MSGA · MSGB
Ground Spur Gears

*m*1 ～ 4 Page 38

SSGS
Ground Spur Pinion Shafts

*m*1.5 ～ 3 Page 50

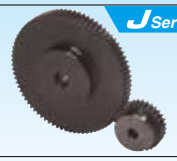
SSG
Ground Spur Gears

*m*0.5 ～ 6 Page 52

SSS
Spur Pinion Shafts

*m*0.5 ～ 3 Page 106

SS
Steel Spur Gears



*m*0.5 ～ 10 Page 108

SSA
Steel Hubless Spur Gears

*m*1 ～ 5 Page 200

SSY
Steel Thin Face Spur Gears

*m*0.8, 1 Page 206

SSAY
Steel Hubless Thin Face Spur Gears

*m*1 Page 210

SSAY/K
Spur Gears with Built-In Clamps

*m*0.8, 1 Page 212

LS
Sintered Metal Spur Gears

*m*0.5, 0.8 Page 216

SUS · SUSA
Stainless Steel Spur Gears

*m*1 ～ 4 Page 218

SUSL
Stainless Steel Fairloc Hub Spur Gears

*m*0.5 ～ 1 Page 266

DSL
Acetal Fairloc Hub Spur Gears

*m*0.5 ～ 1 Page 270

NSU
Plastic Spur Gears with Steel Core

*m*1 ～ 3 Page 274

PU
Plastic Spur Gears with Stainless Steel Core

*m*1 ～ 2 Page 280

PS · PSA
Plastic Spur Gears

*m*1 ～ 3 Page 282

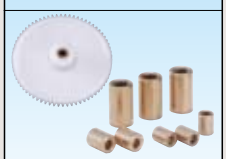
SUKB
Stainless Steel Hubs

φ30 ～ 100 Page 334

DS
Injection Molded Spur Gears

*m*0.5 ～ 1 Page 336

BB
Sintered Metal Bushings



φ5 ～ 8 Page 338

BSS
Brass Spur Gears

*m*0.5 ～ 1 Page 340

SSR
Steel Ring Gears (Spur Gears)

*m*2 ～ 3 Page 346

Spur 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 the Catalog Numbers.

(Example) Spur Gears

S S G 1 - 15

- 15: No. of Teeth (15)
- 1: Module (1)
- G: Others (Ground Gear)
- S: Type (Spur Gear)
- S: Material (S45C)

Material

S	S45C
M	SCM415
SU	SUS303
P	MC901
N	MC602-ST
D	DURACON
BS	Free-Cutting Brass C3604
L	SMF5040

Type

S	Spur Gears

Other Information

A	Hubless Gears
G	Ground Gears
L	Fairloc Hub Gears
R	Ring Gears
S	Pinion Shafts
U	Plastic Gears with Steel Core
Y	Thin Face 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

To meet your requirements, KHK stock gears are made in a variety of types, materials, configurations, modules and numbers of teeth. We also offer products that allow secondary operations to be performed on the bores, shafts, outside diameters, keyways and set screws. The following table lists the main features.

