# **Prices/Changes/Cancellations/Out of Stock**

#### Prices

① Made-to-order products, semi-custom orders, and semi-custom order J Series products are estimated separately. Contact your dealer.

(2) In addition, since the prices are per unit (excluding SRS), the total unit price of miters and the like is the set price.

③ Product prices may be changed without prior notice.

#### Changes and Cancellations

[Standard Machined Products 'Note 1, Made to Order Products, Semi-custom Products, Semi-custom J Series Products] Because production begins upon ordering, cancellations and changes cannot be made.

[KHK Quick-Mod Products, Custom Gears]

Because production begins upon ordering, cancellations and changes are difficult.

Changes may be possible in some cases, depending on modification status, but a further estimate will be required. Contact your dealer for details.

As the product is manufactured to customer-specified dimensions, it cannot be used elsewhere; therefore, returns are not possible.

Out of Stock

[Standard Gears (gears in stock), Standard Machined Products \*Note 1, KHK Quick-Mod Gears] Production takes place according to stock status, so there may not be sufficient quantities available as ordered. Some time may be required for production after orders.

Lead times may be longer depending on material acquisition status and modification processes.

\*Note 1 Standard machined products: J Series, F Series, R Series, E Series, Hardened Plus, Hardened Plus J Series





#### 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) Spur Gears



							d
Gears	SSG F S Ground Sp	Series ur Gears	SSG E S Ground Sp	Series our Gears	SSG R Ground S	Series our Gears	0,0
030		G		6			Helical
Page 58	Material: S450 <i>m</i> 2~3	Page 76	Material: S450 <i>m</i> 1.5~6	C Page 82	Material: S45 <i>m</i> 1.5~6	C Page 92	a a
Spur Gears	SSS Spur Pinio	S n Shafts	SS- Hardened S	H pur Gears	S: Spur (	S Gears	tern
	Material: \$450		Material: S450		Material: S45		Racks In
Page 100	m1, 1.5	Page 102	m1~6	Page 106	m0.5~10	Page 104	
ries ars	SS <sup>V</sup> Spur G	Y ears	SSA Spur G	AY Bears	SUS/S Stainless Stee	SUSA el Spur Gears	Racks &
	•	6	·	6	e	Do	er CP
Page 144	Material: S450 <i>m</i> 0.8, 1	Page 148	Material: S450 <i>m</i> 1	C Page 152	Material: SUS m1~4	Page 154	Mite
th Steel Core	PS/P Plastic Spi	SA ur Gears	SUM Stainless S	(B teel Hubs	PSU SUKB Assembled	KB I PSA Spur Gear	)
0	$\overline{\mathbf{O}}$		PSA Dedica	ted	<u>i</u>	3	Bevel
(SUS303)	Material: MC9	01	Material: SUS	303	Material: MC	901/SUS303	
Spur Gears)	m1~3	Page 170	<i>φ</i> 30~100	Page 180	m2~3	Page 181	Screw
)							Worm
Page 188	Plage or	ler KHK og	are hy ene	cifuing the	a Catalog N	umbers	earboxes
		ior ixinx ye	Juis by spe		Jatalog N	0110013.	Ğ

				-
Mate	rial	Туре		er ucts
Μ	SCM415	S	Spur Gears	od
K	SCM440			02
S	S45C	Other	Information	
SU	Stainless Steel	А	Without Hub	
Р	MC901	G	Ground Gears	
Ν	MC602ST	F	F-loc Hub Gears	
D	Polyacetal	R	Ring Gears	
BS	Brass	S	Pinion Shafts	
L	Sintered Metal Alloy	U	Plastic Gears with Steel Core	
		Υ	Thin Face Gears	
		н	Gear Teeth Induction Hardened	

### þ **Spur Gears**

## **Spur Gears**

### **Features**



To meet your applications, KHK stock gears are made in a variety of types, materials, configurations, modules and numbers of teeth. We also provide finished gears that are ready to use. Secondary operations can be performed to many of the products, allowing for a wider range of designs. The following table lists the main features.

