2 Helical Gears

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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.

(Example)
Helical Gears

K HG 1 - 20 R

- R: Direction of Helix (R)
- 20: No. of Teeth (20)
- 1: Module (1)
- HG: Type (Ground Helical Gear)
- K: Material (SCM440)

Material		Type	
S	S45C	H	Helical Gears
K	SCM440	HG	Ground Helical Gear

Helical Gears

Meets all high-speed rotation needs of industrial machines!

Characteristics

KHK stock helical gears are quiet, compact and economical. They are suitable wherever you require high-speed rotation including in machine tools, speed reducers and other industrial machinery.

■ KHG Ground Helical Gears

① Have excellent strength and wear resistance which allow your designs to be more compact.
② Secondary operations are possible permitting modifications to suit your design.
③ Use of a transverse module allows interchangeability with straight spur gears of the same module and numbers of teeth at the same center distance. This feature is very convenient when switching from spur gears to helical gears due to the gear strength or the noise considerations.
④ The use of CBN grinding wheels produces consistent precision with shorter grinding time, making these products easily affordable.

■ SH Helical Gears

① SH helical gears fit a wide range of applications which have made them popular choices for many years.
② Since helical gears have larger contact ratios than the equivalent SS spur gears, they are effective in reducing noise and vibration.

Selection Hints

It is important to thoroughly understand the contents of the product tables as well as “CAUTION” notes before making the selection. You must specify the right or left hand by including the letter R or L in the catalog number when ordering.

1. Caution in Selecting the Mating Gears.

Right hand and left hand helical gears mate as a set. See the photograph for reference. The table shows the possible combinations.

■ Mating Helical Gear Selection Chart (○ Allowable × Not allowable)

Catalog No. & Helix Hand		KHG		SH		KRHG(F)		SRH	
		RH	LH	RH	LH	RH	LH	RH	LH
KHG	RH	×	○	×	×	×	○	×	×
	LH	○	×	×	×	○	×	×	×
SH	RH	×	×	×	○	×	×	×	○
	LH	×	×	○	×	×	×	○	×

(L) Left

(R) Right

Pinion (L) & Rack (R)

Pinion (R) & Rack (L)

2. Caution in Selecting Gears Based on Gear Strength

Allowable bending strength and surface durability values shown in product tables were computed by assuming a certain application environment. They should be used as reference only. We recommend that each user computes his own values by applying the actual usage conditions.

■ Calculation of Bending Strength of Gears

Item \ Catalog No.	KHG	SH
Formula NOTE 1	Formula of spur and helical gears on bending strength (JGMA401-01)	
No. of teeth of mating gears	Same number of teeth	
Rotation	600min^{-1}	100min^{-1}
Durability	Over 10^7 cycles	
Impact from motor	Uniform load	
Impact from load	Uniform load	
Direction of load	Bidirectional	
Allowable bending stress at root σFlim NOTE 2	20kgf/mm^2	12.67kgf/mm^2
Safety factor S_F	1.2	

■ Calculation of Surface Durability (Except where it is common with bending strength)

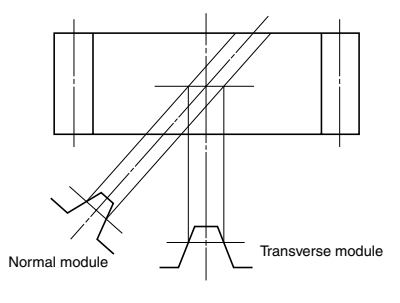
Formula NOTE 1	Formula of spur and helical gears on bending strength (JGMA402-01)	
Kinematic viscosity of lubricant	100cSt(50℃)	
Gear support	Symmetric support by bearings	
Allowable Hertz stress σHlim	116kgf/mm^2	49kgf/mm^2
Safety factor S_H	1.15	

NOTE 1: The formula for gear strength is based on JGMA Standard. The units for the rotational speed (min^{-1}) and the load (kgf/mm^2) were matched to the units needed in the equation.

NOTE 2: Since the load is bidirectional, the allowable bending stress at root σ Flim is set to 2/3 of the value.

3. Caution with Regard to the Special Characteristics of Helical Gears

① KHG ground helical gears and SH helical gears are not interchangeable due to different module systems, pressure angle designations and helix angles. The illustration below shows the difference between the transverse module of KHG type and the normal module of SH type gears.



CAUTION: Above is for illustration purpose only and not a representation of the true tooth forms.

② Since SH helical gears use the normal module, the pitch circle diameters and the center distance are not integral numbers. Please refer to the Table of SH Helical Gear Center Distance on the product pages.

4. Other Points to Consider in Selection Process

① There are various footnotes to the product pages under the headings of “CAUTION” and “NOTE”. Please consider them carefully when selecting these products.

② There may be slight differences in color or shape of products shown in the photograph from the actual products.

③ KHK reserves the right to make changes in specifications and dimensions without notice.

④ KHK is ready to produce and supply custom order products. When you require specific gears different from KHK Stock Gears please contact our distributor for quotation. Also, please refer to page 16 “KHK Custom Order Products”.

Definition of bending strength

The allowable bending strength of a gear is defined as the allowable tangential force at the pitch circle based on the mutually allowable root stress of two meshing gears under load.

Example of the failure due to insufficient bending strength.

Definition of surface durability

The surface durability of a gear is defined as the allowable tangential force at the pitch circle, which permits the force to be transmitted safely without incurring surface failure.

Example of the defacement due to insufficient surface durability.

Application Hints

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

KHK CO., LTD. TECHNICAL DEPARTMENT
PHONE: 81-48-254-1744 FAX: 81-48-254-1765
E-mail export@khkgears.co.jp

1. Caution on Performing Secondary Operations

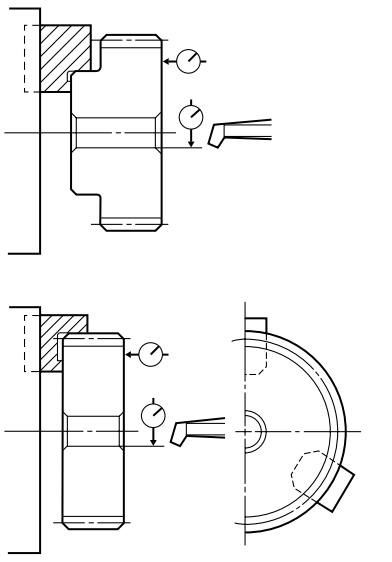
Most KHK gears can be modified by the user. Please note the following points.

① If you are reboring, it is important to pay special attention to locating the center in order to avoid runout.

② The reference datum for gear cutting is the bore. Therefore, use the bore for locating the center. 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 side surface.

③ If the rework requires using scroll chucks, we recommend the use of new or rebored jaws for improved precision. If chucking by the teeth, please apply the pressure carefully to avoid crushing the teeth which will lead to noisy gears.

