GCU-N Screw Gear Kit



Installation: Nonparallel and

nonintersecting gears

Gear Type: Screw Gears : SN2.5-10R

PN2.5-10R

Gear Ratio: 1

Gears

Weight : Approx. 1kg

Screw Gears are helical gears used in nonparallel and nonintersecting situations. Applications include devices like conveyers with light loads.

* This is not a gear box for actual use to transmit power. Please use only as representations of gear systems.

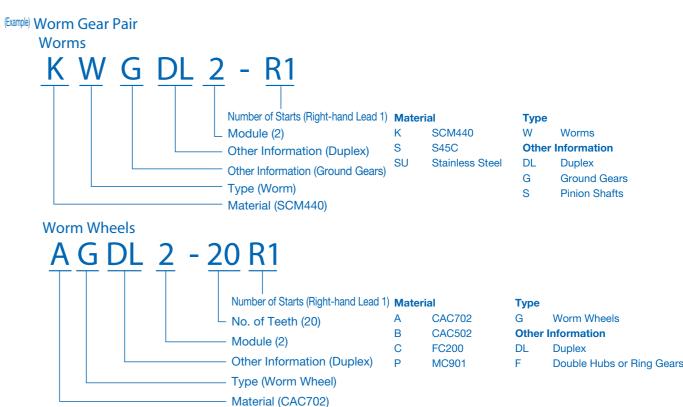


তি Worm Gears



Catalog Number of KHK Stock Gears

The Catalog Number for KHK stock gears is based on the simple formula listed below. Please order KHK gears by specifying the Catalog Numbers.



Features



KHK stock worm gears are available in modules 0.5 to 6, reduction ratios of 1/10 to 1/120, and a wide range of materials and shapes. Duplex worm gears with adjustable backlash and highly accurate rotation are also available. The following table lists the main features.

	Туре	Catalog Number	Module	Number of Starts or Reduction Ratio	Material Old JIS in parentheses	Heat treatment		Precision Grade KHK W 001 KHK W 002 Note 2	Features
Gears	Worms	KWGDL	2~4	Single Start	SCM440	Thermal refined, gear teeth induction hardened	Ground	1	Duplex worms that have been tempered, hardened and ground that has excellent accuracy, strength and abrasion resistance. Secondary operations can be given except for the teeth. Moving it in axial direction will adjust the backlash.
Duplex Worm	Worms	KWGDLS	1.5~4	Single Start	SCM440	Thermal refined, gear teeth induction hardened	Ground	1	Duplex worms with shafts that have been tempered, hardened and ground that has excellent accuracy, strength and abrasion resistance. Secondary operations can be given except for the teeth. Moving it in axial direction will adjust the backlash.
Dupl	Wheels	AGDL	1.5~4	20~60	CAC702 (A & BC2)	_	Cut	1	Duplex worm wheels made of aluminum bronze with excellent accuracy and a good balance between machinability and wear resistance. Used in combination with KWGDL or KWGDLS.
	Worms	KWG	0.5~6	Single or Double Start	SCM440	Thermal refined, gear teeth induction hardened	Ground	2	Worms with shafts that have been tempered, hardened and ground that has excellent accuracy, strength and abrasion resistance. Secondary operations can be performed except for the teeth.
	Wheels	AGF NOTE 1	2~6	10~60	CAC702 (A & BC2)	_	Cut	2	Worm wheels made of aluminum bronze with a good balance between machinability and wear resistance. Used in combination with KWG.
	Worms	SWG	1~6	Single or Double or Triple Start	S45C	Gear teeth induction hardened	Ground	2	Worms that have been hardened and ground with a good balance of accuracy, wear resistance and cost. Secondary operations are possible except for the teeth.
Worm Gears	Wheels	AG NOTE 1	1~6	10~60	CAC702 (A & BC2)	_	Cut	2	Worm wheels made of aluminum bronze with a good balance between machinability and wear resistance. Used in combination with SWG. Note 1
Worn	Worms	sw	0.5~6	Single or Double Start	S45C	_	Cut (Rolling)	4	Many lineups are available at a low price and excellent usability.
	Worms	suw	0.5~3	Single or Double Start	SUS303	_	Cut	4	Stainless steel worms with rust resistance.
	Wheels	BG	0.5~6	10~60	CAC502 (PBC2)	_	Cut	4	Worm wheels made of phosphorus bronze with excellent wear resistance. Used in combination with SW and SUW.
	Wheels	CG	1~6	10~120	FC200	_	Cut	4	Cast iron worm wheels that are inexpensive and suitable for light loads. Used in combination with SW and SUW.
	Wheels	PG	0.5~3	10~50	MC901	_	Cut	5	Worm wheels made of MC nylon. Can be used with no lubrication. Used in combination with SW and SUW.

