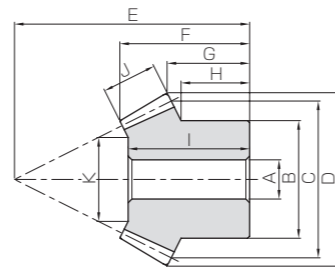


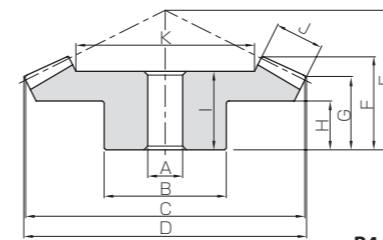


Specifications	
Precision grade	JIS B 1704: 1978 grade 4
Gear teeth	Gleason
Pressure angle	20°
Helix angle	35° *
Material	S45C
Heat treatment	Teeth induction hardened
Tooth hardness	50 ~ 60HRC
Surface treatment	Black oxide coating

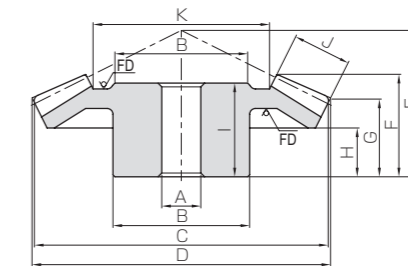
* 39° for 6015R and 1560L of SBS1.5/2 products.



B3



B4



B5

* FD has die-forged finish.

Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore		Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length		Crown to back length
						A	B					C	D	
KSBS2-4515R KSBS2-1545L	3	m2	45	R	B4	12	40	90	90.67	40	30.29	26.01		
			15	L	B3	10	24	30	34.78	60	29.66	15.80		
KSBS2.5-4515R KSBS2.5-1545L	3	m2.5	45	R	B4	15	50	112.5	113.32	50	38.25	32.47		
			15	L	B3	12	30	37.5	43.36	75	38.27	19.73		
KSBS3-4515R KSBS3-1545L	3	m3	45	R	B4	20	60	135	135.99	55	40.59	33.98		
			15	L	B3	15	38	45	52.08	90	44.98	23.68		
KSBS4-4515R KSBS4-1545L	3	m4	45	R	B5	20	80	180	181.3	70	50.62	41.95		
			15	L	B3	16	50	60	69.30	115	54.37	26.55		
KSBS5-4515R KSBS5-1545L	3	m5	45	R	B5	30	90	225	226.61	75	50.05	39.92		
			15	L	B3	20	60	75	86.55	145	66.89	34.43		
KSBS1.5-6015R KSBS1.5-1560L	4	m1.5	60	R	B4	12	60	90	90.36	32	24.08	21.48		
			15	L	B3	8	18	22.5	26.09	56	22.95	11.45		
KSBS2-6015R KSBS2-1560L	4	m2	60	R	B4	15	80	120	120.46	42	31.5	27.91		
			15	L	B3	10	24	30	34.68	75	30.94	15.58		
KSBS2.5-6015R KSBS2.5-1560L	4	m2.5	60	R	B4	20	100	150	150.5	53	39.68	35.24		
			15	L	B3	12	30	37.5	44.16	94	38.9	19.83		
KSBS3-6015R KSBS3-1560L	4	m3	60	R	B4	20	120	180	180.57	64	47.61	42.64		
			15	L	B3	15	38	45	52.64	112	44.01	22.96		

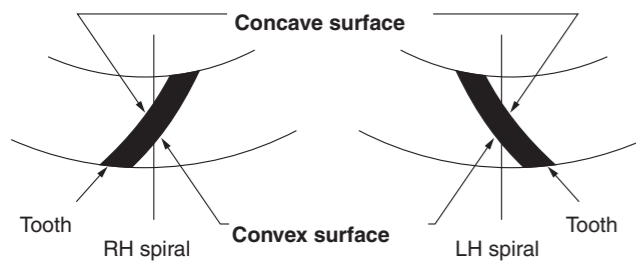
- [Caution on Product Characteristics]
- The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 303 for more details.
 - Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.
 - These gears produce axial thrust forces. See Page 304 for more details.
 - Due to heat treating, some deformation of the bore may occur. It may be necessary to ream the bore to bring it to the stated dimensions.