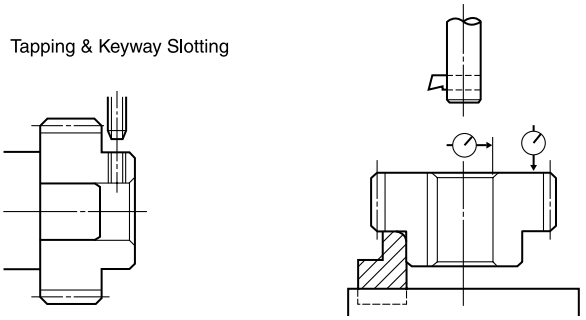
Lathe Operations



④ The maximum bore size is dictated by the requirement that the strength of the hub must be higher than that of the gear teeth.

⑤ In order to avoid stress concentrations, leave radii on the keyway corners.

Tapping & Keyway Slotting



⑥ To avoid problems of reduced gear precision and other manufacturing difficulties, do not attempt to machine the gears to reduce face widths.

⑦ KHG Ground Helical Gears are already stress relieved. But if you subject them to a heavy turning operation such as removing the hubs, the residual stress may cause deformation.

⑧ When heat-treating SH Helical Gears, it is possible to get thermal stress cracks. It is best to subject them to penetrant inspection afterwards. If the tooth strength is not sufficient, it can be increased approximately four times by heat-treating. On the other hand, the precision of the gear will drop about one grade.

Heat Treatment

1) Induction Heat treatment of S45C products should conform with the reference data below.
   - ●Heat treatment temperature - 800~900°C
   - ●Tempering temperature - 200~250°C
   - ●Hardness - 48~53HRC

2) In general, gears made from S45C have not been heat-treated. The user can heat-treat as required, but some deformation will be introduced. Ordinarily, a grinding process is needed after heat-treatment. Otherwise, the precision grade will drop about one grade.

3) SUS303 and SUS304 belong to austenite family and cannot be hardened. To harden stainless, there are martensitic series, such as SUS420J2.

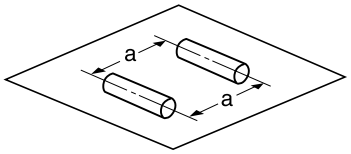
4) The induction hardened depth is approximately 1mm. However, the hardening process does not completely reach the root of the gear tooth at the center portion of the face width.

2. Points of Caution in Assembling

① KHK stock helical gears are designed to give the proper backlash when assembled using the center distance given by the formula on the right (center distance tolerance of H7~H8). The amount of backlash is given in the product table for each gear.

② Because of the helix of the gear teeth, helical gears in mesh produce thrust forces in the axial directions. The axial thrust bearings must be able to resist these forces. The direction of the thrust forces depend on the helix hand and the direction of rotation as shown below

③ Please refer to overall length tolerance for Helical Gears on page 30.

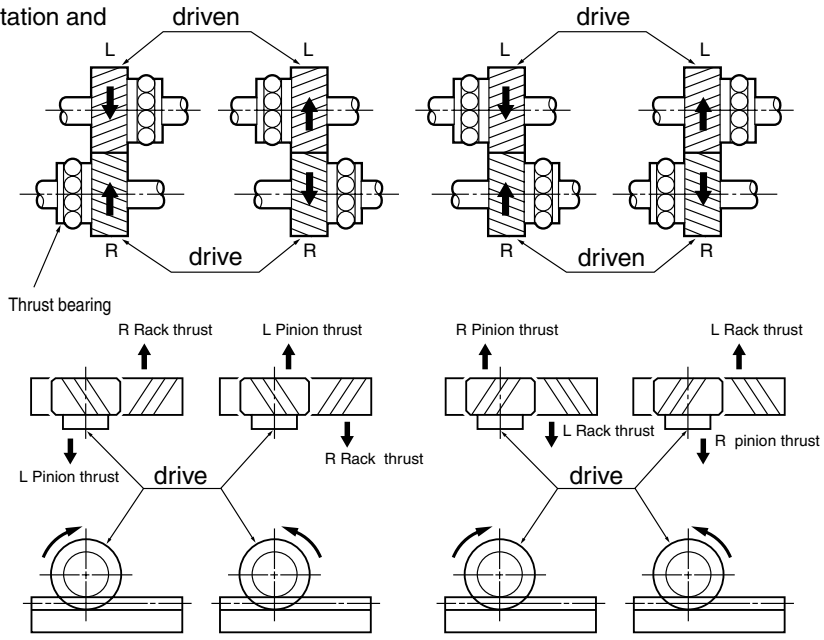


CAUTION:
The center distance of SH series is given in a separate table.

$$a = \frac{d_1 + d_2}{2}$$

where
a = center distance
d_1 = pitch diameter of pinion
d_2 = pitch diameter of gear

Direction of rotation and thrust force



3. Notes on Starting Operations

① Before operating, check the following:

- Are the gears firmly mounted on the shafts?
- Have you eliminated uneven tooth contact?
- Does the gear mesh have the proper amount of backlash? (Please avoid the condition of no backlash.)
- Is there sufficient lubrication?

② If the gears are exposed, install a safety cover for protection. Never touch gears while they are in motion.

③ If there is unusual noise or vibration at the start up or insufficient lubrication after the start up, please recheck the gears and correctness of the assembly. Some of the methods for achieving noise reduction are:

(a) High Precision
(b) Fine Tooth Surface Finish
(c) Accurate Tooth Contact

④ The followings are the gear lubrication methods in general use:

(a) Grease Lubrication
(b) Splash Lubrication (Oil Bath Method)
(c) Forced Oil Circulation Lubrication

Check lubrication after start up. Sometimes, when the unit is initially being operated, lubricating oil deteriorates rapidly.

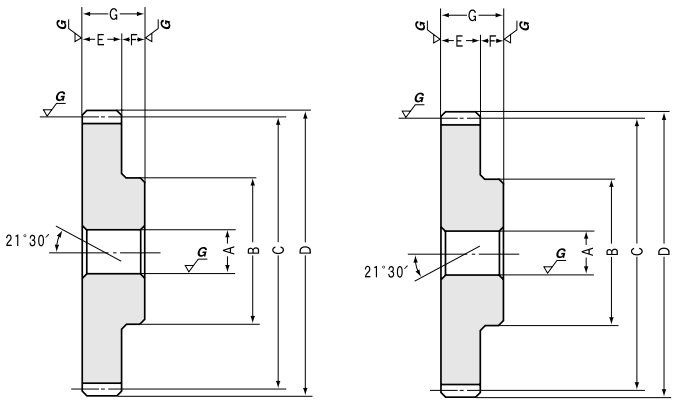
4. Other Points to Consider in Applications

① KHK products are individually packaged to avoid damage. Depending on how they are handled, it is still possible to deform or break them. It is important to exercise care in handling these parts.

② Check the products as they are being taken out of the boxes. If any of them are rusted, scratched or dented, please return to the dealer where they were bought, for exchange.

③ KHK cannot guarantee the precision of gears once the customer performs a secondary operation on them.