[Note 1] FC200 is the material for the hubs of AGF and AG worm wheels. The AG worm wheels are normally combined with the SWG worms, but are also compatible with the KWG worms with module 1.5 and below.

[Note 2] The precision grade of KHK stock worm gears controls the product quality based on the KHK standards. Please see "Precision of Worm Gears" on Page 396 in the Selection Hints section for details.

High-precision ground gear worms are available.

We use screw grinding machines manufactured by DRAKE, USA, to manufacture high-precision ground worms of module 0.5 to 8.



	Worm ground gear machin	ning range		
	Maximum gear accuracy	KHK Grade 1		
	Maximum module	m8		
	Maximum nominal lead angle	±35°		
ı	Maximum outer diameter	φ200mm		
	Maximum length	330mm		

Worm Gear Pair

Application Examples



KHK stock worm gears are used in a wide range of fields, including reduction gears and positioning mechanisms.

■ Wiper Drive Device



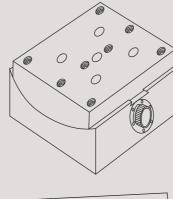
Worm gear used for the oscillating mechanism of wipers

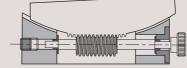
Yaesu Steam Kettle



SW worm and CG worm wheel used for rotating large pans

■ Gonio Stage Design Example





Worm gear used for rotating tables (design example)

■ Masdac Food Filling Device



KWGDL Duplex Worm Wheels and AGDL Worm Wheels used for indexing and driving, for accurate filling of a fixed amount of ingredients

■ Fabric Feeding Device



393

SW worm and BG worm wheel used for adjusting height

Calculation of Bending Strength of Gears



Selection Hints



Please select the most suitable products by carefully considering the characteristics of items and contents of the product tables. It is also important to read all applicable "CAUTION" notes shown below before the final selection.

1. Caution in Selecting the Mating Gears

Worm gears are available in right-hand helix and left-hand helix. Worms and worm wheels of the same helix direction are combined. However, combination may not be possible due to the difference in the number of starts of the worm and the difference in pitch being normal and transverse (axial direction). Below is the Mating Helical Gear Selection Chart for KHK worm gears.

■ Mating Worm Wheel Selection Chart

Worm	s	KWGDL KWGDLS	KV	VG		SWG	i		S	suw			
Mating Wheel Note 1	Hand Number of Starts	R1	R1	R2	R1	R2	R3	R1	R2	L1	L2	R1	R2
AGDL	R1	0											
AG0.5~1.5	R1		0										
AGF	R2			0									
	R1				0								
AG	R2					0							
	R3						0						
	R1							0				0	
BG	R2								0				0
В	L1									0			
	L2										0		
	R1							0				0	
CG	R2								0				0
-	L1									0			
	L2										0		
PG	R1							0				0	
, ,	R2								0				0

[Note 1] The mating wheel must have the same module as the worm.

■ Helix direction of worm gears



2. Caution in Selecting Gears Based on Gear Strength

The gear strength values shown in the product pages were computed by assuming the application environment in the table below. Therefore, they should be used as reference only. We recommend that each user computes their own values by applying the actual usage conditions.

