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: Bevel Gears

MBS G 2 - 40 20 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
- Finished Product
- Ground Gear
- Resin Product
- Injection Molded Product
- Re-machinable Product
- Heat Treated Product
- Stainless Product
- Copper Alloy Product
- Black Oxide coated Product

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

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.

<table>
<thead>
<tr>
<th>Type</th>
<th>Catalog No.</th>
<th>Module</th>
<th>Gear Ratio</th>
<th>Material</th>
<th>Heat Treatment</th>
<th>Tooth Surface Finish</th>
<th>Precision</th>
<th>Secondary Operations</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spiral Bevel gears</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHP</td>
<td>1 ~ 1.5</td>
<td>15 ~ 200</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Cut 3</td>
<td>△</td>
<td></td>
<td></td>
<td>High speed reduction ratio, high efficiency, high rigidity and compact gear assembly.</td>
</tr>
<tr>
<td>MBSG</td>
<td>2 ~ 4</td>
<td>2</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Ground 1</td>
<td>△</td>
<td></td>
<td></td>
<td>High strength, abrasion-resistant and compact for high-speed &amp; torque use.</td>
</tr>
<tr>
<td>SBSG</td>
<td>2 ~ 4</td>
<td>1.5 ~ 3</td>
<td>S45C</td>
<td>Gear teeth induction hardened</td>
<td>Ground 2</td>
<td>△</td>
<td></td>
<td></td>
<td>Reasonably priced ground gear, yet remachinable except for the gear teeth.</td>
</tr>
<tr>
<td>KSP F type</td>
<td>1.5 ~ 5</td>
<td>20 ~ 30</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Ground 0</td>
<td>×</td>
<td></td>
<td></td>
<td>Superior performance with regard to high speed, low noise, and low vibration.</td>
</tr>
<tr>
<td>KSP U type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBSA - MBSB</td>
<td>2 ~ 6</td>
<td>1.5 ~ 3</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Cut 4</td>
<td>×</td>
<td></td>
<td></td>
<td>Ready to use without performing secondary operations. Strong and abrasion resistant.</td>
</tr>
<tr>
<td>SBS</td>
<td>1 ~ 5</td>
<td>1.5 ~ 4</td>
<td>S45C</td>
<td>Gear teeth induction hardened</td>
<td>Cut 4</td>
<td>△</td>
<td></td>
<td></td>
<td>Large nos. of teeth and modules are offered in these affordable spiral bevel gears.</td>
</tr>
<tr>
<td>SBZG</td>
<td>2 ~ 3</td>
<td>1.5 ~ 2</td>
<td>S45C</td>
<td>Gear teeth induction hardened</td>
<td>Ground 2</td>
<td>△</td>
<td></td>
<td></td>
<td>A spiral bevel gear with a helix angle less than 10°. Receives forces from the same directions straight bevel gears receive and have excellent precision.</td>
</tr>
<tr>
<td>SB - SBY</td>
<td>1 ~ 8</td>
<td>1.5 ~ 5</td>
<td>S45C</td>
<td>—</td>
<td>Cut 3</td>
<td>○</td>
<td></td>
<td></td>
<td>Popular series of straight bevel gears for many uses.</td>
</tr>
<tr>
<td>SUB</td>
<td>1.5 ~ 3</td>
<td>1.5 ~ 3</td>
<td>SUS303</td>
<td>—</td>
<td>Cut 3</td>
<td>△</td>
<td></td>
<td></td>
<td>Suitable for food machinery due to SUS303's rust-resistant quality.</td>
</tr>
<tr>
<td>PB</td>
<td>1 ~ 3</td>
<td>1.5 ~ 3</td>
<td>MC901</td>
<td>—</td>
<td>Cut 4</td>
<td>○</td>
<td></td>
<td></td>
<td>MC nylon products are light and can be used without lubricant.</td>
</tr>
<tr>
<td>DB</td>
<td>0.5 ~ 1</td>
<td>2</td>
<td>Duracon (M90-44)</td>
<td>Injection molded 6</td>
<td>△</td>
<td></td>
<td></td>
<td></td>
<td>Injection molded, mass-produced productions, suitable for office machines.</td>
</tr>
</tbody>
</table>

(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.

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.

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.

![Selection Chart for Straight Bevel Gears](image)

- Selection Chart for Straight Bevel Gears ( Allowable x Not allowable)

<table>
<thead>
<tr>
<th>Pinion</th>
<th>Gear</th>
<th>SB</th>
<th>SUB</th>
<th>PB</th>
<th>DB</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>SUB</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>PB</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>DB</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>○</td>
</tr>
</tbody>
</table>

![Selection Chart for Spiral Bevel Gears](image)

- Selection Chart for Spiral Bevel Gears ( Allowable x Not allowable)

<table>
<thead>
<tr>
<th>Pinion</th>
<th>Gear</th>
<th>MBSG</th>
<th>SBSG</th>
<th>MBSA</th>
<th>MBSB</th>
<th>SBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBSG</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBSG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBSA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBSB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Zerol Bevel Gears

SB2G 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 93.