KHG Ground Helical Gears Transverse Module 1



RH S1 Shape LH

■ Module 1

Catalog No.	Direction of Helix	Module	No. of teeth	Bore	Hub dia.	Pitch dia.	Outside dia.	Face width NOTE 1	Hub width	Total length
		m	z	A_{H7}	B	C	D	E	F	G
KHG1- 20R	R	1	20	6	17	20	22	8	10	18
KHG1- 20L	L									
KHG1- 22R	R	1	22	8	18	22	24	8	10	18
KHG1- 22L	L									
KHG1- 24R	R	1	24	8	20	24	26	8	10	18
KHG1- 24L	L									
KHG1- 25R	R	1	25	8	20	25	27	8	10	18
KHG1- 25L	L									
KHG1- 28R	R	1	28	8	20	28	30	8	10	18
KHG1- 28L	L									
KHG1- 30R	R	1	30	10	25	30	32	8	10	18
KHG1- 30L	L									
KHG1- 32R	R	1	32	10	25	32	34	8	10	18
KHG1- 32L	L									
KHG1- 35R	R	1	35	10	25	35	37	8	10	18
KHG1- 35L	L									
KHG1- 36R	R	1	36	10	25	36	38	8	10	18
KHG1- 36L	L									
KHG1- 40R	R	1	40	10	30	40	42	8	10	18
KHG1- 40L	L									
KHG1- 44R	R	1	44	10	30	44	46	8	10	18
KHG1- 44L	L									
KHG1- 45R	R	1	45	10	30	45	47	8	10	18
KHG1- 45L	L									
KHG1- 48R	R	1	48	10	30	48	50	8	10	18
KHG1- 48L	L									
KHG1- 50R	R	1	50	12	35	50	52	8	10	18
KHG1- 50L	L									
KHG1- 60R	R	1	60	12	40	60	62	8	10	18
KHG1- 60L	L									
KHG1- 70R	R	1	70	12	40	70	72	8	10	18
KHG1- 70L	L									
KHG1- 80R	R	1	80	15	50	80	82	8	10	18
KHG1- 80L	L									
KHG1- 90R	R	1	90	15	50	90	92	8	10	18
KHG1- 90L	L									
KHG1-100R	R	1	100	15	50	100	102	8	10	18
KHG1-100L	L									

CAUTION: Right handed and left handed helical gears of the same module are designed to mesh as a pair, but they are not interchangeable with SH type helical gears.

NOTE 1: It is possible to perform secondary operations except on the gear teeth. We recommend that you avoid shortening the hub which will lead to the deformation of the gears.

Specifications

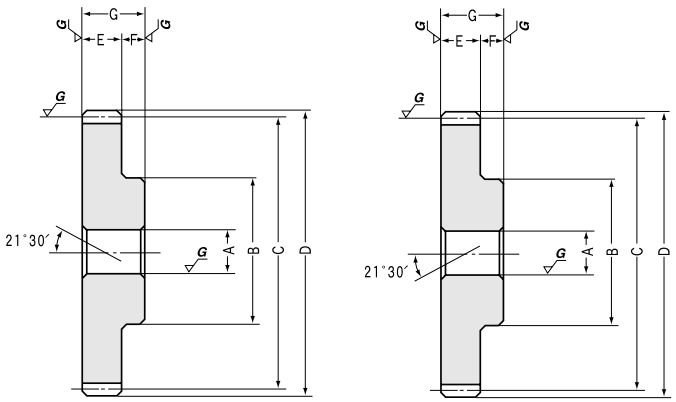
Precision grade	JIS N6 grade (JIS B1702-1: 1998) OLD JIS 2 grade (JIS B1702: 1976)	Heat treatment	Thermal refined, tooth surfaces induction hardened
Reference section of gear	Rotating plane	Tooth hardness	50～55HRC
Gear teeth	Standard full depth	Surface treatment	Black oxide except ground surfaces
Transverse pressure angle	20°	Tooth surface finish	Ground
Helix angle	21°30′	Datum reference surface for gear grinding	Bore
Material	SCM440	Secondary Operations	Possible except tooth area

Shape	Allowable torque (N·m) NOTE 2		Allowable torque (kgf·m)		Backlash (mm) NOTE 3	Weight (kgf)	Catalog No.
	Bending strength	Surface durability	Bending strength	Surface durability			
S1	7.785	4.978	(0.7939)	(0.5076)	0.08 ～ 0.16	0.03	KHG1- 20R KHG1- 20L
S1	8.92	6.139	(0.9096)	(0.626)	0.08 ～ 0.16	0.04	KHG1- 22R KHG1- 22L
S1	10.07	7.429	(1.027)	(0.7576)	0.08 ～ 0.16	0.05	KHG1- 24R KHG1- 24L
S1	10.66	8.123	(1.087)	(0.8283)	0.08 ～ 0.16	0.05	KHG1- 25R KHG1- 25L
S1	12.42	10.39	(1.267)	(1.06)	0.08 ～ 0.16	0.06	KHG1- 28R KHG1- 28L
S1	13.62	12.08	(1.389)	(1.232)	0.08 ～ 0.16	0.07	KHG1- 30R KHG1- 30L
S1	13.47	12.63	(1.374)	(1.288)	0.08 ～ 0.16	0.08	KHG1- 32R KHG1- 32L
S1	15.13	15.36	(1.543)	(1.566)	0.08 ～ 0.16	0.09	KHG1- 35R KHG1- 35L
S1	15.68	16.34	(1.599)	(1.666)	0.08 ～ 0.16	0.09	KHG1- 36R KHG1- 36L
S1	17.93	20.54	(1.828)	(2.095)	0.08 ～ 0.16	0.12	KHG1- 40R KHG1- 40L
S1	20.18	25.26	(2.058)	(2.576)	0.08 ～ 0.16	0.14	KHG1- 44R KHG1- 44L
S1	20.74	26.53	(2.115)	(2.705)	0.08 ～ 0.16	0.14	KHG1- 45R KHG1- 45L
S1	22.46	30.51	(2.29)	(3.111)	0.08 ～ 0.16	0.16	KHG1- 48R KHG1- 48L
S1	23.59	33.32	(2.406)	(3.398)	0.08 ～ 0.16	0.18	KHG1- 50R KHG1- 50L
S1	29.34	49.4	(2.992)	(5.037)	0.1 ～ 0.18	0.26	KHG1- 60R KHG1- 60L
S1	35.15	68.85	(3.584)	(7.021)	0.1 ～ 0.18	0.32	KHG1- 70R KHG1- 70L
S1	40.99	91.78	(4.18)	(9.359)	0.1 ～ 0.18	0.44	KHG1- 80R KHG1- 80L
S1	46.86	118.3	(4.778)	(12.06)	0.1 ～ 0.18	0.53	KHG1- 90R KHG1- 90L
S1	50.44	141.9	(5.144)	(14.47)	0.1 ～ 0.18	0.62	KHG1-100R KHG1-100L

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 131 for more details.

NOTE 3: The backlash values shown in the table are the theoretical values of a pair of identical gears in mesh.