Calculation of Surface Durability

Catalog Number	KWGDL/KWGDLS/AGDL KWG/AGF, SWG/AG	SW/BG	SUW/PG					
Formula NOTE 1	Formula of cylin	drical worm gear strength	n (JGMA405-01)	The Lewis formula				
Lubricating Oil	Lubricating oil with appropriat	Allowable bending stress (kgf/mm ²						
Lubrication Method	Oi							
Startup Status	The starting torque is 200% or les	ss of the rated torque, and the nur	mber of starts per hour is under 2.					
Expected Service Life		26,000 hours		1.15				
Impact from motor	act from motor Uniform load							
Impact from load								
Allowable Stress Coefficient Sclim	0.67	0.70						

[NOTE 1] The gear strength formula is based on JGMA (Japanese Gear Manufacturers Association) specifications, "MC Nylon Technical Data" by Mitsubishi Chemical Advanced Materials. The units for the rotational speed (rpm) and the stress (kgf/mm²) are adjusted to the units needed in the formula.

When selecting KHK standard gears, glance over the Cautions on Product Characteristics and Cautions on Performing Secondary Operations on Page 398.

- ① Products not listed in this catalog or materials, modules, number of teeth and the like not listed in the dimensional tables can be manufactured as custom items. Please see Page 26 for more details about custom-made orders.
- ② The color and shape of the product images listed on the dimension table page of each product may differ from the actual product. Be sure to confirm the shape in the dimension table before selection.
- 3 The details (specifications, dimensions, etc.) listed in the catalog may be changed without prior notice. Changes are announced on the KHK website.

Website URL: https://khkgears.net/new/

Overseas Sales Department: Phone: +81-48-254-1744 Fax: +81-48-254-1765 E-mail: info@khkgears.net

The most important factor in selecting gears is the gear strength.

Step 1

Use the calculation of load torque applied to the gear and the sliding speed to determine the worm gear suitable for the purpose.

Maximum allowable sliding speed due to friction

d: Worm pitch dia.

The maximum allowable sliding speed of each worm gear is shown in the table below. Sliding speed should be calculated when making a selection.

Sliding speed vs (m/s)

$v_{\rm S} = \frac{an}{19100 \rm c}$	os γ	$\begin{array}{c} {\rm n} \ \ : \mbox{Worm rotational speed} \\ {\rm \gamma} \ \ : \mbox{Worm nominal lead angle} \end{array}$
Catalog Number	Maximur	m allowable sliding speed (m/s)
AGDL	*	15
AGF	*	15
AG	*	15

* From JGMA405-01

CG PG ■ Surface durability

Calculated values of the strength at which the worm wheel teeth do not wear due to surface fatigue damage. If the tooth surface is not sufficiently lubricated, the surface may be damaged even if the load is less than the tooth surface durability.

Step 2

Select provisionally from the allowable torque table in this catalog based on the load torque.

For provisional selection from this catalog

2.5

1 (No Lubrication)

