MHP
High-Ratio Hypoid Gears

Gear Ratio 15 ~ 200

*m*1, 1.5 Page 456

MBSG
Ground Spiral Bevel Gears

Gear Ratio 2

*m*2 ~ 4 Page 458

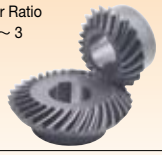
SBSG
Ground Spiral Bevel Gears

Gear Ratio 1.5 ~ 3

*m*2 ~ 4 Page 460

MBSA · MBSB
Finished Bore Spiral Bevel Gears

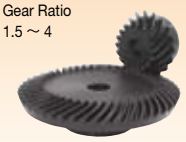
Gear Ratio 1.5 ~ 3



*m*2 ~ 6 Page 462

SBS
Spiral Bevel Gears

Gear Ratio 1.5 ~ 4



*m*1 ~ 5 Page 466

SBZG
Ground Zerol Bevel Gears

Gear Ratio 1.5, 2

New

*m*2 ~ 3 Page 470

SB
Steel Bevel Gears

Gear Ratio 1.5 ~ 4

*m*1.5 ~ 6 Page 472

SBY
Steel Bevel Gears

Gear Ratio 2 ~ 4

*m*5 ~ 8 Page 472

SB
Steel Bevel Gears & Pinion Shafts

Gear Ratio 5

*m*1.5 ~ 3 Page 476

SUB
Stainless Steel Bevel Gears

Gear Ratio 1.5 ~ 3

*m*1.5 ~ 3 Page 478

PB
Plastic Bevel Gears

Gear Ratio 1.5 ~ 3

*m*1 ~ 3 Page 480

DB
Injection Molded Bevel Gears

Gear Ratio 2

*m*0.5 ~ 1 Page 482

BB
Sintered Metal Bushings

ϕ 5 ~ 8 Page 482

Nissei KSP
Ground Spiral Bevel Gears

Gear Ratio 1.5 ~ 2

*m*2 ~ 5 Page 488

Bevel 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 their Catalog Numbers.

(Example) Bevel Gears

M BS G 2 - 40 20 R

- Material (SCM415)
- Type (Spiral Bevel Gear)
- Others (Ground Gear)
- Module (2)
- No. of teeth (40)
- No. of teeth of mating gear (20)
- Direction of Spiral (R)

Material

S	S45C
M	SCM415
SU	SUS303
P	MC901
D	DURACON

Type

B	Straight Bevel Gears
BS	Spiral Bevel Gears
HP	High Ratio Hypoid Gears

Other Information

G	Ground Gears

Feature Icons

- RoHS Compliant Product
- Re-machinable Product
- Finished Product
- Heat Treated Product
- Ground Gear
- Stainless Product
- Resin Product
- Copper Alloy Product
- Injection Molded Product
- Black Oxide coated Product

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	Secondary Operations	Features
Hypoid Gear	**MHP**	1 ~ 1.5	15 ~ 200	SCM415	Carburized Note 1	Cut	3	△	High speed reduction ratio, high efficiency, high rigidity and compact gear assembly.
Spiral bevel gears	**MBSG**	2 ~ 4	2	SCM415	Carburized Note 1	Ground	2	△	High strength, abrasion-resistant and compact for high-speed & torque use.
	SBSG	2 ~ 4	1.5 ~ 3	S45C	Gear teeth induction hardened	Ground	2	△	Reasonably priced ground gear, yet remachinable except for the gear teeth.
	MBSA · MBSB	2 ~ 6	1.5 ~ 3	SCM415	Carburized	Cut	4	×	Ready to use without performing secondary operations. Strong and abrasion resistant.
	SBS	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.
Zerol Bevel Gears	**SBZG**	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 direction as straight bevel gears receive and have excellent precision properties.
Straight bevel gears	**SB · SBY**	1 ~ 8	1.5 ~ 5	S45C	—	Cut	3	○	Popular series of straight bevel gears for many uses.
	SUB	1.5 ~ 3	1.5 ~ 3	SUS303	—	Cut	3	○	Suitable for food machinery due to SUS303's rust-resistant quality.
	PB	1 ~ 3	1.5 ~ 3	MC901	—	Cut	4	○	MC nylon products are light and can be used without lubricant.
	DB	0.5 ~ 1	2	Duracon (M90-44)	—	Injection Molded	8	△	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