### Calculation assumptions for Bending Strength of Gears

<table>
<thead>
<tr>
<th>Item</th>
<th>Catalog No.</th>
<th>MBSG</th>
<th>MBSA</th>
<th>MBSB</th>
<th>SBSG</th>
<th>SBZG</th>
<th>SBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>NOTE 1</td>
<td>Formula of bevel gears on bending strength (JGMA403-01)</td>
<td>The Lewis formula</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No. of teeth of mating gear</td>
<td></td>
<td>No. of teeth of the mating gear of the set</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Rotation</td>
<td></td>
<td>100rpm (600rpm for MBSG, SBSG and SBZG)</td>
<td>100rpm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Durability</td>
<td></td>
<td>Over 10 cycles</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Impact from motor</td>
<td></td>
<td>Uniform load</td>
<td>Allowable bending stress (kgf/mm²)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Impact from load</td>
<td></td>
<td>Uniform load</td>
<td>1.15 (40℃ with No Lubrication)</td>
<td>m 0.5 4.0</td>
<td>m 0.8 4.0</td>
<td>m 1.0 3.5</td>
<td></td>
</tr>
<tr>
<td>Direction of load</td>
<td></td>
<td>Bidirectional</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Allowable bending stress at root $\sigma_{Flim}$ (kgf/mm²)</td>
<td>47</td>
<td>21</td>
<td>19 (24.5)</td>
<td>10.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety factor $K_w$</td>
<td>1.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Formula</th>
<th>NOTE 1</th>
<th>Formula of bevel gears on surface durability (JGMA404-01)</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematic viscosity of lubricant</td>
<td>100cSt (50℃)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gear support</td>
<td>Shafts &amp; gear box have normal stiffness, and gears are supported on one end</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Allowable Hertz stress $\sigma_{Hlim}$ (kgf/mm²)</td>
<td>166</td>
<td>90</td>
<td>49 (62.5)</td>
</tr>
<tr>
<td>Safety factor $C_h$</td>
<td>1.15</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(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/mm²) of stress are adjusted to the units needed in the formula.

(Note 2) The allowable bending stress at the root $\sigma_{Flim}$ 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 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.
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 USA Inc.
PHONE: 516-248-3850         FAX: 516-248-4385
E-mail    info@khkgears.us

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.
   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, L.
   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.

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 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 108).

   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.

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

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>L (mm)</th>
<th>Tap Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB6-4515</td>
<td>130</td>
<td>M10 deep 15</td>
</tr>
<tr>
<td>SBY8-4020</td>
<td>160</td>
<td>M10 deep 15</td>
</tr>
<tr>
<td>SBY8-4515</td>
<td>210</td>
<td>M10 deep 15</td>
</tr>
<tr>
<td>SBY5-6015</td>
<td>160</td>
<td>M10 deep 15</td>
</tr>
<tr>
<td>SBY6-6015</td>
<td>220</td>
<td>M10 deep 15</td>
</tr>
</tbody>
</table>

[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 254.
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".

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

- **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°.

**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.
MHP
High-Ratio Hypoid Gears

■ Features of MHP High Ratio Hypoid Gears

A pair of MHP high-ratio hypoid gears are able to produce an amazing reduction of speed of 200:1 in one stage.

1. Total-cost reduction
   The MHP provides a compact gearing body replacing several stages of reduction gears. This reduces the cost sharply.

2. High efficiency
   Compared to worm gear drives, the MHP has less sliding contact. The resulting higher efficiency allows the use of smaller motors (See the graph on the right).

3. High rigidity
   The carburized hypoid gears lead to smaller size than comparable worms gears.

4. Compact gear assembly
   The size of the gear housing is nearly the same as outer diameter of the large gear. (See the diagrams below)

■ How to determine the radial and thrust loads

Before using the MHP high-ratio hypoid gears, be sure to confirm the direction of radial and thrust loads. Following equations are used to compute these loads. The radial and thrust load coefficients are given on the product pages.

Radial load calculation

\[ W_{RP} = W_{KP} \times T_G \times \frac{n}{2} \]

- \( W_{RP} \): Radial load on the pinion or \( L(N) \)
- \( W_{KP} \): Radial load coefficient of pinion or \( L \) (given on the product pages)
- \( T_G \): Torque of gear or \( R(N \cdot m) \)
- \( n \): Number of teeth of pinion or \( L \)
- \( z \): Number of teeth of gear or \( R \)

Thrust load calculation

\[ W_{XP} = W_{NP} \times T_G \times \frac{n}{2} \]

- \( W_{XP} \): Thrust load on the pinion or \( L(N) \)
- \( W_{NP} \): Thrust load coefficient of pinion or \( L \) (given on the product page)
- \( T_G \): Torque of gear or \( R(N \cdot m) \)
- \( n \): Number of teeth of pinion or \( L \)
- \( z \): Number of teeth of gear or \( R \)

\[ W_{RG} = W_{KG} \times T_G \]

- \( W_{RG} \): Radial load on the gear or \( R(N) \)
- \( W_{KG} \): Radial load coefficient of gear or \( R \) (given on the product pages)
- \( T_G \): Torque of gear or \( R(N \cdot m) \)

\[ W_{XG} = W_{NG} \times T_G \]

- \( W_{XG} \): Thrust load of gear or \( R(N) \)
- \( W_{NG} \): Thrust load coefficient of gear or \( R \) (given on the product pages)
- \( T_G \): Torque of gear or \( R(N \cdot m) \)
Variations in tooth contact due to poor alignment of gears

If the gear engagement position is out of the normal position, variations in tooth contact, as illustrated below, may appear.

1. Tooth contact in case of a shaft-angle error
2. Tooth contact in case of a shaft-offset error
3. Tooth contact in case of a pinion set position error
4. Tooth contact in case of a gear set position error

Inquiries are now being accepted on our website.