Hub width	Length of bore	Face width	Holding surface dia.	Allowable torque (N-m)		Allowable torque (kgf-m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
17	26	15	59.04	31.7	3.23	1.92	0.06~0.16	0.60	KSBS2-4515R KSBS2-1545L	
14	29		19.13	10.1	1.03	0.64				0.095
22	35	20	72.82	64.3	6.56	3.94	0.07~0.17	1.21	KSBS2.5-4515R KSBS2.5-1545L	
17.5	37		20.51	20.6	2.10	1.31				0.19
20	35	23	88.18	108	11.1	6.71	0.08~0.18	1.99	KSBS3-4515R KSBS3-1545L	
21.33	44		28.54	34.7	3.54	2.24				0.34
24	45	30	118.08	253	25.8	15.9	0.12~0.27	4.04	KSBS4-4515R KSBS4-1545L	
23.33	52		32.26	81.1	52.0	5.30				0.76
20	44	35	152.88	473	48.3	30.0	0.14~0.34	6.08	KSBS5-4515R KSBS5-1545L	
30	65		48.64	152	98.2	10.0				1.44
12	21	12	65.39	17.9	1.83	1.31	0.05~0.15	0.70	KSBS1.5-6015R KSBS1.5-1560L	
10.43	22.5		15.55	4.22	3.21	0.43				0.33
16	27	16	87.02	42.5	30.9	4.33	0.06~0.16	1.59	KSBS2-6015R KSBS2-1560L	
14.25	30		18.06	10.0	7.73	1.02				0.79
20	34	20	108.64	96.1	58.4	9.79	0.07~0.17	3.13	KSBS2.5-6015R KSBS2.5-1560L	
18.06	37.5		20.58	22.6	14.6	2.31				1.49
25	41	22	134.4	156	15.9	9.76	0.08~0.18	5.38	KSBS3-6015R KSBS3-1560L	
21.12	43		31.58	36.8	23.9	3.75				2.44

- [Caution on Secondary Operations]
- Please read "Caution on Performing Secondary Operations" (Page 304) when performing modification and/or secondary operations for safety concerns.
 - 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).

Contact Surface of Spiral Bevel Gears

Tooth surfaces of spiral gears have concave and convex sides. Changes in the rotational direction of the driving gear alter the contact surface accordingly. The illustrations show the top view of RH and LH Spiral Gears, and the tables on the right explain the different contact surface depending on the situation.



RH Spiral as a driving gear

Rotating Direction of Driving Gear <small>Note 1</small>	Contact Surface	
	Driving Gear (RH Spiral)	Driving Gear (LH Spiral)
RH Rotation (Clockwise)	Convex Surface	Concave Surface
LH rotation (counterclockwise)	Concave Surface	Convex Surface

LH Spiral as a driving gear

Rotating Direction of Driving Gear <small>Note 1</small>	Contact Surface	
	Driving Gear (LH Spiral)	Driving Gear (RH Spiral)
RH Rotation (Clockwise)	Concave Surface	Convex Surface
LH Rotation (Counterclockwise)	Convex Surface	Concave Surface

[Note 1] Rotation directions given in the tables are for viewing the gears from the hub side.

Forces Acting on Spiral Bevel Gear Teeth

For a spiral bevel gear with shaft angle $\Sigma=90^\circ$, pressure angle $\alpha_n=20^\circ$, and spiral angle $\beta_m=35^\circ$, the tables below show the axial thrust force F_x and the radial force F_r when a tangential force F_t of 100 units is applied at the center of face width. For details, please refer to separate technical reference book, section of "Features of Tooth Surface Contact" (Page 107).

The tables show the values of $\frac{\text{Axial Thrust Force } F_x}{\text{Radial Force } F_r}$

(1) Forces acting upon pinion

Contact Surface	Gear Ratio z_2/z_1						
	1.0	1.5	2.0	2.5	3.0	4.0	5.0
Concave Surface	80.9	82.9	82.5	81.5	80.5	78.7	77.4
	-18.1	-1.9	8.4	15.2	20.0	26.1	29.8
Convex Surface	-18.1	-33.6	-42.8	-48.5	-52.4	-57.2	-59.9
	80.9	75.8	71.1	67.3	64.3	60.1	57.3

(2) Forces acting upon gear

Contact Surface	Gear Ratio z_2/z_1						
	1.0	1.5	2.0	2.5	3.0	4.0	5.0
Concave Surface	80.9	75.8	71.1	67.3	64.3	60.1	57.3
	-18.1	-33.6	-42.8	-48.5	-52.4	-57.2	-59.9
Convex Surface	-18.1	-1.9	8.4	15.2	20.0	26.1	29.8
	80.9	82.9	82.5	81.5	80.5	78.7	77.4

Characteristics



KHK stock bevel gears are available in two types, spiral and straight tooth, in gear ratios of 1.5 through 5, and are offered in a large variety of modules, numbers of teeth, materials and styles. The following table lists the main features for easy selection.