● **For safe handling and to prevent damage such as deformation, KHK stock bevel gears have round chamfering at the corners, on the top surface plane of a gear tooth.**

■ The chamfering of the corner gear tips for bevel gear

Module	Outside edge R	Inside edge R
0.5 up to 1	0.5	All burrs removed
1 up to 2.5	1	0.5
2.5 up to 5	2	1
Over 5	3	1.5

Integrated combination of cutting-edge technologies and know-how.

The popularity in our large selection of product lineups is established by a production system integrated with advanced manufacturing technology and know-how, achieving quality products.

Gear cutting of Straight Bevel Gears

Bevel Gear Grinding Machine (Gleason PH-275HG)

Gear cutting of Spiral Bevel Gears

Bevel Gear Cutting Machine Equipments

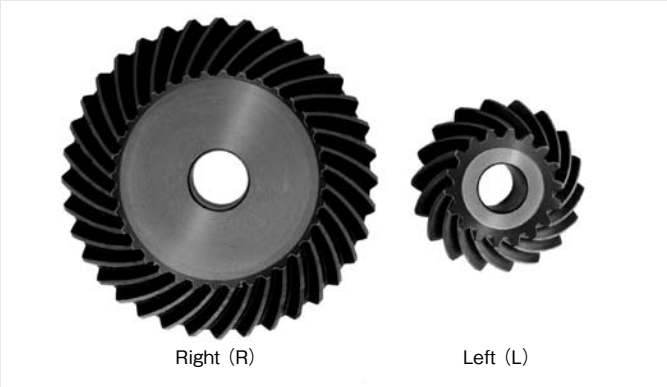
Inspection Equipment

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. MBSG2-4020R should mate with MBSG2-2040L). 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)

Pinion \ Gear	SB	SUB	PB	DB
SB	○	○	○	×
SUB	○	○	○	×
PB	○	○	○	×
DB	×	×	×	○

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

Pinion \ Gear	MBSG	SBSG	MBSA MBSB	SBS
MBSG	○	×	×	×
SBSG	×	○	×	×
MBSA・MBSB	×	×	○	×
SBS	×	×	×	○

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 679, and the "Surface Durability of Bevel Gears" section on page 685.

■ Calculation assumptions for Bending Strength of Gears

Item \ Catalog No.	MBSG MBSA MBSB	SBSG SBZG SBS	SB NOTE 3 SBY	SUB	PB	DB
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				——	
Rotation	100rpm (600rpm for MBSG, SBSG and SBZG)				100rpm	
Durability	Over 10^7cycles				——	
Impact from motor	Uniform load				Allowable bending stress (kgf/mm^2)	
Impact from load	Uniform load				1.15 (40℃ with No Lubrication)	*m* 0.5 4.0 *m* 0.8 4.0 *m* 1.0 3.5 (40℃ with Grease Lubrication)
Direction of load	Bidirectional					
Allowable bending stress at root σ_{Flim}(kgf/mm^2) NOTE 2	47	21	19 (24.5)	10.5		
Safety factor K_R	1.2					

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

Formula NOTE 1	Formula of bevel gears on surface durability (JGMA404-01)			
Kinematic viscosity of lubricant	100cSt (50℃)			
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 Polypenco Limited and "Duracon Gear Data" by Polyplastic Co. Also, the units (rpm) of number of rotations and unit (kgf/mm^2) of stress are adjusted to the units needed in the formula.

〔NOTE 2〕 Since the load is bidirectional, the allowable bending stress at root σ_{Hlim}, used in JGMA 403-01 formula is set to 2/3 of the value.