KHG Ground Helical Gears Transverse Module 1.5



RH S1 Shape LH

■ Module 1.5

Catalog No.	Direction of Helix	Module	No. of teeth	Bore	Hub dia.	Pitch dia.	Outside dia.	Face width NOTE 1	Hub width	Total length
		m	z	A_{H7}	B	C	D	E	F	G
KHG1.5- 20R	R	1.5	20	12	24	30	33	12	12	24
KHG1.5- 20L	L									
KHG1.5- 22R	R	1.5	22	12	26	33	36	12	12	24
KHG1.5- 22L	L									
KHG1.5- 24R	R	1.5	24	12	28	36	39	12	12	24
KHG1.5- 24L	L									
KHG1.5- 25R	R	1.5	25	12	30	37.5	40.5	12	12	24
KHG1.5- 25L	L									
KHG1.5- 26R	R	1.5	26	12	32	39	42	12	12	24
KHG1.5- 26L	L									
KHG1.5- 28R	R	1.5	28	15	36	42	45	12	12	24
KHG1.5- 28L	L									
KHG1.5- 30R	R	1.5	30	15	38	45	48	12	12	24
KHG1.5- 30L	L									
KHG1.5- 32R	R	1.5	32	15	40	48	51	12	12	24
KHG1.5- 32L	L									
KHG1.5- 35R	R	1.5	35	15	42	52.5	55.5	12	12	24
KHG1.5- 35L	L									
KHG1.5- 36R	R	1.5	36	15	45	54	57	12	12	24
KHG1.5- 36L	L									
KHG1.5- 40R	R	1.5	40	15	50	60	63	12	12	24
KHG1.5- 40L	L									
KHG1.5- 44R	R	1.5	44	15	50	66	69	12	12	24
KHG1.5- 44L	L									
KHG1.5- 45R	R	1.5	45	18	50	67.5	70.5	12	12	24
KHG1.5- 45L	L									
KHG1.5- 48R	R	1.5	48	18	50	72	75	12	12	24
KHG1.5- 48L	L									
KHG1.5- 50R	R	1.5	50	18	60	75	78	12	12	24
KHG1.5- 50L	L									
KHG1.5- 52R	R	1.5	52	18	60	78	81	12	12	24
KHG1.5- 52L	L									
KHG1.5- 60R	R	1.5	60	20	60	90	93	12	12	24
KHG1.5- 60L	L									
KHG1.5- 70R	R	1.5	70	20	60	105	108	12	12	24
KHG1.5- 70L	L									
KHG1.5- 80R	R	1.5	80	20	70	120	123	12	12	24
KHG1.5- 80L	L									
KHG1.5- 90R	R	1.5	90	20	70	135	138	12	12	24
KHG1.5- 90L	L									
KHG1.5-100R	R	1.5	100	20	70	150	153	12	12	24
KHG1.5-100L	L									

CAUTION: Right handed and left handed helical gears in the same module are designed to mesh as a pair, but they are not interchangeable with SH type helical gears.
NOTE 1: It is possible to perform secondary operations except on the gear teeth. We recommend that you avoid shortening the hub which will lead to the deformation of the gears.

Specifications

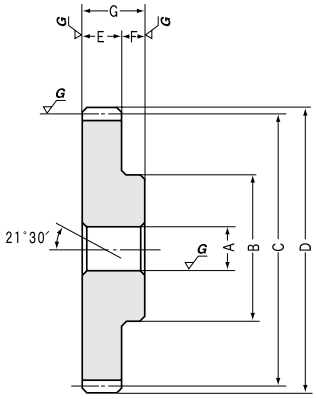
Precision grade	JIS N6 grade (JIS B1702-1: 1998) OLD JIS 2 grade (JIS B1702: 1976)	Heat treatment	Thermal refined, tooth surfaces induction hardened
Reference section of gear	Rotating plane	Tooth hardness	50～55HRC
Gear teeth	Standard full depth	Surface treatment	Black oxide except ground surfaces
Transverse pressure angle	20°	Tooth surface finish	Ground
Helix angle	21°30′	Datum reference surface for gear grinding	Bore
Material	SCM440	Secondary Operations	Possible except tooth area

Shape	Allowable torque (N·m) NOTE 2		Allowable torque (kgf·m)		Backlash (mm) NOTE 3	Weight (kgf)	Catalog No.
	Bending strength	Surface durability	Bending strength	Surface durability			
S1	26.27	18.53	(2.679)	(1.89)	0.08 ～ 0.16	0.09	KHG1.5- 20R KHG1.5- 20L
S1	27.37	20.83	(2.791)	(2.124)	0.08 ～ 0.16	0.11	KHG1.5- 22R KHG1.5- 22L
S1	30.9	25.3	(3.151)	(2.58)	0.08 ～ 0.16	0.13	KHG1.5- 24R KHG1.5- 24L
S1	32.7	27.71	(3.334)	(2.826)	0.08 ～ 0.16	0.15	KHG1.5- 25R KHG1.5- 25L
S1	34.49	30.24	(3.517)	(3.084)	0.08 ～ 0.16	0.17	KHG1.5- 26R KHG1.5- 26L
S1	38.12	35.67	(3.887)	(3.637)	0.08 ～ 0.16	0.19	KHG1.5- 28R KHG1.5- 28L
S1	41.78	41.57	(4.26)	(4.239)	0.08 ～ 0.16	0.22	KHG1.5- 30R KHG1.5- 30L
S1	45.47	47.96	(4.637)	(4.891)	0.08 ～ 0.16	0.26	KHG1.5- 32R KHG1.5- 32L
S1	51.06	58.47	(5.207)	(5.962)	0.1 ～ 0.18	0.3	KHG1.5- 35R KHG1.5- 35L
S1	52.94	62.22	(5.398)	(6.345)	0.1 ～ 0.18	0.33	KHG1.5- 36R KHG1.5- 36L
S1	60.49	78.49	(6.168)	(8.004)	0.1 ～ 0.18	0.42	KHG1.5- 40R KHG1.5- 40L
S1	68.11	96.79	(6.945)	(9.87)	0.1 ～ 0.18	0.47	KHG1.5- 44R KHG1.5- 44L
S1	70.02	101.7	(7.14)	(10.37)	0.1 ～ 0.18	0.47	KHG1.5- 45R KHG1.5- 45L
S1	75.78	117.2	(7.727)	(11.95)	0.1 ～ 0.18	0.52	KHG1.5- 48R KHG1.5- 48L
S1	79.63	128.2	(8.12)	(13.07)	0.1 ～ 0.18	0.63	KHG1.5- 50R KHG1.5- 50L
S1	83.49	139.6	(8.514)	(14.24)	0.1 ～ 0.18	0.67	KHG1.5- 52R KHG1.5- 52L
S1	99.05	191	(10.1)	(19.48)	0.1 ～ 0.18	0.81	KHG1.5- 60R KHG1.5- 60L
S1	113.5	256	(11.57)	(26.1)	0.12 ～ 0.2	1	KHG1.5- 70R KHG1.5- 70L
S1	132.3	342.7	(13.49)	(34.95)	0.12 ～ 0.2	1.4	KHG1.5- 80R KHG1.5- 80L
S1	151.2	442.3	(15.42)	(45.1)	0.12 ～ 0.2	1.65	KHG1.5- 90R KHG1.5- 90L
S1	170.2	554.4	(17.36)	(56.53)	0.12 ～ 0.2	1.97	KHG1.5-100R KHG1.5-100L

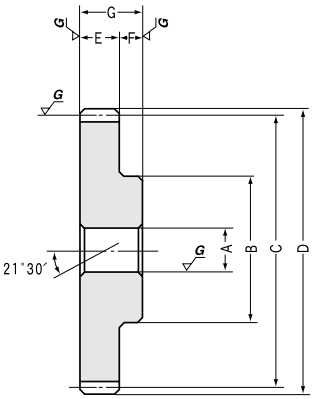
NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 131 for more details.