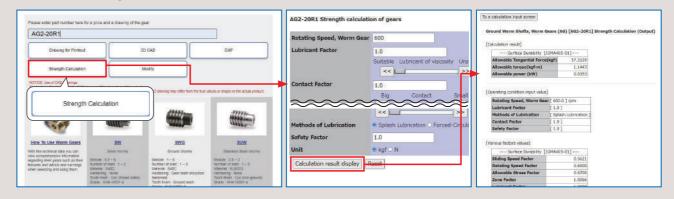
Catalog Number Cata
AG1-30R1 0 2 2 7 W 0 6 12 2 3 3 1 1 3 3 1 2 2 2 7 W 0 6 16 20 2 2 3 1 1 8 3 1 2 6 2 6 16 1 8 1 8 1 1 1 5 1 3 6 6 3 6 1 6 1 8 1 8 1 1 5 1 3 1 2 2 2 8 6 1 3 6 1 8 1 8 1 1 2 2 1 2 8 1 8 1 8 1 2 1 2 1
AG1-30921 30 20 1 1 2757 R H 6 20 20 22 23 30 10 10 20 20 20 708 84 484 645 263 331 322 23 461-3092 46
AG1-J0012 15 30 2 7 or 10 11 11 20 3 10 12 3 10 10 20 23 701 12 11 20 10 10 20 23 701 34 4.56 1.27 3.31 103 2.00 000-000-00000000000000000000000000
AG1-4081 40 40 1 1 1795 8 80 40 42 43 28 28 121 102 843 7.72 638 5.66 513 AG1-5081 50 50 1 1795 8 83 50 52 53 33 83 56 513 13 152 63 720 638 5.66 513 641-5081 60 60 1 1795 10 55 60 62 63 38 56 62 181 181 184 141 122 114 AG1-5-2081 20 20 1 1795 10 22 30 23 345 25 75 596 818 60 3.30 468 423 188 641-5-2082 60 20 20 20 20 20 31 345 25 75 797 287 587 647 625 625 625 625 625 625 625 625 625 625
AGI-5081 00 50 1 2787 0 50 50 2 33 3. 33 183 185 120 50 9 20 20 3 30 50 50 50 50 50 50 50 50 50 50 50 50 50
AG1-50R1 60 60 1 3735 10 35 60 62 63 38 256 218 821 55 41 129 11.4 AG1-5-20R1 20 20 1 3726 82 30 33 345 275 994 218 6.0 5.30 4.68 4.25 3.08 AG1-5-20R2 10 20 2 6'5'1 8 22 30 33 345 275 992 218 52 428 42 328 327
AG1.5-20R1 20 20 1 3'26' 8 22 30 33 34.5 27.5 9.84 8.18 6.40 5.30 4.68 4.25 3.68 AG1.5-20R2 10 20 2 6'51' 8 22 30 33 34.5 27.5 9.72 7.87 5.92 4.87 4.25 3.83 3.27
AG1.5-20R2 10 20 2 6'51' 8 22 30 33 34.5 27.5 9.72 7.87 5.92 4.87 4.25 3.83 3.27
AG1.5-30R1 30 30 1 3°26′ 10 30 45 48 49.5 35 20.8 17.5 13.9 11.7 10.4 9.40 8.28
AG1.5-30R2 15 30 2 6°51′ R H1 10 30 45 48 49.5 14 10 24 35 20.7 17.1 13.1 10.8 9.56 8.58 7.46 0.10-0.
AG1.5-40R1 40 40 1 3°26' 12 35 60 63 64.5 42.5 35.6 30.0 24.2 20.6 18.3 16.6 14.6
AG1.5-50R1 50 50 1 3°26′ 12 45 75 78 79.5 50 53.8 45.4 36.9 31.6 28.3 25.8 22.6
AG1.5-60R1 60 60 1 3°26' 12 50 90 93 94.5 57.5 75.3 63.8 51.9 44.7 40.4 36.7 32.4

Step 3

Calculate the strength under the actual usage conditions.

Calculate the strength formally using the various gear strength formulas. We recommend using the simple strength calculation available on our website.

■ Use the strength calculation function on our website.





3. Cautions on Selecting Racks By Precision

The precision standards of KHK stock worm gears are established by us. Check the precision table below.

① Worm Precision (KHK W 001)

For the pitch error and lead error of the worm, the allowable values of 1 to 4 grades are set for each module with reference to the JIS standards. The lead error is the allowable value of the tooth trace error in one lead.

Worm Precision KHK W 001 (Unit: μ m)

e				Module		
Grade	Error	Over <i>m</i> 0.4 to 1	Over <i>m</i> 1 to 1.6	Over <i>m</i> 1.6 to 2.5	Over <i>m</i> 2.5 to 4	Over m4 to 6
4	Pitch Error	8	12	16	20	25
<u> </u>	Lead Error	7	9	11	13	16
2	Pitch Error	12	16	20	24	29
	Lead Error	15	15 18 21		25	28
3	Pitch Error	16	23	30	37	50
	Lead Error	20	23	27	33	37
4	Pitch Error	20	30	40	50	70
4	Lead Error	30	32	38	46	52

② Worm Wheel Accuracy (KHK W 002)

Our precision grades for pitch errors are established by referring to old JIS Standards. The precision grades are set from 1 to 5, in accordance with the tolerance of a single pitch error (S.P.E.), adjacent tooth-to-tooth error (T.T.E.), and the total composite error (T.C.E.) for each module and pitch diameter.

■ Total Length Tolerance for Worms

3 Total Length Tolerance for Worm Gears

Series	Total Length (mm)	Tolerance
KWGDL	Uniform	0 -0.10
SWG SW	100 or less	0 -0.15
SUW	Over 100 200 or less	0 -0.20
KWGDLS KWG	Uniform	Normal Tolerance

■ Total Length Tolerance for Worm Wheels

Total Length (mm)	Tolerance
30 or less	0 -0.10
31 to 100	0 -0.15
Over 100	0 0.20

[NOTE] PG Plastic Wheels are excluded.