Catalog Number	Module	Material	Heat Treatment	Tooth Surface Finish	Precision JIS B 1702-1:1998	Secondary Operations	Features			
MSGA/MSGB	1~4	SCM415	Carburized	Ground	N5	×	Fully hardened, ground and keyway machined gears with excellent accuracy, strength and abrasion resistance.			
KSG	1~3	SCM440	Thermal refined, gear teeth induction hardened	Ground	N6		Gears that have been tempered, hardened and ground that have excellent accuracy, strength and abrasion resistance. Secondary operations can be performed except for the teeth. This product is ideal for the pinion of the KRGF rack.			
SSGS	1.5~3	S45C	Thermal refined, gear teeth induction hardened	Ground	N7		Gears with shafts that have been tempered, hardened and ground. Secondary operations can be performed except for the teeth.			
SSG	0.5~10	8450	Gear teeth induction	Cround	NZ	_	Gears that have been hardened and ground with a good balance of accuracy, wear resistance and cost.			
SSAG	1~6	3430	hardened NOTE 1	Ground	117		Secondary operations are possible except for the teeth.			
кѕ	1.5~5	SCM440	Thermal refined	Cut	N8	0	Tempered gears with excellent bending strength. The teeth can be additionally hardened. This product is ideal for the pinion of the KRF rack.			
SSS	1, 1.5	S45C	Thermal refined NOTE 2	Cut	N8 NOTE 3	0	Gears with a tempered shaft.			
SS	0.5~10	S45C	_	Cut	N8 NOTE 2		Many lineups are available at a low price. The teeth			
SSA	1~5	0400		Out	NO NOTE 3		can be additionally hardened.			
SSY/SSAY	0.8, 1	S45C	_	Cut	N8 NOTE 3	0	Gears with narrow teeth. Suitable for light loads.			
SUS/SUSA	1~4	SUS303	_	Cut	N8	0	Stainless steel gears with rust resistance.			
SUSF	0.5, 1	SUS303	_	Cut	N8 NOTE 3	×	Stainless steel gears with rust resistance. Locking Hub allows easy attachment.			
DSF	0.5, 1	Polyacetal (SUS303)	_	Cut	N10 NOTE 3	×	Gears made of polyacetal. Locking Hub allows easy attachment.			
NSU	1~3	MC602ST (S45C)	_	Cut	N9	0	Steel hubs are fused and fixed to reinforced nylon gears for secure fastening.			
PU	1~2	MC901 (SUS303)	_	Cut	N9	0	Stainless steel hubs are fused and fixed to nylon gears for secure fastening.			
PS/PSA	1~3	MC901	_	Cut	N9	0	Nylon gears can be used with no lubrication.			
DS	0.5~1	Duracon (R) (M90-44) NOTE 4	_	Injection Molded	N12 equivalent		Low-priced gears made through injection molding. Suitable for light loads.			
BSS	0.5~1	Free-cutting Brass (C3604)	_	Cut	N8 NOTE 3	0	Brass gears with excellent machinability.			
SSR	2~3	S45C	_	Cut	N9	0	They have a ring shape with a large number of teeth.			

[NOTE 1] Products with module under 1 are thermal refined. Gear teeth are not hardened. Consistence Are the Possible Are the

[NOTE 2] SA-shaped products with module 1 have no material thermal refinement treatment.

[NOTE 3] The product accuracy class having a module under 1 corresponds to 'equivalent' as shown in the table.

[NOTE 4] "Duracon (R)" is a registered trademark of Polyplastics Co., Ltd. in Japan as well as other countries.

• KHK stock spur gears (m1.5 and higher) have semi-topping on the tooth tips.

Black products are KHK stock gears that have an applied black oxide coating for rust resistance.

#### **Application Examples** £03£03

KHK stock spur gears are widely used in various industrial machines including food machinery.

Fish processing machine manufactured by TOYO SUISAN KIKAI CO., LTD.



Food machinery by Jey Machine Co.



SSA/SS spur gears used in stirrers

High-speed automatic wire straightening/cutting machine manufactured by Takashima Sangyo Co.





SS spur gears used for wire feeder

Packing machine by New Max



## **KHK** Technical Information

#### Carton former





SS spur gears used in automatic carton forme



PS/PSA spur gears used in fully-automatic food forming machines



#### Electric wire winder by Sakuma Tekko KK.





### **Spur Gears**

### **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

(1) Basically, all spur gears, internal gears and racks can be paired as long as the module and pressure angle match. Products with different materials, tooth widths or accuracy can be mated.

#### 2. Caution in Selecting Gears Based on Gear Strength

The gear strength values shown in the product pages were computed by assuming the application environment in the table below. Therefore, they should be used as reference only. We recommend that each user computes their own values by applying the actual usage conditions. Also, F-loc hub spur gears and various F series that use the friction coupling method to fasten the gear shaft need additional consideration for starting torque.