NOTE 3: The backlash values shown in the table are the theoretical values of a pair of identical gears in mesh.

KHG Ground Helical Gears Transverse Module 2



RH S1 Shape



LH

■ Module 2

Catalog No.	Direction of Helix	Module	No. of teeth	Bore	Hub dia.	Pitch dia.	Outside dia.	Face width NOTE 1	Hub width	Total length
		m	z	AH7	B	C	D	E	F	G
KHG2- 15R **KHG2- 15L**	R L	2	15	12	24	30	34	16	13	29
KHG2- 16R **KHG2- 16L**	R L	2	16	12	26	32	36	16	13	29
KHG2- 18R **KHG2- 18L**	R L	2	18	12	30	36	40	16	13	29
KHG2- 20R **KHG2- 20L**	R L	2	20	15	32	40	44	16	13	29
KHG2- 22R **KHG2- 22L**	R L	2	22	15	36	44	48	16	13	29
KHG2- 24R **KHG2- 24L**	R L	2	24	15	38	48	52	16	13	29
KHG2- 25R **KHG2- 25L**	R L	2	25	15	40	50	54	16	13	29
KHG2- 26R **KHG2- 26L**	R L	2	26	15	42	52	56	16	13	29
KHG2- 28R **KHG2- 28L**	R L	2	28	15	45	56	60	16	13	29
KHG2- 30R **KHG2- 30L**	R L	2	30	18	50	60	64	16	13	29
KHG2- 32R **KHG2- 32L**	R L	2	32	18	50	64	68	16	13	29
KHG2- 35R **KHG2- 35L**	R L	2	35	18	50	70	74	16	13	29
KHG2- 36R **KHG2- 36L**	R L	2	36	18	50	72	76	16	13	29
KHG2- 40R **KHG2- 40L**	R L	2	40	20	60	80	84	16	13	29
KHG2- 44R **KHG2- 44L**	R L	2	44	20	60	88	92	16	13	29
KHG2- 45R **KHG2- 45L**	R L	2	45	20	60	90	94	16	13	29
KHG2- 48R **KHG2- 48L**	R L	2	48	20	60	96	100	16	13	29
KHG2- 50R **KHG2- 50L**	R L	2	50	25	60	100	104	16	13	29
KHG2- 52R **KHG2- 52L**	R L	2	52	25	65	104	108	16	13	29
KHG2- 60R **KHG2- 60L**	R L	2	60	25	65	120	124	16	13	29
KHG2- 70R **KHG2- 70L**	R L	2	70	25	70	140	144	16	13	29
KHG2- 80R **KHG2- 80L**	R L	2	80	25	80	160	164	16	13	29
KHG2- 90R **KHG2- 90L**	R L	2	90	25	90	180	184	16	13	29
KHG2-100R **KHG2-100L**	R L	2	100	25	100	200	204	16	13	29

CAUTION: Right handed and left handed helical gears in the same module are designed to mesh as a pair, but they are not interchangeable with SH type helical gears.
NOTE 1: It is possible to perform secondary operations except on the gear teeth. We recommend that you avoid shortening the hub which will lead to the deformation of the gears.

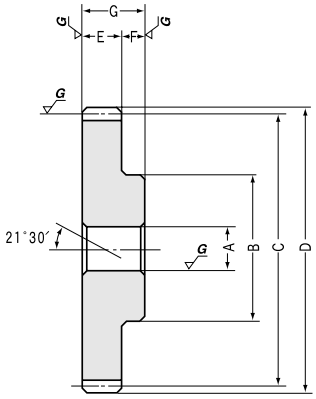
Specifications

Precision grade	JIS N6 grade (JIS B1702-1: 1998) OLD JIS 2 grade (JIS B1702: 1976)	Heat treatment	Thermal refined, tooth surfaces induction hardened
Reference section of gear	Rotating plane	Tooth hardness	50～55HRC
Gear teeth	Standard full depth	Surface treatment	Black oxide except ground surfaces
Transverse pressure angle	20°	Tooth surface finish	Ground
Helix angle	21°30′	Datum reference surface for gear grinding	Bore
Material	SCM440	Secondary Operations	Possible except tooth area

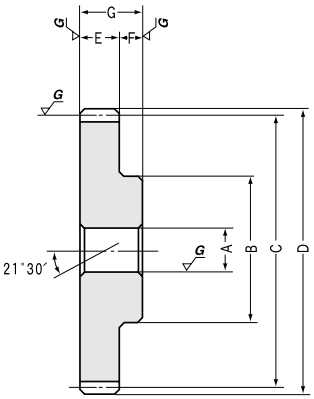
Shape	Allowable torque (N·m) NOTE 2		Allowable torque (kgf·m)		Backlash (mm) NOTE 3	Weight (kgf)	Catalog No.
	Bending strength	Surface durability	Bending strength	Surface durability			
S1	40.45	22.75	(4.125)	(2.32)	0.1 ～ 0.2	0.11	KHG2- 15R KHG2- 15L
S1	40.63	24.09	(4.143)	(2.457)	0.1 ～ 0.2	0.13	KHG2- 16R KHG2- 16L
S1	48.53	31.86	(4.949)	(3.249)	0.1 ～ 0.2	0.17	KHG2- 18R KHG2- 18L
S1	56.62	40.83	(5.774)	(4.164)	0.1 ～ 0.2	0.2	KHG2- 20R KHG2- 20L
S1	64.87	50.56	(6.615)	(5.156)	0.1 ～ 0.2	0.25	KHG2- 22R KHG2- 22L
S1	73.25	61.43	(7.47)	(6.264)	0.1 ～ 0.2	0.3	KHG2- 24R KHG2- 24L
S1	77.49	67.29	(7.902)	(6.862)	0.1 ～ 0.2	0.33	KHG2- 25R KHG2- 25L
S1	81.76	73.44	(8.337)	(7.489)	0.12 ～ 0.22	0.37	KHG2- 26R KHG2- 26L
S1	90.35	86.62	(9.213)	(8.833)	0.12 ～ 0.22	0.43	KHG2- 28R KHG2- 28L
S1	99.05	101	(10.1)	(10.3)	0.12 ～ 0.22	0.5	KHG2- 30R KHG2- 30L
S1	107.8	116.5	(10.99)	(11.88)	0.12 ～ 0.22	0.55	KHG2- 32R KHG2- 32L
S1	121	142.2	(12.34)	(14.5)	0.12 ～ 0.22	0.63	KHG2- 35R KHG2- 35L
S1	125.5	151.3	(12.8)	(15.43)	0.12 ～ 0.22	0.65	KHG2- 36R KHG2- 36L
S1	143.4	191	(14.62)	(19.48)	0.12 ～ 0.22	0.85	KHG2- 40R KHG2- 40L
S1	161.4	235.7	(16.46)	(24.04)	0.12 ～ 0.22	0.98	KHG2- 44R KHG2- 44L
S1	165.9	247.7	(16.92)	(25.26)	0.12 ～ 0.22	1	KHG2- 45R KHG2- 45L
S1	171.8	273.2	(17.52)	(27.86)	0.12 ～ 0.22	1.1	KHG2- 48R KHG2- 48L
S1	180.5	298.9	(18.41)	(30.48)	0.12 ～ 0.22	1.2	KHG2- 50R KHG2- 50L
S1	189.3	326	(19.3)	(33.24)	0.14 ～ 0.24	1.29	KHG2- 52R KHG2- 52L
S1	224.6	446.7	(22.9)	(45.55)	0.14 ～ 0.24	1.6	KHG2- 60R KHG2- 60L
S1	269	624.8	(27.43)	(63.71)	0.14 ～ 0.24	2.2	KHG2- 70R KHG2- 70L
S1	300.6	798.6	(30.65)	(81.44)	0.14 ～ 0.24	2.9	KHG2- 80R KHG2- 80L
S1	343.6	1030	(35.04)	(105)	0.14 ～ 0.24	3.37	KHG2- 90R KHG2- 90L
S1	386.7	1290	(39.43)	(131.5)	0.14 ～ 0.24	4.63	KHG2-100R KHG2-100L