Worm Wheel Accuracy KHK W 002

Init:	,,,	m

	_ · · · · · · · · · · · · · · · · · · ·																									
			Over	m0.4	4 to 1	ı	(Over	<i>m</i> 1 t	to 1.6	6	C	Over i	n1.6	to 2.	.5		Over	m2.	5 to 4	ļ		Ove	r m4	to 6	
													Pitch	dia.	(mm)										
Grade	Error	6 to 12	12 to 25	25 to 50	51 to 100	100 to 200	12 to 25	25 to 50	51 to 100	100 to 200	200 to 400	12 to 25	25 to 50	51 to 100	100 to 200	200 to 400	25 to 50	51 to 100	100 to 200	200 to 400	400 to 800	25 to 50	51 to 100	100 to 200	200 to 400	400 to 800
1	Single Pitch Error	5	6	7	7	9	6	7	8	9	10	7	7	8	9	11	8	9	10	11	13	9	10	11	13	14
	Total Pitch Error	21	24	26	30	34	25	28	31	35	41	27	30	33	37	43	33	36	40	46	53	37	40	45	50	57
2	Single Pitch Error	8	8	9	10	12	9	10	11	12	14	9	10	12	13	15	11	13	14	16	18	13	14	16	18	20
2	Total Pitch Error	30	33	37	42	48	35	39	44	50	57	38	42	46	52	60	46	51	57	64	74	52	57	63	71	80
3	Single Pitch Error	11	12	13	15	17	12	14	16	18	20	13	15	16	19	21	16	18	20	23	26	19	20	22	25	29
	Total Pitch Error	43	47	53	60	68	50	55	62	71	81	53	59	66	74	85	65	72	81	91	105	74	81	90	100	115
4	Single Pitch Error	15	17	19	21	24	18	19	22	25	29	19	21	23	26	30	23	25	28	32	37	26	28	32	35	40
4	Total Pitch Error	60	66	74	83	95	70	77	87	99	115	75	83	92	105	120	91	100	115	130	145	105	115	125	140	160
5	Single Pitch Error	21	24	26	30	34	25	28	31	35	41	27	30	33	37	43	33	36	40	46	53	37	40	45	50	57
	Total Pitch Error	86	94	105	120	135	100	110	125	140	165	105	120	130	150	170	130	145	160	185	210	150	160	180	200	230

4. Cautions in Selecting Worm Gears Based on Efficiency

The transmission efficiency of worm gears varies slightly depending on the assembled state, lubricating oil and the like, but the transmission efficiency (excludes bearing loss and loss of lubricating oil due to stirring) of worm wheels when driven from the worm is approximately 30% to 90%. The transmission efficiency table of the KHK stock worm gears is shown below (reference values).

1) Efficiency of Various Worms

■ KWGDL/KWGDLS/AGDL Worm Gear Efficiency (%)

(rpm = Worm Rotational Speed)

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Worm Rotational Speed Catalog Number	100	300	600	900	1200	1800							
KWGDLS1.5-R1	35	42	47	51	53	57							
KWGDL2-R1	38	45	51	55	56	61							
KWGDL2.5-R1	40	48	54	57	60	63							
KWGDL3-R1	41	49	55	58	62	65							
KWGDL3.5-R1	42	50	56	61	62	65							
KWGDL4-R1	42	51	56	61	63	67							

■ KWG/AG/AGF Worm Gear Efficiency (%)

(rpm = Worm Rotational Speed)

			(i piii – i			. /
Worm Rotational Speed Catalog Number	100	300	600	900	1200	1800
KWG0.5-R1	30	34	38	41	43	46
KWG0.8-R1	35	40	44	47	49	53
KWG1-R1	34	40	45	48	51	54
KWG1.5-R1	35	42	47	51	53	57
KWG2-R1	45	51	56	60	62	65
KWG2.5-R1	44	51	57	61	62	67
KWG3-R1	44	52	58	61	64	67
KWG4-R1	50	58	64	66	70	72
KWG5-R1	51	60	66	69	71	73
KWG6-R1	53	61	66	70	72	75
KWG0.5-R2	46	50	54	58	60	63
KWG0.8-R2	51	56	61	64	66	69
KWG1-R2	51	56	62	64	67	70
KWG1.5-R2	52	59	64	67	69	73
KWG2-R2	61	67	71	74	76	78
KWG2.5-R2	60	67	72	75	76	80
KWG3-R2	61	68	73	75	78	80
KWG4-R2	66	73	77	79	82	84