#### Calculation of Bending Strength of Gears

Catalog Number Item	MSGA MSGB	SSGS	SSG SSAG	SSS,SS SSA,SSY SSAY,SSR	SS-H	SUS SUSA SUSF	BSS	KSG	KS	KS-H	SSG SSCPG Note 6	ZSTP Note 6	NSU	PU PS PSA	DSF DS
Formula NOTE 1	F	ormula	of spur an	d helical ge	ears c	n bend	ing s	trengt	h (JG	iMA4(	01-01	)	The	e Lewis fo	ormula
No. of teeth of mating gears	Sar	Same number of teeth (30 for SSGS, SSS, SSR) Racks							-						
Rotational Speed	6	00rpm ⊧	IOTE 2			100r	pm				40	Orpm	100rpm		
Design Life (Durability)				Ov	ver 10	<sup>7</sup> cycles							-		
Impact from motor	Uniform load Allowable bending stress (kgf/mm²)														
Impact from load	Uniform load m 0.5 4									<i>m</i> 0.5 4.0					
Direction of load	Bidirectional load (calculated with allowable bending stress of 2/3)							(40°C	m 0.8 4.0 m 1.0 3.5						
Allowable bending stress at root $\sigma_{\rm Flim}$ (kgf/mm²)	47 24.5 19 (24.5) Note 3 19 (24.5) Note 4 19 10.5 4 30 32 32 30 19 With no uvith no uvith no							(40°C with							
Safety factor SF	1.2									lubrication)	lubrication)				

#### Calculation of Surface Durability (Except where it is common with bending strength)

Formula NOTE 1	Formula of spur and helical gears on surface durability (JGMA402-01)								
Kinematic viscosity of lubricant	100cSt (50°C)								
Gear support	Symmetric support by bearings Note 5 Supported on one end.						end.		
Allowable Hertz stress $\sigma_{\rm Hlim}$ (kgf/mm <sup>2</sup> )	166	166 99 90 (62.5) Note 3 49 (62.5) Note 4 90 41.3 - 112 79 112 1						112	90
Safety factor SH	1.15								

[NOTE 1] The gear strength formula is based on JGMA (Japanese Gear Manufacturers Association) specifications, "MC Nylon Technical Data" by Mitsubishi Chemical Advanced Materials and "Duracon (R) Gear" by Polyplastics Co. The units for the rotational speed (rpm) and the stress (kgf/mm<sup>2</sup>) are adjusted to the units needed in the formula.

[NOTE 2] For semi-custom gears, the rotation speed is based on 300rpm.

[NOTE 3] For SSG Ground Spur Gears, with module under 1, thermal refining is applied. Allowable bending stress and allowable hertz stress values are shown in parentheses. [NOTE 4] For SSS Spur Pinion Shafts, with module over 1.5, tooth induction hardening is not applied. Allowable bending stress and allowable hertz stress values

are shown in parentheses. [NOTE 5] SSS Spur Pinion Shafts with module 1 or less (SA configuration) are set to cantilever support as they are single shaft types. [NOTE 6] For Nabtesco GH Series.

When selecting KHK standard gears, glance over the Cautions on Product Characteristics and Cautions on Performing Secondary Operations on Page 46.

- (1) Products not listed in this catalog or materials, modules, number of teeth and the like not listed in the dimensional tables can be manufactured as custom items. Please see Page 24 for more details.
- (2) The color and shape of the product images listed on the dimension table page of each product may differ from the actual product.

Be sure to confirm the shape in the dimension table before selection.

③ The details (specifications, dimensions, etc.) listed in the catalog may be changed without prior notice. Changes are announced on the KHK website.

Website URL: https://khkgears.net/new/ Overseas Sales Department: Phone: +81-48-254-1744 Fax: +81-48-254-1765 E-mail: info@khkgears.net

# Selecting the Gears



for the purpose.



load torque.

For provisional selection from this catalog



Step 3

Calculate the strength under the actual usage conditions.

strength calculation available on our website.

#### Use the strength calculation function on our website.



#### Bending strength

Calculated values of the strength at which the gear teeth do not break due to fatigue.