Catalog No.	Module	Material	Heat Treatment	Tooth Surface Finish	Precision JIS B 1702-1:1998	Secondary Operations	Features
MSGA・MSGB	1～4	SCM415	Carburized	Ground	N5	×	High strength, abrasion-resistant and compact.
SSGS	1.5～3	S45C	Thermal refined・Gear teeth induction hardened	Ground	N7	△	Ground shaft pinions that allow modification of shafts to fit your bearings.
SSG	0.5～6	S45C	Gear teeth induction hardened NOTE 1	Ground	N7	△	Although heat treatment is applied to tooth area, secondary operation can be added. Finished products for J Series are also available.
SSS	0.5～3	S45C	Thermal refined NOTE 2	Cut	N8 NOTE 3	○	For the SS series, Shaft-Pinions with a small number of teeth (10 to 13 teeth) are available.
SS	0.5～10	S45C	—	Cut	N8 NOTE 3	○	A low priced, general usage gear with a large selection of modules and number of teeth, finished products for J Series are also available.
SSA	1～5	S45C	—	Cut	N8	○	Hubless gears for lighter and more compact applications.
SSY	0.8、1	S45C	—	Cut	N8 NOTE 3	○	Narrower face gears for light-duty applications.
SSAY	1	S45C	—	Cut	N8	○	Hubless and narrow faces for even lighter and more compact gears.
SSAY/K	0.8、1	S45C	—	Cut	N8 NOTE 3	△	Compact sized gears can be clamped to the shafts without a hub.
LS	0.5、0.8	SMF5040 (Equiv. to S45C)	—	Sintered	N8 NOTE 3	○	Low cost due to elimination of machining and reduction in wasted material.
SUS・SUSA	1～4	SUS303	—	Cut	N8	○	Stainless steel gears for more rust-resistant gears. Finished products for J Series are also available.
SUSL	0.5～1	SUS303	—	Cut	N8 NOTE 3	△	Smaller module gears which clamp to the shafts without any keys or set screws.
DSL	0.5～1	Acetal (SUS303)	—	Cut	N10 NOTE 3	△	These rust-resistant gears can be clamped to the shafts without any keys or set screws.
NSU	1～3	MC602ST (S45C)	—	Cut	N9	○	Nylon teeth with steel hubs that can have keyways and set screws added.
PU	1～2	MC901 (SUS303)	—	Cut	N9	○	Nylon teeth with stainless steel hubs for rust-resistance.
PS・PSA	1～3	MC901	—	Cut	N9	○	Possible to operate without lubrication. Suitable for food processing machines. Finished products for J Series are also available.
DS	0.5～1	Duracon (M90-44)	—	Injection Molded	Equiv. to N12	△	Low cost, mass-produced products suitable for light duty office machines.
BSS	0.5～1	Free-cutting Brass (C3604)	—	Cut	N8 NOTE 3	○	Small module brass spur gears suitable for mating with DS gears.
SSR	2～3	S45C	—	Cut	N9	○	Allows large gear ratios. Can also be used as segment gears and corner racks.

(NOTE 1) Products with module less than 0.8 are thermal refined, without gear teeth hardened.
(NOTE 2) SA-shaped products with module less than 1 have no material thermal refinement treatment.
(NOTE 3) For products which are smaller than module 0.8, the accuracy grade is equivalent to the value shown.

○ Possible △ Partly possible × Not possible

- **By chamfering the corners of the top land, gear noise is reduced, and the chances of damage due to handling and transportation are decreased. All KHK gears larger than m1.5 have their teeth chamfered.**
- **Black colored products are KHK stock gears that have black oxide coating for rust resistance; this 'blackness' is a product characteristic of KHK stock 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 before the final selection. Use of catalog numbers when ordering will simplify and expedite the processing of your order.

1. Caution in selecting the mating Gears

① Basically, all spur gears, internal gears and racks can be paired as long as the module matches. The product with different materials, tooth widths, or methods of cutting the teeth can be mated.

② When using a pinion with an internal gear with a small difference in the numbers of teeth, there are possibilities for involute interference, trochoid interference and trimming interference. See the internal gear interference portion of the technical section to avoid problems in assembling these items. (Page 367)

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 his own values by applying the actual usage conditions. Also, SUSL Fairloc hub spur gears, DSL Fairloc hub spur gears and SSAY/K spur gears with built-in clamps need additional considerations of the starting torque.

The table below contains the assumptions established for various products in order to compute gear strengths.