Type	Catalog No.	Module	Gear Ratio	Material	Heat Treatment	Tooth Surface Finish	Precision JIS B 1704 : 1978	Secondary Operations	Features
Spiral bevel gears	KMHP	1, 1.5	15 ~ 60	SCM415	Carburized Note 1	Cut	3	△	High speed reduction ratio, high efficiency, high rigidity and compact gear assembly.
	KMBSG	2 ~ 4	2	SCM415	Carburized Note 1	Ground	1	△	High strength, abrasion-resistant and compact for high-speed & torque use.
	KSBSG	2 ~ 4	1.5 ~ 3	S45C	Gear teeth induction hardened	Ground	2	△	Reasonably priced ground gear, yet remachinable except for the gear teeth.
	KKSP	1.5 ~ 5	1.5, 2	SCM415	Carburized Note 1	Ground	0	△	Superior performance with regard to high speed, low noise, and low vibration.
	KMBSA · KMBSB	2 ~ 6	1.5 ~ 3	SCM415	Carburized	Cut	4	×	Ready to use without performing secondary operations. Strong and abrasion resistant.
Spiral bevel gears	KSBS	1 ~ 5	1.5 ~ 4	S45C	Gear teeth induction hardened	Cut	4	△	Large nos. of teeth and modules are offered in these affordable spiral bevel gears.
	KSBSG	2 ~ 3	1.5 ~ 2	S45C	Gear teeth induction hardened	Ground	2	△	A spiral bevel gears with a helix angle less than 10°. Receives forces from the same directions straight bevel gears receive and have excellent precision.
Straight bevel gears	KSB · KSBY	1 ~ 8	1.5 ~ 5	S45C	—	Cut	3	○	Popular series of straight bevel gears for many uses.
	KSUB	1.5 ~ 3	1.5 ~ 3	SUS303	—	Cut	3	○	Suitable for food machinery due to SUS303's rust-resistant quality.
	KPB	1 ~ 3	1.5 ~ 3	MC901	—	Cut	4	○	MC nylon products are light and can be used without lubricant.
	KDB	0.5 ~ 1	2	Duracon (M90-44)	—	Injection Molded	6	△	Injection molded, mass-produced productions, suitable for office machines.

(NOTE 1) Although these are carburized products, secondary operations can be performed as the bore and the hub portions are masked during the carburization. However, as a precaution, high hardness (HRC40 at maximum) occurs in some cases.

○ Possible △ Partly possible
× Not possible

Application Examples



KHK stock bevel gears are used as gears for power transmission of intersecting axes in various devices.

Differential Gear Mechanism Example

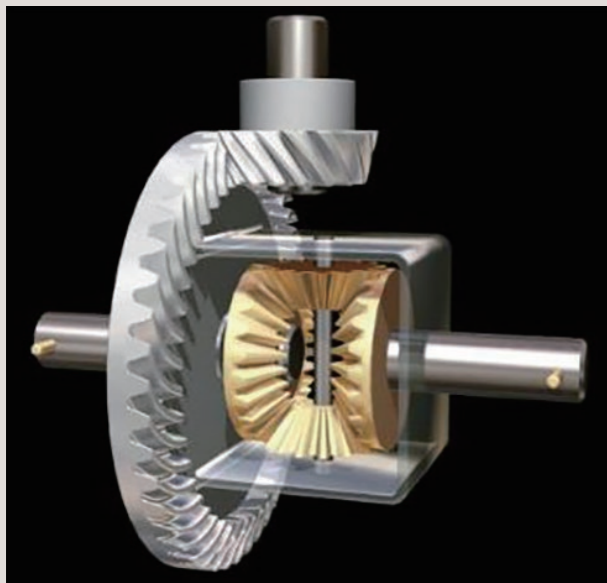


Image provided by: PK Design

SHESCO 2WD Bike



KSB Bevel Gears are used in the driving components in both the front and rear wheels