〔NOTE 3〕 Since SB Bevel Pinion Shafts are thermally refined, the allowable tooth-root bending stress and allowable hertz stress are referred to 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.

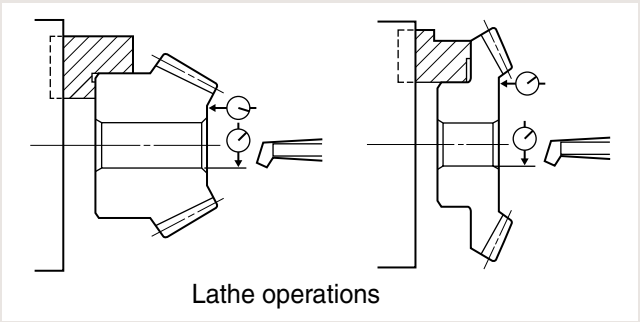
KHK Co., Ltd.
TEL.048-254-1744 FAX.048-254-1765
E-mail export@khkgears.co.jp

1. Caution on Performing Secondary Operations

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

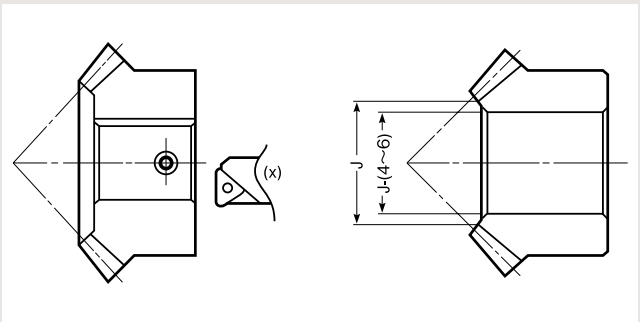
② The reference datum for gear cutting is the bore. Therefore, it is best to use the bore for locating the center. If it is too difficult to do for small bores, the alternative is to use one spot on the bore and the runout of the side surface.

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.



Lathe operations

④ For items with induction hardened teeth, such as SBSG and SBS 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.

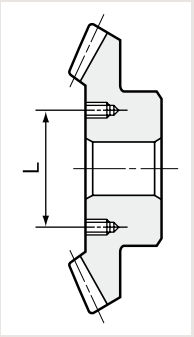


⑤ For tapping and keyway operations, see the examples given in "1. Caution on Performing Secondary Operations" in KHK Stock Spur Gear section. When cutting keyways, to avoid stress concentration, always leave radii on corners.

⑥ PB plastic bevel gears are susceptible to changes due to temperature and humidity. Dimensions may change between during and after remachining 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.

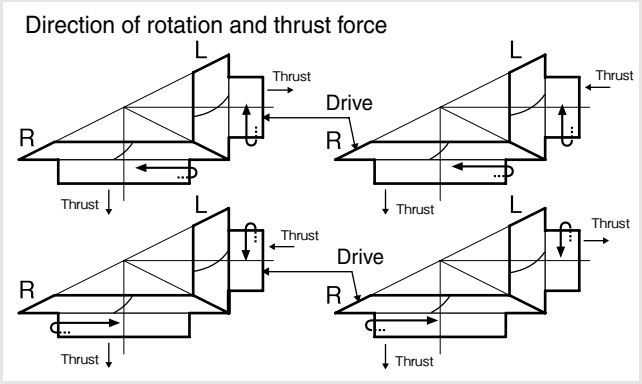
⑧ For the handling conveniences, SB and SBY series listed below has the tapped holes (180° apart, 2 places) on the holding surface.



Catalog No.	L (mm)	Tap Size
SB6-4515	130	M10 deep 15
SBY8-4020	160	M10 deep 15
SBY8-4515	210	M10 deep 15
SBY5-6015	160	M10 deep 15
SBY6-6015	220	M10 deep 15

2. 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 change 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 the technical reference, section of "Gear Forces" (Page 700).