■ Calculation of Bending Strength of Gears

Item \ Catalog No.	MSGA MSGB	SSGS	SSG	SSS,SS,SSA SSY,SSAY SSAY/K SSR	SUS SUSA SUSL LS	BSS	NSU	PU PS PSA	DSL DS
Formula NOTE 1	Formula of spur and helical gears on bending strength (JGMA401-01)						The Lewis formula		
No. of teeth of mating gears	Same number of teeth (30 for SSGS、SSS、SSR)						——		
Rotation	600rpm			100rpm			100rpm		
Durability	Over 10^7 cycles						——		
Impact from motor	Uniform load						Allowable Bending Stress(kgf/mm^2)		
Impact from load	Uniform load						1.38 (40℃ with No Lubrication)	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 stresss at root σ_{Flim} (kgf/mm^2) NOTE 1	47	24.5	19 (24.5)Note 3	19 (24.5)Note 4	10.5	4			
Safety factor S_F	1.2								

■ 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℃)					
Gear support	Symmetric support by bearings Note 5					
Allowable Hertz stress σ_{Hlim} (kgf/mm^2)	166	99	90 (62.5) NOTE 3	49 (62.5) NOTE 4	41.3	——
Safety factor S_H	1.15					

〔NOTE 1〕 JGMA (Japanese Manufacturers' Association), "MC Nylon Technical Data" of Nippon Polypenco Limited and "Duracon Gear" of Polyplastic Co. The units for rotational speed (rpm) and the load (kgf/mm2) were matched to the units needed in the equation.

〔NOTE 2〕 Since the load is bidirectional, the allowable bending stress at root σ_{Flim}, calculated from JGMA 401-01, is set to 2/3 of the value.

〔NOTE 3〕 For SSG Ground Spur Gears, with module 0.8 or lesser, thermal refining is applied. Allowable bending stress and allowable hertz stress are referred to as the value shown in the parentheses.

〔NOTE 4〕 For SSS Spur Pinion Shafts, with module over 1.5, teeth induction hardening is not applied. Allowable bending stress and allowable hertz stress are referred to the value shown in the parentheses.

〔NOTE 5〕 SSS Spur Pinion Shafts with module 1.0 or lesser (SA configuration) are set to cantilever support as it is a single shaft type.

■ Definition of bending strength by JGMA 401-01(1974)

The allowable bending strength of a gear is defined as the allowable tangential force at the pitch circle based on the mutually allowable root stress of two meshing gears under load.

Example of the failure due to insufficient bending strength.

■ Definition of surface durability by JGMA 402-01(1975)

The surface durability of a gear is defined as the allowable tangential force at the pitch circle, which permits the force to be transmitted safely without incurring surface failure.

Example of the defacement due to insufficient surface durability.

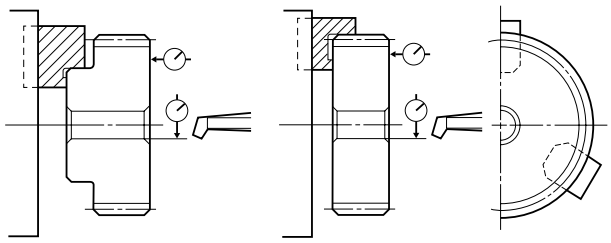
Application Hints

In order to use KHK stock gears safely, carefully read the Application Hints before proceeding. If there are questions or if you require clarifications, please contact our technical department or your nearest distributor.

KHK CO., LTD. TECHNICAL DEPARTMENT
PHONE: 81-48-254-1744 FAX: 81-48-254-1765
E-mail export@khkgears.co.jp

1.Caution on Performing Secondary Operations

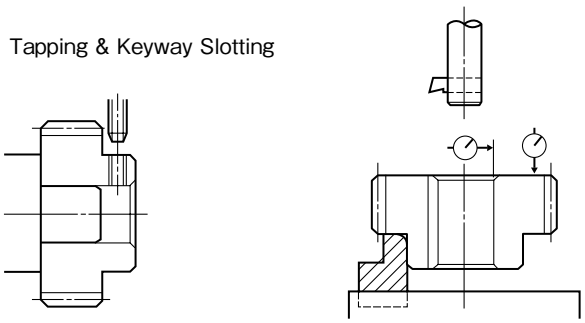
① If you are reboring, it is important to pay special attention to locating the center in order to avoid runout.
② The reference datum for gear cutting is the bore. Therefore, use the bore for locating the center. If it is too difficult to do for small bores, the alternative is to use one spot on the bore and the runout of the side surface.
③ If the rework requires using scroll chucks, we recommend the use of new or rebored jaws for improved precision. If chucking by the teeth, please apply the pressure carefully to avoid crushing the teeth which will lead to noisy gears.