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 131 for more details.
NOTE 3: The backlash values shown in the table are the theoretical values of a pair of identical gears in mesh.

KHG Ground Helical Gears Transverse Module 2.5



RH S1 Shape



LH

■ Module 2.5

Catalog No.	Direction of Helix	Module	No. of teeth	Bore	Hub dia.	Pitch dia.	Outside dia.	Face width NOTE 1	Hub width	Total length
		m	z	A_{H7}	B	C	D	E	F	G
KHG2.5-15R **KHG2.5-15L**	R L	2.5	15	15	30	37.5	42.5	20	14	34
KHG2.5-16R **KHG2.5-16L**	R L	2.5	16	15	32	40	45	20	14	34
KHG2.5-18R **KHG2.5-18L**	R L	2.5	18	15	38	45	50	20	14	34
KHG2.5-20R **KHG2.5-20L**	R L	2.5	20	18	40	50	55	20	14	34
KHG2.5-22R **KHG2.5-22L**	R L	2.5	22	18	44	55	60	20	14	34
KHG2.5-24R **KHG2.5-24L**	R L	2.5	24	18	48	60	65	20	14	34
KHG2.5-25R **KHG2.5-25L**	R L	2.5	25	20	50	62.5	67.5	20	14	34
KHG2.5-26R **KHG2.5-26L**	R L	2.5	26	20	50	65	70	20	14	34
KHG2.5-28R **KHG2.5-28L**	R L	2.5	28	20	60	70	75	20	14	34
KHG2.5-30R **KHG2.5-30L**	R L	2.5	30	20	65	75	80	20	14	34
KHG2.5-32R **KHG2.5-32L**	R L	2.5	32	20	70	80	85	20	14	34
KHG2.5-35R **KHG2.5-35L**	R L	2.5	35	20	70	87.5	92.5	20	14	34
KHG2.5-36R **KHG2.5-36L**	R L	2.5	36	20	70	90	95	20	14	34
KHG2.5-40R **KHG2.5-40L**	R L	2.5	40	25	70	100	105	20	14	34
KHG2.5-44R **KHG2.5-44L**	R L	2.5	44	25	75	110	115	20	14	34
KHG2.5-45R **KHG2.5-45L**	R L	2.5	45	25	75	112.5	117.5	20	14	34
KHG2.5-48R **KHG2.5-48L**	R L	2.5	48	25	75	120	125	20	14	34
KHG2.5-50R **KHG2.5-50L**	R L	2.5	50	25	80	125	130	20	14	34
KHG2.5-52R **KHG2.5-52L**	R L	2.5	52	25	80	130	135	20	14	34
KHG2.5-60R **KHG2.5-60L**	R L	2.5	60	25	80	150	155	20	14	34

CAUTION: Right handed and left handed helical gears in the same module are designed to mesh as a pair, but they are not interchangeable with SH type helical gears.
NOTE 1: It is possible to perform secondary operations except on the gear teeth. We recommend that you avoid shortening the hub which will lead to the deformation of the gears.

Specifications

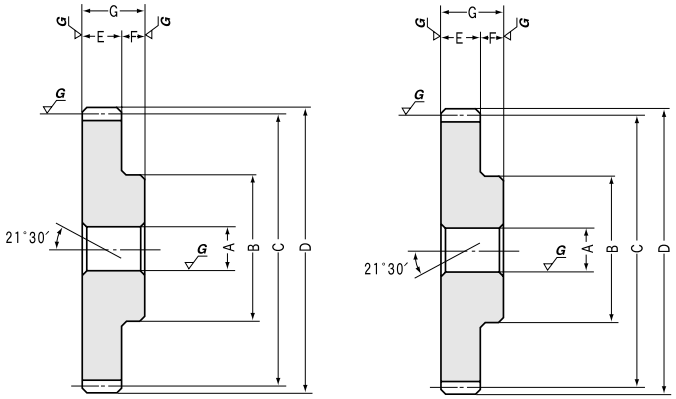
Precision grade	JIS N6 grade (JIS B1702-1: 1998) OLD JIS 2 grade (JIS B1702: 1976)	Heat treatment	Thermal refined, tooth surfaces induction hardened
Reference section of gear	Rotating plane	Tooth hardness	50～55HRC
Gear teeth	Standard full depth	Surface treatment	Black oxide except ground surfaces
Transverse pressure angle	20°	Tooth surface finish	Ground
Helix angle	21°30′	Datum reference surface for gear grinding	Bore
Material	SCM440	Secondary Operations	Possible except tooth area