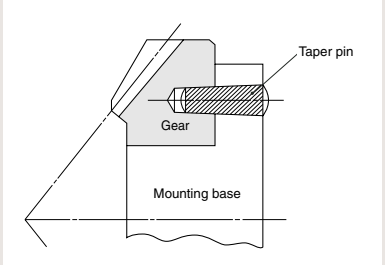


[NOTE] Bevel gears with the gear ratio 1.57 or less, produce a thrust force which has the same direction as miter gears. For details, see page 422.

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.

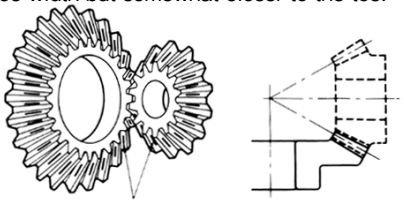
④ When installing MBSA or MBSB spiral bevel gears in B7 style (ring type), always secure the gears onto the mounting base with taper pins to absorb the rotational loads. It is dangerous to secure with bolts only.



⑤ KHK stock bevel gears are designed such that, when assembled according to the specified mounting distance with a tolerance of H7 - H8, the 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".

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.

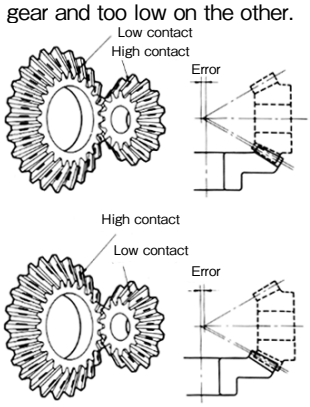


Center contact closer to toes

Incorrect Tooth Contact

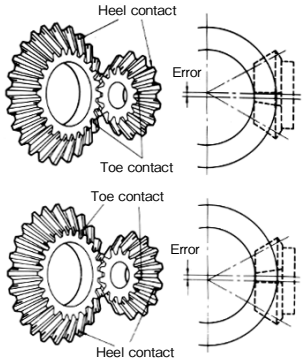
■ Mounting Distance Error

● 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.



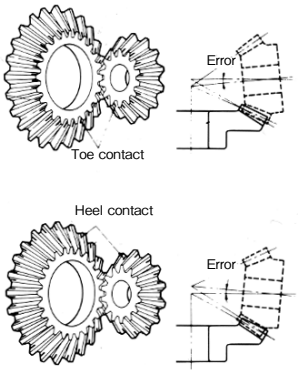
■ Offset Error

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

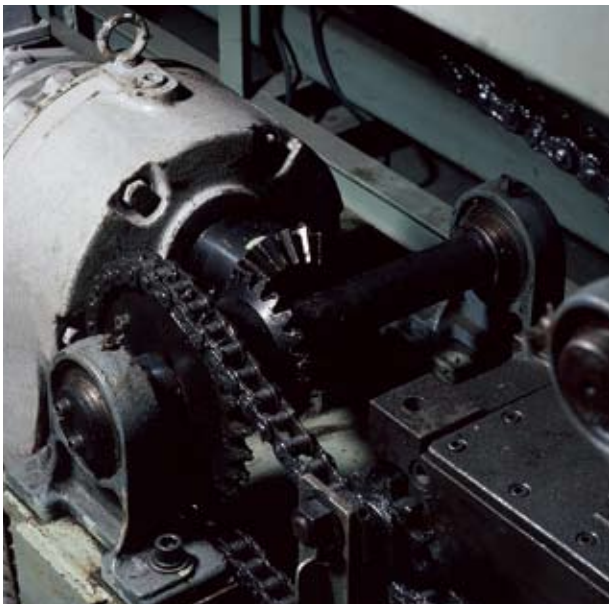


■ Shaft Angle Error

● 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°.



Application Examples



SB Bevel Gears are used in the automatic line-feeding of a machine part processing machine.

2WD Bicycle by SHESCO

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