■ SWG/AG Worm Gear Efficiency (%)

(rpm = Worm Rotational Speed)

Worm Rotational Speed Catalog Number	100	300	600	900	1200	1800
SWG1-R1	34	40	45	48	51	54
SWG1.5-R1	35	42	47	51	53	57
SWG2-R1	38	45	51	55	56	61
SWG2.5-R1	40	48	54	57	60	63
SWG3-R1	41	49	55	58	62	65
SWG4-R1	42	51	56	61	63	67
SWG5-R1	46	54	60	64	66	70
SWG6-R1	48	57	64	66	68	73
SWG1-R2	51	56	62	64	67	70
SWG1.5-R2	52	59	64	67	69	73
SWG2-R2	55	62	67	70	72	75
SWG2.5-R2	57	64	69	72	75	77
SWG3-R2	58	66	71	73	76	78
SWG4-R2	59	67	72	75	77	80
SWG5-R2	62	70	75	78	79	82
SWG6-R2	65	72	77	80	81	84
SWG3-R3	67	74	78	80	82	84
SWG4-R3	68	75	79	82	83	86

SW, SUW/CG, BG, PG Worm Gear Efficiency

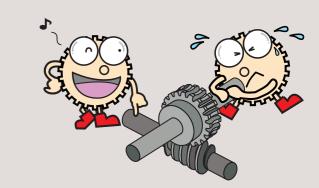
The values shown in the table below are estimates and may vary slightly according to conditions such as assembled state, load, lubrication and rotation speed.

Catalog Number	Number of Starts	Efficiency (%)
SW/SUW	1 Start	30~50%
	2 Starts	50~60%

2 Self-locking of worm gears

The state of the worm not being able to be rotated from the worm wheel is called self-locking. Self-locking happens due to the worm gear's material, lead angle, machining accuracy, bearing type, lubricating oil, etc.

There are various factors, so self-lock is not always determined only by the lead angle, but usually a singlestart worm self-locks at a lead angle of 4° or less. If complete reverse prevention is required, use another braking mechanism or the like in combination.





Product Precautions



Worm Common Notes

[Caution on Product Characteristics]

- (1) These worm gears produce axial thrust forces. Please see Page 400 for more details.
- (2) For bores of ϕ 4 or below, the bore tolerance is H8. As well, the tolerance is H8 for ϕ 5 or ϕ 6 bores with hole length (total length) 3x the bore or more.
- (3) For hole lengths 3.5x the bore or more, the hole center is out of H7 tolerance.
- (4) Keyways are made according to JIS B1301 standards, Js9 tolerance. Also note that keyway tooth position alignment is not performed.
- (5) For products having a tapped hole, a set screw is included.

[Caution on Secondary Operations]

- (1) Please read "Cautions on Performing Secondary Operations" on Page 400 when performing modifications and/or secondary operations for safety concerns.
- (2) Due to the gear teeth being induction hardened, no secondary operations can be performed on tooth areas including the bottom land (approx. 2 to 3 mm).

[J Series]

- (1) Cancellation is not possible for made-to-order products. For lead time details, see Page 38.
- (2) Black oxide is not re-applied to parts undergoing secondary operations.

Worm Wheel Common Notes

[Caution on Product Characteristics]

- (1) The allowable torque shown in the table are calculated values according to the assumed usage conditions. Please see Page 394 for more details.
- (2) These worm gears produce axial thrust forces. Please see Page 400 for more details.
- (3) Variations in temperature or humidity can cause dimensional changes in plastic gears, including tooth diameter, bore, and backlash. The accuracy and tolerances shown in the catalog are values obtained when machining is performed.
- (4) For bores of ϕ 4 or below, the bore tolerance is H8. As well, the tolerance is H8 for ϕ 5 or ϕ 6 bores with hole length (total length) 3x the bore or more.
- (5) Some products have a slight gap in the casted section, but this does not affect the holding strength.
- (6) Keyways are made according to JIS B1301 standards, Js9 tolerance. Also note that keyway tooth position alignment is not performed.
- (7) For products having a tapped hole, a set screw is included.