Shape	Allowable torque (N·m) NOTE 2		Allowable torque (kgf·m)		Backlash (mm) NOTE 3	Weight (kgf)	Catalog No.
	Bending strength	Surface durability	Bending strength	Surface durability			
S1	71.82	41.09	(7.324)	(4.19)	0.1 ～ 0.2	0.21	KHG2.5-15R KHG2.5-15L
S1	79.36	47.93	(8.093)	(4.888)	0.1 ～ 0.2	0.25	KHG2.5-16R KHG2.5-16L
S1	94.78	63.4	(9.665)	(6.465)	0.1 ～ 0.2	0.34	KHG2.5-18R KHG2.5-18L
S1	110.6	81.25	(11.28)	(8.285)	0.1 ～ 0.2	0.39	KHG2.5-20R KHG2.5-20L
S1	126.7	100.6	(12.92)	(10.26)	0.12 ～ 0.22	0.49	KHG2.5-22R KHG2.5-22L
S1	143.1	122.3	(14.59)	(12.47)	0.12 ～ 0.22	0.6	KHG2.5-24R KHG2.5-24L
S1	151.3	134	(15.43)	(13.66)	0.12 ～ 0.22	0.64	KHG2.5-25R KHG2.5-25L
S1	159.7	146.2	(16.28)	(14.91)	0.12 ～ 0.22	0.65	KHG2.5-26R KHG2.5-26L
S1	176.4	172.6	(17.99)	(17.6)	0.12 ～ 0.22	0.87	KHG2.5-28R KHG2.5-28L
S1	193.4	201.2	(19.72)	(20.52)	0.12 ～ 0.22	1	KHG2.5-30R KHG2.5-30L
S1	210.5	232.3	(21.47)	(23.69)	0.12 ～ 0.22	1.2	KHG2.5-32R KHG2.5-32L
S1	236.4	283.6	(24.11)	(28.92)	0.12 ～ 0.22	1.3	KHG2.5-35R KHG2.5-35L
S1	245.1	301.9	(24.99)	(30.79)	0.12 ～ 0.22	1.4	KHG2.5-36R KHG2.5-36L
S1	267.8	364.9	(27.31)	(37.21)	0.12 ～ 0.22	1.6	KHG2.5-40R KHG2.5-40L
S1	301.6	450.8	(30.75)	(45.97)	0.14 ～ 0.24	1.9	KHG2.5-44R KHG2.5-44L
S1	310.1	473.9	(31.62)	(48.32)	0.14 ～ 0.24	2	KHG2.5-45R KHG2.5-45L
S1	335.6	546.7	(34.22)	(55.75)	0.14 ～ 0.24	2.2	KHG2.5-48R KHG2.5-48L
S1	352.6	598.5	(35.96)	(61.03)	0.14 ～ 0.24	2.4	KHG2.5-50R KHG2.5-50L
S1	369.7	652.3	(37.7)	(66.52)	0.14 ～ 0.24	2.5	KHG2.5-52R KHG2.5-52L
S1	438.5	890.1	(44.72)	(90.77)	0.14 ～ 0.24	3.3	KHG2.5-60R KHG2.5-60L

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 131 for more details.

NOTE 3: The backlash values shown in the table are the theoretical values of a pair of identical gears in mesh.

KHG Ground Helical Gears Transverse Module 3



RH S1 Shape LH

■ Module 3

Catalog No.	Direction of Helix	Module	No. of teeth	Bore	Hub dia.	Pitch dia.	Outside dia.	Face width NOTE 1	Hub width	Total length
		m	z	A_{H7}	B	C	D	E	F	G
KHG3-15R **KHG3-15L**	R L	3	15	18	36	45	51	25	16	41
KHG3-16R **KHG3-16L**	R L	3	16	18	38	48	54	25	16	41
KHG3-18R **KHG3-18L**	R L	3	18	18	40	54	60	25	16	41
KHG3-20R **KHG3-20L**	R L	3	20	20	50	60	66	25	16	41
KHG3-22R **KHG3-22L**	R L	3	22	20	54	66	72	25	16	41
KHG3-24R **KHG3-24L**	R L	3	24	20	58	72	78	25	16	41
KHG3-25R **KHG3-25L**	R L	3	25	20	60	75	81	25	16	41
KHG3-26R **KHG3-26L**	R L	3	26	20	60	78	84	25	16	41
KHG3-28R **KHG3-28L**	R L	3	28	20	70	84	90	25	16	41
KHG3-30R **KHG3-30L**	R L	3	30	25	75	90	96	25	16	41
KHG3-32R **KHG3-32L**	R L	3	32	25	75	96	102	25	16	41
KHG3-35R **KHG3-35L**	R L	3	35	25	80	105	111	25	16	41
KHG3-36R **KHG3-36L**	R L	3	36	25	80	108	114	25	16	41
KHG3-40R **KHG3-40L**	R L	3	40	25	80	120	126	25	16	41
KHG3-44R **KHG3-44L**	R L	3	44	25	80	132	138	25	16	41
KHG3-45R **KHG3-45L**	R L	3	45	25	80	135	141	25	16	41
KHG3-48R **KHG3-48L**	R L	3	48	25	85	144	150	25	16	41
KHG3-50R **KHG3-50L**	R L	3	50	30	85	150	156	25	16	41
KHG3-52R **KHG3-52L**	R L	3	52	30	85	156	162	25	16	41
KHG3-60R **KHG3-60L**	R L	3	60	30	90	180	186	25	16	41

CAUTION: Right handed and left handed helical gears in the same module are designed to mesh as a pair, but they are not interchangeable with SH type helical gears.
NOTE 1: It is possible to perform secondary operations except on the gear teeth. We recommend that you avoid shortening the hub which will lead to the deformation of the gears.

Specifications

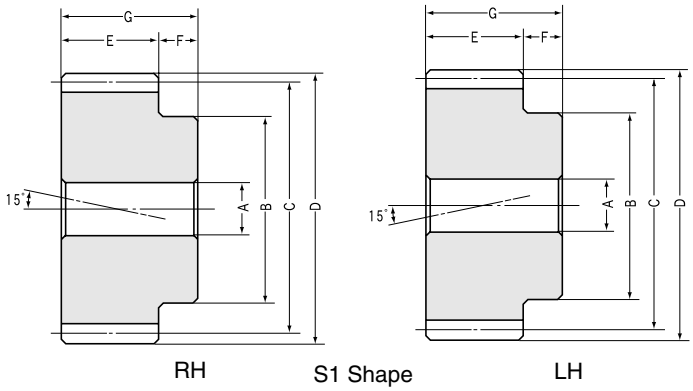
Precision grade	JIS N6 grade (JIS B1702-1: 1998) OLD JIS 2 grade (JIS B1702: 1976)	Heat treatment	Thermal refined, tooth surfaces induction hardened
Reference section of gear	Rotating plane	Tooth hardness	50～55HRC
Gear teeth	Standard full depth	Surface treatment	Black oxide except ground surfaces
Transverse pressure angle	20°	Tooth surface finish	Ground
Helix angle	21°30′	Datum reference surface for gear grinding	Bore
Material	SCM440	Secondary Operations	Possible except tooth area