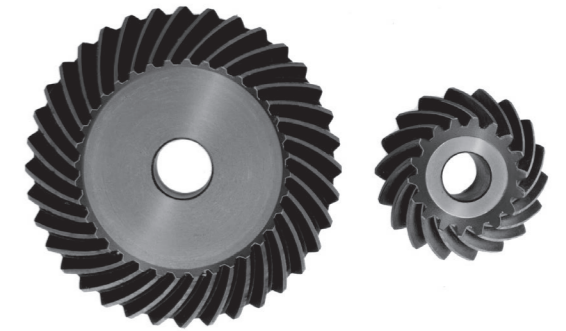
Selection Hints



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

Basically, KHK stock bevel gears should be selected as shown in the catalog in pairs (e.g. KMBSG2-4020R should mate with KMBSG2-2040L). But, for straight tooth bevel gears, there is some interchangeability with different series. For plastic bevel gears, we recommend metal mating gears for good heat conductivity.



Right (R) Left (L)

Selection Chart for Straight Bevel Gears (○ Allowable × Not allowable)

Gear	KSB	KSUB	KPB	KDB
Pinion				
KSB	○	○	○	×
KSUB	○	○	○	×
KPB	○	○	○	×
KDB	×	×	×	○

Zerol Bevel Gears

KSBZG products are not interchangeable with products in other series.

2. Caution in Selecting Gears Based on Gear Strength

The gear strength values shown in the product pages were computed by assuming a certain application environment. Therefore, they should be used as reference only. We recommend that each user computes their own values by applying the actual usage conditions. To learn more about strength calculation, please refer to the technical information contained in the "Bending Strength of Bevel Gears" section on Page 87, and the "Surface Durability of Bevel Gears" section on Page 92.

Selection Chart for Spiral Bevel Gears (○ Allowable × Not allowable)

Gear	KMBSG	KSBSG	KMBSA KMBSB	KSBS
Pinion				
KMBSG	○	×	×	×
KSBSG	×	○	×	×
KMBSA · KMBSB	×	×	○	×
KSBS	×	×	×	○

Calculation assumptions for Bending Strength of Gears

Item	Catalog No.	KMBSG KMBSA KMBSB	KSBSG KSBSG KSBS	KSB NOTE 3 KSBY	KSUB	KPB	KDB
Formula NOTE 1	Formula of bevel gears on bending strength(JGMA403-01)					The Lewis formula	
No. of teeth of mating gear	No. of teeth of the mating gear of the set					—	
Rotational Speed	100rpm (600rpm for KMBSG, KSBSG and KSBZG)					100rpm	
Design Life (Durability)	Over 10 ⁷ cycles					—	
Impact from motor	Uniform load					Allowable bending stress (kgf/mm ²)	
Impact from load	Uniform load					1.15	
Direction of load	Bidirectional					(40°C with No Lubrication)	
Allowable bending stress at root σ_{Fim} (kgf/mm ²) NOTE 2	47	21	19 (24.5)	10.5	m 0.5 4.0 m 0.8 4.0 m 1.0 3.5 (40°C with Grease Lubrication)		
Safety factor K_R	1.2						

Calculation assumptions for Surface Durability (Except those in common with bending strength)

Item	Catalog No.	KMBSG KMBSA KMBSB	KSBSG KSBSG KSBS	KSB NOTE 3 KSBY	KSUB	KPB	KDB
Formula NOTE 1	Formula of bevel gears on surface durability (JGMA404-01)						
Kinematic viscosity of lubricant	100cSt (50°C)						
Gear support	Shafts & gear box have normal stiffness, and gears are supported on one end						
Allowable Hertz stress σ_{Hlim} (kgf/mm ²)	166	90	49 (62.5)	41.3			
Safety factor C_R	1.15						

(NOTE 1) The gear strength formula is based on JGMA (Japanese Gear Manufacturers Association) specifications. "MC Nylon Technical Data" by Nippon Polyplastic Limited and "Duracon Gear Data" by Polyplastic Co. Also, the units (rpm) of number of rotations and unit (kgf/mm²) of stress are adjusted to the units needed in the formula.

(NOTE 2) The allowable bending stress at the root σ_{Fim} is calculated from JGMA403-01, and set to 2/3 of the value in the consideration of the use of planetary-, idler-, or other gear systems, loaded in both directions.

(NOTE 3) Since KSB Bevel Pinion Shafts are thermally refined, the allowable tooth-root bending stress and allowable hertz stress are the value shown in parentheses.

Application Hints

In order to use KHK stock 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.