[Caution on Secondary Operations]

- (1) Please read "Cautions on Performing Secondary Operations" on Page 400 when performing modifications and/or secondary operations for safety concerns.
- (2) Because it affects the cast portion, there is no additional modification other than to the boss part.
- (3) As the worm wheel is casted, bubbles may form inside the material.

 If the air bubbles found in secondary operations are problematic, contact the supplier.

[.] Series

- (1) Cancellation is not possible for made-to-order products. For lead time details, see Page 38.
- (2) Certain products which would otherwise have a very long tapped hole are counterbored. For details, please see the KHK website.
- (3) For bores over ϕ 50, the bore tolerance is H8.

KWGDL(S) Duplex Worms

[Caution on Product Characteristics]

(1) When the center distance is moved to reduce the backlash, the V max is the maximum amount of distance that you may shift without causing problems with the gear mesh. The V max is not a recommended value to use for adjustment when assembling.

AGDL Duplex Worm Wheels

[Caution on Product Characteristics]

(1) Duplex worms and worm wheels must be mated in a predetermined orientation, which is indicated by the arrows. Therefore, the arrow on the wheel does not indicate the mounting direction, but the rotating direction. See "Points of Caution in Assembling" on Page 400.

AGF Worm Wheels

[Caution on Product Characteristics]

(1) For H0 products with bore of ϕ 190 or larger, the bore tolerance is H8.

BG Worm Wheels

[Caution on Product Characteristics]

(1) The worm wheel is shifted to fit the mounting distance.

CG Worm Wheels

[Caution on Product Characteristics]

- (1) The worm wheel is shifted to fit the mounting distance.
- (2) H2 has a long cast hole in the web (H) section.

PG Worm Wheels

[Caution on Product Characteristics]

(1) The worm wheel is shifted to fit the mounting distance.



Application Hints



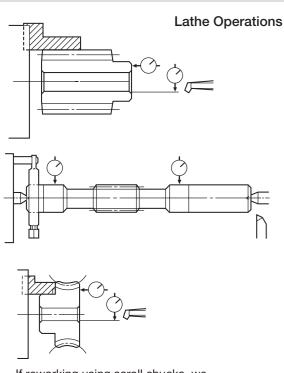
In order to use KHK stock worm gears safely, carefully read the Application Hints before proceeding. If there are questions or you require clarifications, please contact our technical department or your nearest distributor.

1. Cautions on Handling

- ① KHK products are packaged one by one to prevent scratches and dents, but if you find issues such as rust, scratches, or dents when the product is removed from the box after purchase, please contact the supplier.
- 2 Depending on the handling method, the product may become deformed or damaged. Resin gears and ring gears deform particularly easily, so please handle with care.

2. Caution on Performing Secondary Operations

① Gears are machined based on the ground section of the hole or shaft. If machining, it is important to pay special attention to locating the center in order to avoid runout. (Fig.1) If it is too difficult to do for small bores, the alternative is to use one spot on the bore and the runout of the hub end surface.



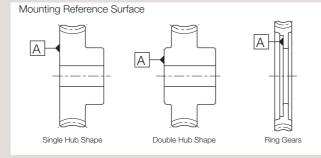
If reworking using scroll chucks, we recommend the use of new or rebored jaws for improved precision.

Fig. 1

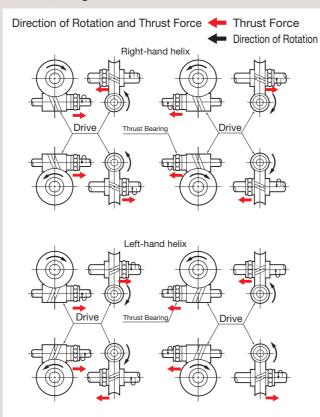
- 2 If enlarging the bore diameter, the wall strength of the hub must be higher than that of the gear teeth. The maximum bore size should be 60% to 70% of the hub diameter (or tooth root diameter), and 50% to 60% for keyway applied modifications. Also, because the cast FC200 hub is weaker and more brittle than other steels, we recommend using a maximum bore diameter about 10% smaller.
- 3 As the worm wheel is casted, bubbles may form inside the material. If the air bubbles found in secondary operations are problematic, contact the supplier.

