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) Miter Gears

M MS G  2 - 20 R

Material
S  S45C
M  SCM415
SU  SUS303
L  SMF5040
P  MC901
D  DURACON

Type
M  Straight Miter Gears
MS  Spiral Miter Gears
AM  Angular Miter 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
We use Crowning method for gear cutting

KHK utilizes Gleason Coniflex No.104, 102 and 114 bevel gear generating machinery, also equipped for mass production of straight miter gears. You can count on a stable supply of economically priced straight miter gears from KHK.
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

Among KHK stock miter gears, there are products which are not interchangeable even when the module and the number of teeth are the same. Also, spiral miter gears require additional consideration since the right-hand mates with the left-hand spiral as shown in the table below.

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>SMA</th>
<th>SMB</th>
<th>SMC</th>
<th>MM</th>
<th>SM</th>
<th>SUM</th>
<th>SUMA</th>
<th>PM</th>
<th>DM</th>
<th>LM</th>
<th>SAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMA • SMB • SMC</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>○</td>
</tr>
<tr>
<td>MM</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
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<td>×</td>
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<tr>
<td>SM</td>
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<td>○</td>
<td>○</td>
<td>○</td>
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<td>×</td>
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<tr>
<td>SUM</td>
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<td>○</td>
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<td>×</td>
<td>×</td>
</tr>
<tr>
<td>SUMA</td>
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<td>○</td>
<td>○</td>
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<td>×</td>
<td>×</td>
<td>×</td>
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<td>×</td>
<td>×</td>
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<tr>
<td>PM</td>
<td>○</td>
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<td>○</td>
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<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
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<tr>
<td>DM</td>
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<td>×</td>
<td>×</td>
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<td>×</td>
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<tr>
<td>LM</td>
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<td>○</td>
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</tr>
<tr>
<td>SAM</td>
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<td>○</td>
<td>×</td>
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<td>○</td>
</tr>
</tbody>
</table>

2. Caution in Selecting Gear 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 the strength calculations, 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>MMSG</th>
<th>MMSG - MMSB</th>
<th>SM</th>
<th>SUM</th>
<th>LM</th>
<th>PM</th>
<th>DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of teeth of mating gear</td>
<td>Formula of bevel gears on bending strength (JGMA403-01)</td>
<td>The Lewis formula</td>
<td>Same number of teeth</td>
<td>——</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation</td>
<td>100rpm (600rpm for MMSG, MMSG and SMZG)</td>
<td>100rpm</td>
<td>——</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durability</td>
<td>Over 10 cycles</td>
<td>Allowable bending stress (kgf/mm²)</td>
<td>1.15 (40°C with No Lubrication)</td>
<td>m 0.5 4.0 m 0.8 4.0 m 1.0 3.5 m 1.5 1.8 (60°C) (40°C with Grease Lubrication)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact from motor</td>
<td>Uniform load</td>
<td>——</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact from load</td>
<td>Uniform load</td>
<td>——</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direction of load</td>
<td>Bidirectional</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable bending stress at root σflim (kgf/mm²)</td>
<td>47</td>
<td>21</td>
<td>19</td>
<td>10.5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Safety factor Kx</td>
<td>1.2</td>
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<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>Item</th>
<th>Catalog No.</th>
<th>Formula of bevel gears on bending strength (JGMA404-01)</th>
<th>Kinematic viscosity of lubricant</th>
<th>Gear support</th>
<th>Allowable Hertz stress σHlim (kgf/mm²)</th>
<th>Safety factor CK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Formula of bevel gears on bending strength (JGMA404-01)</td>
<td>100cSt (50°C)</td>
<td>Shafts &amp; gear box have normal stiffness, and gears are supported on one end</td>
<td>166</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kinematic viscosity of lubricant</td>
<td>100cSt (50°C)</td>
<td>Gear support</td>
<td>Allowable Hertz stress σHlim (kgf/mm²)</td>
<td>Safety factor CK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gear support</td>
<td>Shafts &amp; gear box have normal stiffness, and gears are supported on one end</td>
<td>166</td>
<td>90</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Allowable Hertz stress σHlim (kgf/mm²)</td>
<td>166</td>
<td>90</td>
<td>49</td>
<td>41.3</td>
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<td></td>
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<td>Safety factor CK</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</td>
<td>1.15</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. The units for the number of rotations (rpm) and the the stress (kgf/mm²) are adjusted to the units needed in the formula.

(Note 2) The allowable bending stress at the root σFlim 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) The values of the allowable bending stresses for DM m1.5 and the allowable root bending stress for LM gears are our own estimates.
**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.

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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 SMSG and SMS series, the hardness is high near the tooth root. When machining the front face, 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. PM plastic miter 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. If 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.
8. For items with induction hardened teeth, such as SMSG and SMS series, the hardness is high near the tooth root. When machining the front face, the machined area should be 4 to 6mm smaller than the dimension, J.

**2. Points of Caution in Assembling**

1. Since miter gears are cone shaped, they produce axial thrust forces. Specifically with regard to spiral miter 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 more technical information, please see the section “Gear Forces” (Page 107) of separate technical reference book.
2. If a miter 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 miter 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 miter gears, the gears, shafts and bearings have the tendency to loosen up during operation. Miter gears should be fastened to the shaft with keys and set screws, taper pins, step shafts, etc.
4. When installing MMSA or MMSB finished bore spiral miter 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.

**Example of Assembling**
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°.

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.

Application Examples

Automatic packaging machine (Miter gears - inset)

Electric components assembly line (Miter gears <SM and PM>)