Shape	Allowable torque (N·m) NOTE 2		Allowable torque (kgf·m)		Backlash (mm) NOTE 3	Weight (kgf)	Catalog No.
	Bending strength	Surface durability	Bending strength	Surface durability			
S1	129.3	74.69	(13.18)	(7.616)	0.1 ～ 0.2	0.36	KHG3-15R KHG3-15L
S1	142.9	87.16	(14.57)	(8.888)	0.1 ～ 0.2	0.42	KHG3-16R KHG3-16L
S1	170.6	115.3	(17.4)	(11.76)	0.12 ～ 0.22	0.53	KHG3-18R KHG3-18L
S1	199.1	148	(20.3)	(15.09)	0.12 ～ 0.22	0.7	KHG3-20R KHG3-20L
S1	228.1	184.1	(23.26)	(18.77)	0.12 ～ 0.22	0.86	KHG3-22R KHG3-22L
S1	257.5	223.8	(26.26)	(22.82)	0.12 ～ 0.22	1	KHG3-24R KHG3-24L
S1	272.4	245.2	(27.78)	(25)	0.12 ～ 0.22	1.1	KHG3-25R KHG3-25L
S1	287.4	267.7	(29.31)	(27.3)	0.12 ～ 0.22	1.2	KHG3-26R KHG3-26L
S1	317.6	316.1	(32.39)	(32.23)	0.12 ～ 0.22	1.5	KHG3-28R KHG3-28L
S1	348.1	368.7	(35.5)	(37.6)	0.12 ～ 0.22	1.6	KHG3-30R KHG3-30L
S1	362.5	407.4	(36.96)	(41.54)	0.12 ～ 0.22	1.8	KHG3-32R KHG3-32L
S1	407	497.6	(41.5)	(50.74)	0.14 ～ 0.26	2.2	KHG3-35R KHG3-35L
S1	422	529.8	(43.03)	(54.03)	0.14 ～ 0.26	2.3	KHG3-36R KHG3-36L
S1	482.1	670.1	(49.16)	(68.33)	0.14 ～ 0.26	2.7	KHG3-40R KHG3-40L
S1	542.9	827.5	(55.36)	(84.38)	0.14 ～ 0.26	3.2	KHG3-44R KHG3-44L
S1	558.1	869.2	(56.91)	(88.63)	0.14 ～ 0.26	3.3	KHG3-45R KHG3-45L
S1	604	1000	(61.59)	(102)	0.14 ～ 0.26	3.8	KHG3-48R KHG3-48L
S1	634.8	1094	(64.73)	(111.6)	0.14 ～ 0.26	4	KHG3-50R KHG3-50L
S1	665.6	1191	(67.87)	(121.5)	0.14 ～ 0.26	4.2	KHG3-52R KHG3-52L
S1	756.6	1560	(77.15)	(159.1)	0.14 ～ 0.26	5.6	KHG3-60R KHG3-60L

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 131 for more details.

NOTE 3: The backlash values shown in the table are the theoretical values of a pair of identical gears in mesh.

SH Helical Gears Normal Modules 2~3



■ Module 2

Catalog No.	Direction of Helix	Module	No. of teeth	Bore	Hub dia.	Pitch dia.	Outside dia.	Face width	Hub width	Total length
		m	z	A_{H7}	B	C	D	E	F	G
SH2-15R **SH2-15L**	R L	2	15	12	24	31.06	35.06	25	10	35
SH2-20R **SH2-20L**	R L	2	20	12	32	41.41	45.41	25	10	35
SH2-30R **SH2-30L**	R L	2	30	12	50	62.12	66.12	25	10	35
SH2-40R **SH2-40L**	R L	2	40	18	60	82.82	86.82	25	10	35
SH2-60R **SH2-60L**	R L	2	60	18	70	124.23	128.23	25	10	35
SH2-90R **SH2-90L**	R L	2	90	18	120	186.35	190.35	25	10	35

■ Module 3

SH3-15R **SH3-15L**	R L	3	15	15	36	46.59	52.59	35	15	50
SH3-20R **SH3-20L**	R L	3	20	15	50	62.12	68.12	35	15	50
SH3-30R **SH3-30L**	R L	3	30	20	70	93.17	99.17	35	15	50
SH3-40R **SH3-40L**	R L	3	40	20	80	124.23	130.23	35	15	50
SH3-60R **SH3-60L**	R L	3	60	20	140	186.35	192.35	35	15	50

CAUTION: Right handed and left handed helical gears in the same module are designed to mesh as a pair, but they are not interchangeable with KHG type helical gears.

Specifications

Precision grade	JIS N8 grade (JIS B1702-1: 1998) OLD JIS 4 grade (JIS B1702: 1976)	Heat treatment	—
Reference section of gear	Normal plane	Tooth hardness	Less than 194HB
Gear teeth	Standard full depth	Surface treatment	Black oxide
Transverse pressure angle	20°	Tooth surface finish	Cut
Helix angle	15°	Datum reference surface for gear cutting	Bore
Material	S45C	Secondary Operations	Possible

Shape	Allowable torque (N·m) NOTE 1		Allowable torque (kgf·m)		Backlash (mm) NOTE 2	Weight (kgf)	Catalog No.
	Bending strength	Surface durability	Bending strength	Surface durability			
S1	43.72	2.895	(4.458)	(0.2952)	0.12 ~ 0.26	0.16	SH2-15R SH2-15L
S1	67.11	5.851	(6.843)	(0.5966)	0.12 ~ 0.26	0.31	SH2-20R SH2-20L
S1	116.8	15.25	(11.91)	(1.555)	0.14 ~ 0.3	0.7	SH2-30R SH2-30L
S1	168.6	28.92	(17.19)	(2.949)	0.14 ~ 0.3	1.2	SH2-40R SH2-40L
S1	274.9	70.81	(28.03)	(7.221)	0.18 ~ 0.36	3	SH2-60R SH2-60L
S1	437.4	173	(44.6)	(17.64)	0.18 ~ 0.36	6.1	SH2-90R SH2-90L
S1	137.7	9.672	(14.04)	(0.9863)	0.16 ~ 0.32	0.5	SH3-15R SH3-15L
S1	211.3	19.39	(21.55)	(1.977)	0.16 ~ 0.32	1	SH3-20R SH3-20L
S1	367.8	50.2	(37.51)	(5.119)	0.18 ~ 0.38	2.2	SH3-30R SH3-30L
S1	530.8	95.46	(54.13)	(9.734)	0.18 ~ 0.38	3.8	SH3-40R SH3-40L
S1	865.8	235.5	(88.29)	(24.01)	0.22 ~ 0.44	9.3	SH3-60R SH3-60L

NOTE 1: The allowable torques shown in the table are calculated values according to the assumed usage conditions.
Please see page 131 for more details.

NOTE 2: The backlash values shown in the table are the theoretical values of a pair of identical gears in mesh.

■ SH Helical Gear Center Distance

Catalog No.	SH2-15$^{R}_{L}$	SH2-20$^{R}_{L}$	SH2-30$^{R}_{L}$	SH2-40$^{R}_{L}$	SH2-60$^{R}_{L}$	SH2-90$^{R}_{L}$
SH2-15$^{R}_{L}$	31.05	—	—	—	—	—
SH2-20$^{R}_{L}$	36.23	41.41	—	—	—	—
SH2-30$^{R}_{L}$	46.58	51.76	62.11	—	—	—
SH2-40$^{R}_{L}$	56.93	62.11	72.46	82.82	—	—
SH2-60$^{R}_{L}$	77.64	82.82	93.17	103.52	124.23	—
SH2-90$^{R}_{L}$	108.70	113.88	124.23	134.58	155.29	186.35

■ SH Helical Gear Center Distance

Catalog No.	SH3-15$^{R}_{L}$	SH3-20$^{R}_{L}$	SH3-30$^{R}_{L}$	SH3-40$^{R}_{L}$	SH3-60$^{R}_{L}$
SH3-15$^{R}_{L}$	46.58	—	—	—	—
SH3-20$^{R}_{L}$	54.34	62.11	—	—	—
SH3-30$^{R}_{L}$	69.87	77.64	93.17	—	—
SH3-40$^{R}_{L}$	85.40	93.17	108.70	124.23	—
SH3-60$^{R}_{L}$	116.46	124.23	139.76	155.29	186.35