Example of failure due to insufficient bending strength

### **KHK Technical Information**

Determine the calculated load torque applied to the gear and the gear type suitable

Select provisionally from the allowable torque table in this catalog based on the

#### Calculate the strength formally using the various gear strength formulas. We recommend using the simple

th calculation of	Spur Gears O Racks O In	Ground Spur Gears (SSG) [SSG1-1	5) Stree	ngth Calculation (Outpu	it)	
ar of teeth	15	Ending Strength [JGM4401-0	1-1	Surface Ourability	(JGMA40	12-01Ĵ
Vidth	8	Allowable Tangential Force(kgf) 4	0.2652	Allowable Tangential	Force(kg	12.8927 B 0057
a finish	Cut & Ground	Allowable power (KW)	0.1861	Allowable power (kW	)	0.0596
~~~		(Operating condition input value) Mating type	[ Spur (	Geers ]		
	1.2	Meshing number of teeth	[15]	00000 B		
shaft Support	Bearing on One End . Be	Meshing Surface finish	Graut	d1		
	- Hole - Income - Income	Rotating Speed	600.0	1 cpm		
2	Unidirectional  Bidirectic	Number of repetitions	Above	10,000,000 1		
	kof N	Direction of Load	Elidica	ctionti 1		
_	and the control of th	Dimension Pactor of Root Stress	[1.4]			
It display Rese	t	Kinematic Viscosity of Lubricant	[ 150 V	G 100 ] cSt		
and the state of t	104 y	Method of Gear shaft Support	( Bearing	ig on Both Ends ]		
		Safety Factor	[1.2]			

#### Surface durability

Calculated values of the strength at which the gear teeth do not wear due to surface fatigue damage.



Example of wear due to insufficient surface durability

# **Spur Gears**

### **Product Precautions**

#### **Common Notes**

#### [Caution on Product Characteristics]

- (1) The allowable torque shown in the table are calculated values according to the assumed usage conditions. Please see Page 44 for more details.
- (2) The backlash values shown in the table are the theoretical values for the backlash in the normal direction of a pair of identical gears in mesh.
- (3) Significant variations in temperature or humidity can cause dimensional changes in plastic gears, including tooth diameter, bore, and backlash. The accuracy and tolerances shown in the catalog are values obtained when machining is performed.
- (4) For hole lengths 3.5x the bore or more, the hole center is out of H7 tolerance.
- (5) For bores of  $\phi$  4 or below, the bore tolerance is H8. As well, the tolerance is H8 for  $\phi$  5 or  $\phi$  6 bores with hole length (total length) 3x the bore or more.
- (6) Keyways are made according to JIS B1301 standards, Js9 tolerance. Also note that keyway tooth position alignment is not performed. (7) For products having a tapped hole, a set screw is included.
- (8) Products with S at the end of the Catalog No. are semi-custom stock products. For lead time details, see Page 38.
- (9) For S semi-custom standard products weighing 15 kg or more, eyebolt mounting screws (2-M12 depth 25 mm) are machined around the periphery of the boss side surface. Confirm the PCD of the screw on the website.

#### [Caution on Secondary Operations]

- (1) Please read "Cautions on Performing Secondary Operations" on Page 48 when performing modifications and/or secondary operations for safety concerns.
- (2) 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).
- (3) See Page 22 for more details on Hardened Plus (H Series and HJ Series).

#### [J Series]

- (1) Cancellation is not possible for made-to-order products. For lead time details, see Page 38.
- (2) Certain products which would otherwise have a very long tapped hole are counterbored. For details, please see the KHK website.
- (3) Black oxide is not re-applied to parts undergoing secondary operations.

(4) For bores over  $\phi$  50, the bore tolerance is H8.

#### MSGA/MSGB Ground Spur Gears

#### [Caution on Product Characteristics]

- (1) The keyway tolerance is the value before hardening.
- (2) Products marked with "\*\*" have a small amount of material between the corner of the keyway and the tooth root. This mode of failure must be considered when selecting these gears.
  - For details, please see the KHK website.

#### [Caution on Secondary Operations]

(1) No secondary operations can be performed on these finished gears due to the applied carburizing process.

#### SSGS Ground Spur Pinion Shafts

#### [Caution on Product Characteristics]

- (1) For the center distance of the profile shifted gear, please refer to "Center distance of stock spur gear meshing with profile shifted gear" on Page 56.
- (2) The backlash values shown in the table are the theoretical values for the normal direction for the internal ring in mesh with an SSG spur gear.

#### **SSAG Ground Spur Gears**

#### [Caution on Secondary Operations]

(1) A reference surface is set for gear grinding. Use the surface opposite from the markings as the reference surface for secondary operation.

#### SSS Spur Pinion Shafts

#### [Caution on Product Characteristics]

- (1) For the center distance of the profile shifted gear, please refer to "Center distance of stock spur gear meshing with profile shifted gear" on Page 102.
