note 1	Nm	88 (72)	216 (176)	248 (206)	520 (431)	1,080 (902)	1,867 (1,558)	2,914 (2,440)	4,274 (3,587)	5,927 (4,910)	8,658
	lb-in	779 (637)	1,912 (1,558)	2,195 (1,823)	4,602 (3,815)	9,559 (7,983)	16,524 (13,789)	25,791 (21,596)	37,828 (31,748)	52,458 (43,457)	76,630

1. Value not in parentheses is for SHG-LW. Value in parentheses is for SHF-LW Series.
2. Recommended bolt : JIS B 1176 socket head cap screw strength range : JIS B 1051 over 12.9
3. Torque coefficient : K=0.2
4. Clamp coefficient A=1.4
5. Coefficient of friction: 0.15
6. 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. Flat washers should be used for all screws in direct contact with the aluminum housing. s(Please contact a Sales Engineer for more information.)

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