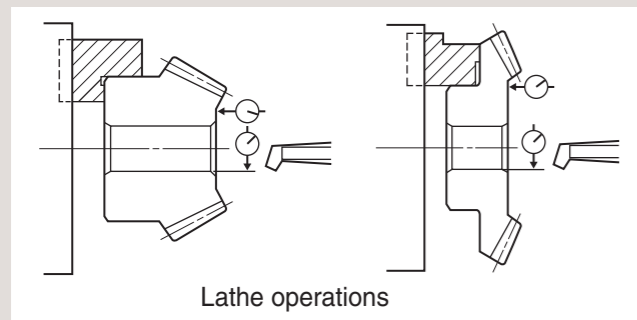
TEL: 1-516-437-6700 FAX: 1-516-328-3343 E-mail: qtcsupport@qtcgears.com

1. Cautions on Handling

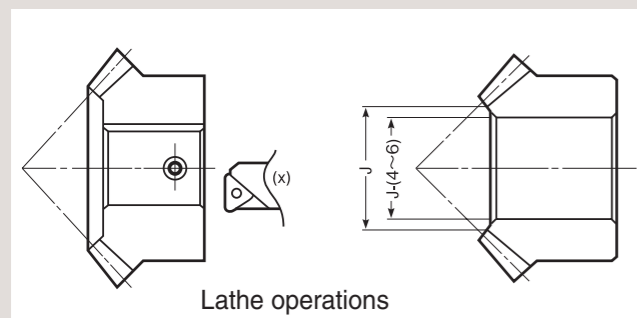
- ① KHK products are packaged one by one to prevent scratches and dents, but if you find issues such as rust, scratches, or dents when the product is removed from the box after purchase, please contact the supplier.
- ② Depending on the handling method, the product may become deformed or damaged. Resin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

2. Caution on Performing Secondary Operations

- ① If you are re-boring, 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, it is best to 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 reworking using scroll chucks, we recommend the use of new or rebored jaws for improved precision. Please exercise caution not to crush the teeth by applying too much pressure. Any scarring will cause noise during operation.

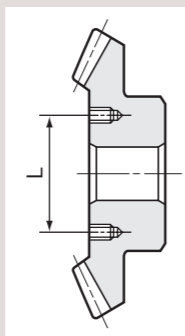


- ④ For items with induction hardened teeth, such as KSBSG and KSBS series, the hardness is high near the tooth root. When machining the front end, the machined area should be 4 to 6mm smaller than the dimension, J.



- ⑤ For tapping and keyway operations, see the examples given in "1. Caution on Performing Secondary Operations" in KHK Stock Spur Gear section. When cutting keyways, to avoid stress concentrations, always leave radii on corners.
- ⑥ KPB plastic bevel gears are susceptible to changes due to temperature and humidity. Dimensions may change between, during, and after re-machining operations.

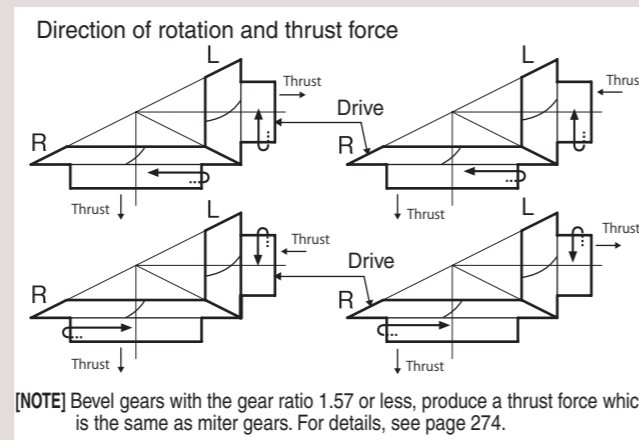
- ⑦ When heat treating S45C products, it is possible to get thermal stress cracks. It is best to subject them to penetrant inspection afterwards. While the teeth strength may increase four fold, the precision of the gear will drop approximately one grade.
- ⑧ For the handling conveniences, the KSB and KSBY series listed below have the tapped holes (180° apart, 2 places) on the holding surface.



Catalog No.	L (mm)	Tap Size
KSB6-4515	130	M10 deep 20
KSBY8-4020	160	M10 deep 20
KSBY8-4515	210	M10 deep 20
KSBY5-6015	160	M10 deep 20
KSBY6-6015	220	M10 deep 20

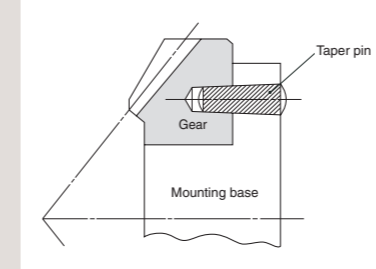
3. Points of Caution in Assembling

- ① Since bevel gears are cone shaped, they produce axial thrust forces. Especially for spiral bevel gears, the directions of thrust changes with the hand of spiral 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, please refer to separate technical reference book, section of "Gear Forces" (Page 107).