3. Points of Caution during Assembly

- 1) The recommended center distance tolerance of KHK stock worm gears is H7 for ground gears and H8 for cut gears. The amount of backlash is given in the product table for each gear.
- 2 The mounting reference surface of the worm wheel is as shown in the figure below. Assemble the worm wheel so that the center of the worm shaft is at the center of its tooth width.



③ As the tooth trace of worm gears is spiraled, axial thrust force is generated. Also, the directions of thrust change with the hand of helix and the direction of rotation. This is illustrated below. The bearings must be selected properly to be able to handle these thrust forces. For details, use gear calculation software GCSW.

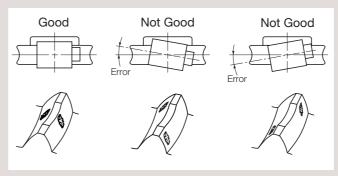


4 The worm may move due to a large thrust force that acts on the worm if it is not sufficiently attached to the shaft. Use a stepped shaft to secure the worm and shaft, and be careful not to loosen the bearing.

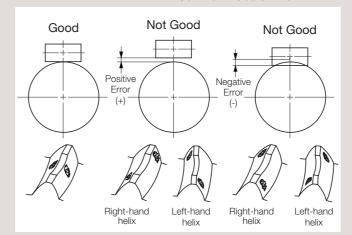
4. Confirming the installation

The wear of a worm gear is greatly affected by the quality of assembly. When assembling, confirm the following items for tooth contact and the like before use.

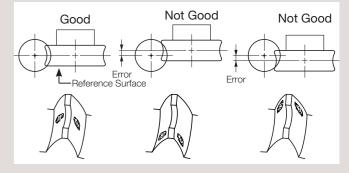
The shaft angle tolerance between the worm shaft and worm wheel shaft is 90°±1'.



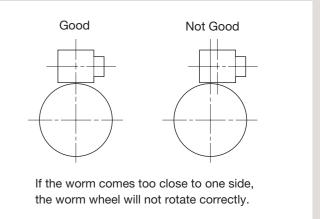
■ The center distance tolerance recommended by the worm gear assembly distance is Ground Worm Gears...H7 Cut Worm Gears...H8.



• The tolerance between the center of the worm shaft and center of the worm wheel tooth width is ±0.2 mm.



■ The tolerance between the center of the worm wheel shaft and center of the worm tooth width is ±2mm.



5. Cautions on Starting

- 1) Check the following items before starting.
- Are the gears installed securely?
- Is there uneven tooth contact?
- Is there adequate backlash? (Be sure to avoid zero-backlash.)
- Has proper lubrication been supplied?
- 2 If gears are exposed, be sure to attach a safety cover to ensure safety. Also, be careful not to touch rotating

③ If there is any abnormality such as noise or vibration during startup, stop the operation immediately and check the assembly condition such as tooth contact, eccentricity and looseness

KHK considers safety a priority in the use of our products.

When handling, adding secondary operations, assembling, and operating KHK products, please be aware of the following issues in order to prevent accidents.



Warning: Precautions for preventing physical and property damage

- When using KHK products, follow relevant safety regulations (Occupational Safety and Health Regulations, etc.).
- 2. Pay attention to the following items when installing, removing, or performing maintenance and inspection of the product. Turn off the power switch.
- 2 Do not reach or crawl under the product.
- 3 Wear appropriate clothing and protective equipment for the work.



Caution: Cautions in Preventing Accidents

- . Before using a KHK product, read the precautions in the catalog carefully in order to use it correctly.
- Avoid use in environments that may adversely affect the product.
- 3. Our products are manufactured under a superior quality control system based on the ISO9000 quality management system; if you notice any malfunctions upon purchasing a product, please contact the supplier