- (2) The backlash values shown in the table are the theoretical values for the normal direction for the internal ring in mesh with an SS spur gear.

#### SUSF/DSF F-loc Gears

#### [Caution on Product Characteristics]

- (1) F-loc gears are attached to the shaft by a friction coupling. Recommended shaft tolerances are g6, h6, or h7. Torque slippage should be considered when making a selection.
- (3) The tooth and hub mating section has a rotation-stop pin inserted.
- (4) To reduce heat generation, it is recommended to mate DSF with steel gears.

#### [Caution on Secondary Operations]

(1) Secondary operations cannot be performed, as this is a complete product.

#### NSU/PU Plastic Spur Gears with Steel Core

#### [Caution on Product Characteristics]

(1) When the core O.D is the same as the hub diameter, you may see some serration on the hub. There is no effect on the strength of the gear. (2) To reduce heat generation, it is recommended to mate them with steel gears.

#### [Caution on Secondary Operations]

(1) Because it affects the welded portion, there is no additional modification other than to the boss part.

#### **PS/PSA Plastic Spur Gears**

#### [Caution on Product Characteristics]

(1) To reduce heat generation, it is recommended to mate them with steel gears.

#### [J Series]

(1) Since tapped holes of plastic products are easily broken, avoid too much tightening when fastening screws. For some products which have a short tapped hole (products marked with "\*\*" tap size), fasten with torques less than 0.12N · m for M4, and 0.38N · m for M5.

#### SUKB Stainless Steel Hubs

#### [Caution on Product Characteristics]

- (1) The area where PSA Plastic Spur Gears are attached, with hub tolerance h7.
- (2) The friction coupling torques shown in the table are reference values calculated according to these set values; friction factors and fastening torques of the tapping screw.
- (3) Please refer to the assembly example below, and then attach the hub to the gear with the accessories, plain washers, spring washers and hexagon socket head cap screws.
- (4) In accordance with the fastening torque values shown in the dimension table, use a torque wrench and fasten hexagon socket head cap screws firmly, to attach the hub.
- be maintained. It is recommended to check the fasteners regularly and retighten when required.
- (6) For secure positioning, it is recommended to use dowel pins.

#### [Caution on Secondary Operations]

- (1) Datum plane for machining hubs is the outer circumference of the hub, where PSA Plastic Spur Gears are attached, and the flank of the flange is facing the hub.
- the mounting bolt head, using the S1KBK figure as reference.

#### **DS Injection Molded Spur Gears**

#### [Caution on Product Characteristics]

(1) The bore tolerance is -0.05 to -0.30, but it may be slightly higher at the center of the hole. (2) For the dimensional accuracy of each part, see the dimensional tolerance of molded items on Page 185. (3) To reduce heat generation, it is recommended to mate them with steel gears.

#### [Caution on Secondary Operations]

(1) As it is a molded item, bubbles may form inside the material. Avoid performing secondary operations.

#### SSR Steel Ring Gears (Spur Gears)

#### [Caution on Product Characteristics]

(1) The backlash values shown in the table are the theoretical values for the normal direction for the internal ring in mesh with an SS spur gear. (2) The bore tolerance is modified at H8, but there may be some errors as the ring shape deforms easily.

### **KHK** Technical Information

(2) Do not tighten the clamping screw without inserting a shaft, or the bore will be permanently deformed and will not accept a shaft.

(5) If a fastened hexagon socket head cap screw comes loose, the friction tightening torque values shown in the table can not

(2) For modifying tapped holes at the outer circumference of the hub, apply machining at positions which will not interfere with

# **Spur Gears**

## Spur Gears

## **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 your nearest distributor. E-mail: info@khkgears.net

### 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. Plastic gears and ring gears deform particularly easily, so please handle with care.

### 2. Caution on Performing Secondary Operations

- ① If reboring, it is important to pay special attention to locating the center in order to avoid runout.
- 2 The reference datum for gear machining is the bore. Therefore, 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.



- ④ The maximum bore size is dictated by the requirement that the strength of the hub is to be higher than that of the gear teeth. The maximum bore size should be 60% to 70% of the hub diameter (or tooth root diameter), and 50% to 60% for keyway applied modifications.
- (5) In order to avoid stress concentration, round the keyway corners.



- (6) To avoid problems of reduced gear precision and other manufacturing difficulties, do not attempt to machine the gears to reduce face widths.
