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

M BS G 2 - 40 20 R

- **Material**: S45C
- **Type**: Straight Bevel Gears
- **Other Information**: Ground Gears

- **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

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>Catalog No.</th>
<th>Module</th>
<th>Gear Ratio</th>
<th>Material</th>
<th>Heat Treatment</th>
<th>Tooth Surface Finish</th>
<th>Tooth Surface Hardness</th>
<th>Profile &amp; Size</th>
<th>Quantity</th>
<th>Safety Coefficient</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBSG</td>
<td>2~4</td>
<td>15 ~ 60</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Cut</td>
<td>Ground 1</td>
<td>Ground</td>
<td>1 △</td>
<td></td>
<td>High speed reduction ratio, high efficiency, high rigidity and compact gear assembly.</td>
</tr>
<tr>
<td>SBSG</td>
<td>2~4</td>
<td>15 ~ 3</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Cut</td>
<td>Ground 2</td>
<td>Ground</td>
<td>2 △</td>
<td></td>
<td>Reasonably priced ground gear, yet remachinable except for the gear teeth.</td>
</tr>
<tr>
<td>KSP</td>
<td>1.5~1</td>
<td>15, 2 SM415</td>
<td>Carburized</td>
<td>Cut</td>
<td></td>
<td>Ground 0</td>
<td>Ground</td>
<td>0 △</td>
<td></td>
<td>Superior performance with regard to high speed, low noise, and low vibration.</td>
</tr>
<tr>
<td>MBSA - MBSB</td>
<td>2~6</td>
<td>15 ~ 3</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Cut</td>
<td>Ground 1</td>
<td>Ground</td>
<td>1 △</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>15 ~ 4</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Cut</td>
<td>Ground 2</td>
<td>Ground</td>
<td>2 △</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>15 ~ 2</td>
<td>SCM415</td>
<td>Carburized</td>
<td>Cut</td>
<td>Ground 2</td>
<td>Ground</td>
<td>2 △</td>
<td></td>
<td>A spiral bevel gear with a helix angle less than 10°. Reasonable force from the same directions straight bevel gear and have excellent performance.</td>
</tr>
<tr>
<td>SB - SBY</td>
<td>1~8</td>
<td>15 ~ 5</td>
<td>SCM415</td>
<td>Cut</td>
<td></td>
<td>Ground 2</td>
<td>Ground</td>
<td>2 △</td>
<td></td>
<td>Regular series of straight bevel gears for many uses.</td>
</tr>
<tr>
<td>SUB</td>
<td>1.5~1</td>
<td>15, 3 SUS30</td>
<td>Cut</td>
<td></td>
<td></td>
<td>Ground 2</td>
<td>Ground</td>
<td>2 △</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>15 ~ 3</td>
<td>SCM415</td>
<td>Cut</td>
<td></td>
<td>Ground 5</td>
<td>Ground</td>
<td>5 △</td>
<td></td>
<td>Injection molded, mass-produced products, suitable for office machines.</td>
</tr>
<tr>
<td>DB</td>
<td>0~0.5</td>
<td>2</td>
<td>SCM415</td>
<td>Cut</td>
<td></td>
<td>Ground 2</td>
<td>Ground</td>
<td>2 △</td>
<td></td>
<td>Injection molded, mass-produced products, suitable for office machines.</td>
</tr>
</tbody>
</table>

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

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. MBSG2-4020 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.

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.

Calculation assumptions for Bending Strength of Gears

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Catalog No.</th>
<th>MBSG</th>
<th>MBSA</th>
<th>MBSB</th>
<th>SBZG</th>
<th>MBSA</th>
<th>MBSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor X</td>
<td>1.2</td>
<td>1.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable bending stress [σ_bending]</td>
<td>47</td>
<td>21</td>
<td>19 (24.5)</td>
<td>10.5</td>
<td>1.5 (40%) with No Lubrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable Hertz stress [σ_Hertz]</td>
<td>166</td>
<td>90</td>
<td>49 (62.5)</td>
<td>41.3</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>Item No.</th>
<th>Catalog No.</th>
<th>MBSG</th>
<th>MBSA</th>
<th>MBSB</th>
<th>SBZG</th>
<th>MBSA</th>
<th>MBSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor X</td>
<td>1.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable loading bending stress [σ_bending]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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 Polyaramides Limited and "A Do-It-Yourself Guide to Gear Data" by Polyplastics 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_b, is calculated from JGMA404-01, 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 the values 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.

### 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 regrinding, 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 scraping will cause noise during operation.**

### 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 “Gear Forces” (Page 107).**

2. **For items with induction hardened teeth, such as S5B and S5B 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, f.**

3. **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.**

4. **PB plastic bevel gears are susceptible to changes due to temperature and humidity. Dimensions may change between, during, and after re-machining operations.**

5. **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.**

6. **For the handling conveniences, the SB8 and SBY series listed below have the tapped holes (180° apart, 2 places) on the holding surface.**

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>L (mm)</th>
<th>Top Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB8-4515</td>
<td>130</td>
<td>M10 deep 20</td>
</tr>
<tr>
<td>SBY-4020</td>
<td>160</td>
<td>M10 deep 20</td>
</tr>
<tr>
<td>SB8-4515</td>
<td>210</td>
<td>M10 deep 20</td>
</tr>
<tr>
<td>SBY-4015</td>
<td>160</td>
<td>M10 deep 20</td>
</tr>
<tr>
<td>SBY-4015</td>
<td>220</td>
<td>M10 deep 20</td>
</tr>
</tbody>
</table>

### 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.**

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**Bevel Gears**

**KHK Technical Information**

**Application Hints**

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

2. **If you are regrinding, it is important to pay special attention to locating the center in order to avoid runout.**

3. **Due to the thrust load of bevel gears, the gears, shafts, and bearings have the tendency to loosen up during operation.**

4. **When installing MBSA or MBSB 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.**

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**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**

- When the pinion is incorrect, the contact will occur in the middle of the flank and center of face width but somewhat closer to the toe.

**Mounting Distance Error**

- When the mounting distance of the pinion is incorrect, the contact will occur in the middle of the flank and center of face width but somewhat closer to the toe.

**Offset Error**

- When the pinion shaft is offset, the contact will occur 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°.
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 small motors (See the graph on the right).

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
\[
W_R = \text{Radial load on the pinion or L(N)}
\]
\[
W_R = W_{re} \times T_s \times \frac{z}{n}
\]

\[
W_{re} = \text{Radial load coefficient of pinion or L (given on the product pages)}
\]
\[
T_s = \text{Torque of gear or R(N-m)}
\]
\[
n = \text{Number of teeth of pinion or L}
\]
\[
z = \text{Number of teeth of gear or R}
\]

#### Thrust load calculation
\[
W_T = \text{Thrust load on the pinion or L(N)}
\]
\[
W_T = W_{re} \times T_s \times \frac{n}{z}
\]

\[
W_{re} = \text{Thrust load coefficient of pinion or L (given on the product page)}
\]
\[
T_s = \text{Torque of gear or R(N-m)}
\]
\[
n = \text{Number of teeth of pinion or L}
\]
\[
z = \text{Number of teeth of gear or R}
\]

### 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