Lathe Operations

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 teeth root diameter), and 50% to 60% for keyway applied modifications.
⑤ In order to avoid stress concentration, leave radii on the keyway corners.

Tapping & Keyway Slotting



⑥ To avoid problems of reduced gear precision and other manufacturing difficulties, do not attempt to machine the gears to reduce face widths.
⑦ If you apply induction hardening on gear teeth, please be aware of potential thermal stress cracks. 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.

Heat Treatment

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:

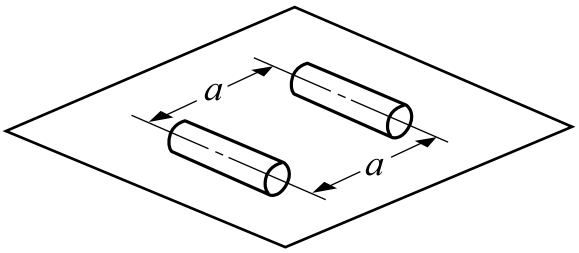
● Common Specifications for Heat Treatment
Area: Tooth surface, or, Tooth surface and Tooth root
Hardness: Within 10 HRC in the range from 45 to 60 HRC. (e.g. 48 - 58 HRC)

● KHK's Specifications for Heat Treatment
Area: Tooth surface, or, Tooth surface and Tooth root
Hardness: From 45 to 55 HRC.

＊Hardness and Depth of Gear-teeth Induction Hardening
The hardening method and the state of hardened teeth area are varied depending on the size of gears. 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 pitch line. For some of our products, there may be a case that 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.

2. Points of Caution in Assembling

① KHK stock spur gears are designed to give the proper backlash when assembled using the center distance given by the formula below (center distance tolerance of H7 – H8).
Backlash may be adjusted by changing the center distance of mating gears. For more information, please consult the technical section on gear backlash (page 648).



$a = m(Z_1+Z_2)/2$

where
a : Center Distance
m : Module
Z_1 : No. of teeth of pinion
Z_2 : No. of teeth of gear

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

■ Overall Length Tolerance for Spur and Helical Gears

Overall Length(mm)	Tolerance
Under 30	0 − 0.10
Over 30 Under 100	0 − 0.15
Over 100	0 − 0.20

(Note) Following products are excluded from this table: Spur pinion shafts, Injection molded spur gears, Fairloc 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 secured by applying drilled 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 a MACHALOCK, a Posi-Lock, or a Shupan-ring, which are parts for the 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, the gear mesh can be checked by applying a contact pattern compound and rotating the gears.)

■ Test example: Abrasion occurred on SSG3-30 due to poor edge contact (only 30% with proper contact).

Poor tooth contact and pitting

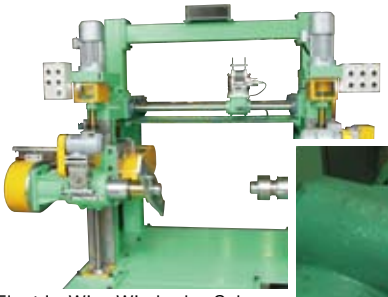
In this example, the gear oil used is equivalent to the JIS gear oil category 2, No. 3
The design conditions were load torque at 278 rpm, 42.5 kg/m (12 kW), 1.5 times the allowable bending strength, and 3 times the allowable surface durability torque. The pitting occurred on the poor tooth contact area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

Application Examples

Full-automatic Forming Machine by Jey Machine Co.
SSA and SS Spur Gears are used for stirring devices.

Takashima High-Speed Wire Straightening & Cutting Machines by Takashima Sangyo Co., Ltd.
SS Spur Gears are used at the feeder.

Automatic Packing Machine by New Max
SS Spur Gears, segment shaped by secondary operation, are used at the crimping device.



Electric Wire Winder by Sakuma Tekko KK.
SS Spur Gears are used at the stopper of handgrip.