- ⑦ When induction-hardening S45C products, thermal stress cracks may appear. Also, note that the precision grade of the product declines by 1 or 2 grades, as deformation on material may occur. If you require tolerance for bore or other parts, machining is necessary after heat treatment.

### Induction Hardening

If you apply induction hardening to the gear teeth of S45C products, you need to designate the hardness and where to apply the heat treatment. Below is an example of common specifications and KHK's specifications for hardening:

Common Specifications for Heat Treatment Hardened location: Tooth surface, or Tooth surface and Tooth root Hardness: Within 10 HRC in the range from 45 to **60 HRC** 

(Example: 48 to 58 HRC)

- KHK's Specifications for Heat Treatment Hardened location: Tooth surface, or Tooth surface and Tooth root Hardness: 50 to 60 HRC
- \* Hardness and Depth of Gear-teeth Induction Hardening

The hardening method and the state of the hardened teeth area vary depending on the size of dears.

Since different hardening treatment is applied in accordance with the module and number of teeth, the hardness level you designate is referred to as the hardness of the reference diameter. For some of our products, the hardness at tooth tip / root may not be equal to the hardness you designated. As to the effective case depth for S45C, it is specified by JIS, as "The distance from the surface of the case to the area with hardness HV450." The case depth differs from area to area of a tooth, so the depth cannot be specified.

#### 3. Points of Caution during Assembly

(1) The recommended center distance tolerance of KHK stock spur gears is H7 for ground gears and H8 for cut gears. Backlash may be adjusted by changing the center distance of mating gears. For the connection between center distance change amount and peripheral direction backlash amount, use the gear calculation software.



(2) The table below indicates the tolerance on the total length of KHK stock spur gears. Please refer to this data when designing gearboxes or other components.

Total Length Tolerance for Spur and Helical Gears

Total Length (mm)	Tolerance
30 or less	0 -0.10
31 to 100	0 -0.15
Over 100	0 -0.20

[Note] The following products are excluded from this table: Hardened plus. Spur pinion shafts. Injection molded spur gears, F-loc hub spur gears, and MC nylon products.

③ Spur gears produce no thrust forces; however, be sure to fasten them firmly with stepped shafts, or collars, to prevent shifting toward the shaft. Keyways are generally used in fastening gears to a shaft, and they should be fastened by applying drilled

KHK considers safety a priority in the use of our products. When handling, adding secondary operations, assembling, and operating KHK products, please be aware of the following issues in order to prevent accidents.

#### Warning: Precautions for preventing physical and property damage

- 1. When using KHK products, follow relevant safety regulations (Occupational Safety and Health Regulations, etc.). 2. Pay attention to the following items when installing, removing, or performing maintenance and inspection of the product.
- Turn off the power switch.
- Do not reach or crawl under the product.
- 3 Wear appropriate clothing and protective equipment for the work.

#### **Caution:** Cautions in preventing accidents

- 1. Before using a KHK product, read the precautions in the catalog carefully in order to use it correctly.
- Avoid use in environments that may adversely affect the product. 3. Our products are manufactured under a superior quality control system based on the ISO9000 quality management system; if you
- notice any malfunctions upon purchasing a product, please contact the supplier.

holes for set screws, or applying flats to the shaft, in case of fastening only with set screws.

There are also methods of secure settings using parts for engaging the hole and the axis.

- (4) Verify that the two shafts are parallel. Incorrect assembly will lead to uneven teeth contact which will cause noise and wear. (After assembly, check the tooth contact by painting a thin layer of red lead primer or the like on the gear teeth, meshing them together and rotating them.)
- Test example: Abrasion occurred on SSG3-30 due to poor edge contact (only 30% with proper contact).



Poor tooth contact and pitting

In this example, the gear oil used is equivalent to the JIS gear oil category 2, No. 3 The design conditions were load torque at 278 rpm, 42.5 kg/m (12 kW), 1.5 times the allowable bending strength, and 3 times the allowable surface durability torque. The pitting occurred on the poor tooth contact area after 60 hours of continuous operation.

#### 4. Cautions on Starting

- (1) Check the following items before starting.
  - Are the gears fastened 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 dears.
- ③ If there is any abnormality such as noise or vibration during startup, stop the operation immediately and check the assembly condition such as tooth contact, eccentricity and looseness.