- ② If a bevel gear is mounted on a shaft far from the bearings, the shaft may bend. We recommend mounting bevel gears as close to the bearings as possible. This is especially important since most bevel gears are supported on one end. The bending of shafts will cause abnormal noise and wear, and may even cause fatigue failure of the shafts. Both shafts and bearings must be designed with sufficient strength.
- ③ Due to the thrust load of bevel gears, the gears, shafts and bearings have the tendency to loosen up during operation. Bevel gears should be fastened to the shaft with keys and set screws, taper pins, step shafts, etc.

- ④ When installing KMBSA or KMBSB spiral bevel gears produced in B7 style (ring type), always secure the gears onto the mounting base with taper pins to absorb the rotational loads. It is dangerous to secure with bolts only.



- ⑤ KHK stock bevel gears are designed such that, when assembled according to the specified mounting distance with a tolerance of H7 to H8, the normal direction backlash shown in the table is obtained. Mounting distance error, offset error and shaft angle error must be minimized to avoid excessive noise and wear. For various conditions of teeth contact, please see the following illustrations, "Correct Tooth Contact" and "Incorrect Tooth Contact".

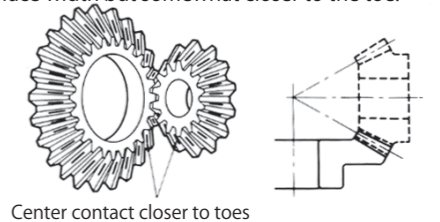
Gear Ratio (Reduction Ratio)	Normal direction Backlash	Travel in axial direction	
		Pinions	Gears
1.5	j_n	$0.81 \times j_n$	$1.22 \times j_n$
2		$0.65 \times j_n$	$1.31 \times j_n$
2.5		$0.54 \times j_n$	$1.36 \times j_n$
3		$0.46 \times j_n$	$1.39 \times j_n$
4		$0.35 \times j_n$	$1.42 \times j_n$
5		$0.29 \times j_n$	$1.43 \times j_n$
15 or more		$1.4 \times j_n \div \text{Gear Ratio}$	$1.40 \times j_n$

4. 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 gears.
- ③ Gears can be lubricated with the "grease lubrication method", "splash lubrication method (oil bath method)", or "forced lubrication method (circulation lubrication method)". For initial operation, the lubricant may deteriorate markedly, so check the condition of the lubricant after starting. For more technical information, please see the section "Gear Lubrication" (Page 112) of our technical reference book.
- ④ If there is any abnormality such as noise or vibration during startup, check the gears and assembly condition. "High gear accuracy", "smooth gear teeth surface" and "correct tooth contact" are some of the measures against gear noise. For more technical information, please see the section "Gear Noise and Countermeasures" (Page 119) of our technical reference book.

Correct Tooth Contact

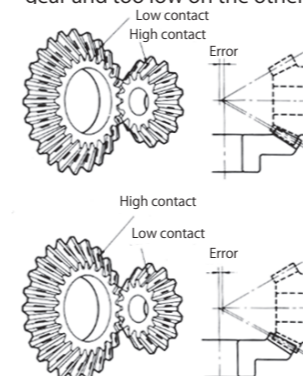
- When assembled correctly, the contact will occur on both gears in the middle of the flank and center of face width but somewhat closer to the toe.



Incorrect Tooth Contact

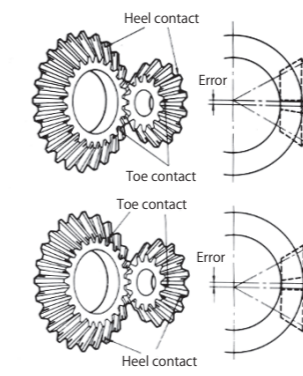
Mounting Distance Error

- When the mounting distance of the pinion is incorrect, the contact will occur too high on the flank on one gear and too low on the other.



Offset Error

- When the pinion shaft is offset, the contact surface is near the toe of one gear and near the heel of the other.



Shaft Angle Error

- When there is an angular error of shafts, the gears will contact at the toes or heels depending on whether the angle is greater or less than 90°.

