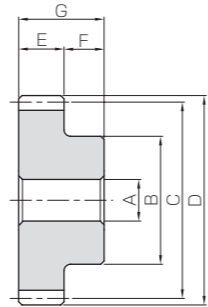


Specifications	
Precision grade	JIS grade N9 (JIS B1702-1:1998)
Reference section of gear	Normal plane
Gear teeth	Standard full depth
Normal pressure angle	20°
Helix angle	45°
Material	MC901
Heat Treatment	—

* The precision grade of these products is equivalent to the value shown in the table.



S1

Catalog Number	Module	No. of teeth	Direction of spiral	Shape	Bore		Pitch dia.	Outside dia.	Face width	Hub width	Total Length
					A	B					
KPN1-13R KPN1-13L	m1	13	R L	S1	6	15	18.38	20.38	10	10	20
KPN1-15R KPN1-15L		15	R L				21.21	23.21			
KPN1-20R KPN1-20L		20	R L				28.28	30.28			
KPN1.5-10R KPN1.5-10L	m1.5	10	R L	S1	6	16	21.21	24.21	15	10	25
KPN1.5-13R KPN1.5-13L		13	R L				27.58	30.58			
KPN1.5-15R KPN1.5-15L		15	R L				31.82	34.82			
KPN1.5-20R KPN1.5-20L		20	R L				42.43	45.43			
KPN2-10R KPN2-10L	m2	10	R L	S1	10	22	28.28	32.28	20	15	35
KPN2-13R KPN2-13L		13	R L				36.77	40.77			
KPN2-15R KPN2-15L		15	R L				42.43	46.43			
KPN2-20R KPN2-20L		20	R L				56.57	60.57			
KPN2.5-10R KPN2.5-10L	m2.5	10	R L	S1	10	26	35.36	40.36	22	16	38
KPN2.5-13R KPN2.5-13L		13	R L				45.96	50.96			
KPN2.5-15R KPN2.5-15L		15	R L				53.03	58.03			
KPN2.5-20R KPN2.5-20L		20	R L				70.71	75.71			
KPN3-10R KPN3-10L	m3	10	R L	S1	12	34	42.43	48.43	25	18	43
KPN3-13R KPN3-13L		13	R L				55.15	61.15			
KPN3-15R KPN3-15L		15	R L				63.64	69.64			
KPN3-20R KPN3-20L		20	R L				84.85	90.85			

Catalog Number	Allowable torque (N-m)		Allowable torque (kgf-m)		Backlash (mm)	Weight (kg)
	Bending strength	Surface durability	Bending strength	Surface durability		
KPN1-13R KPN1-13L KPN1-15R KPN1-15L KPN1-20R KPN1-20L	—	0.19	—	0.019	0.18~0.32	0.0045
		0.29		0.029	0.20~0.34	0.0064
		0.66		0.068		0.012
KPN1.5-10R KPN1.5-10L KPN1.5-13R KPN1.5-13L KPN1.5-15R KPN1.5-15L KPN1.5-20R KPN1.5-20L	—	0.29	—	0.029	0~0.38	0.0077
		0.62		0.063		0.014
		0.93		0.095		0.018
		2.14		0.22		0.031
KPN2-10R KPN2-10L KPN2-13R KPN2-13L KPN2-15R KPN2-15L KPN2-20R KPN2-20L	—	0.66	—	0.068	0~0.42	0.018
		1.42		0.14		0.034
		2.14		0.22		0.046
		4.84		0.49		0.081
KPN2.5-10R KPN2.5-10L KPN2.5-13R KPN2.5-13L KPN2.5-15R KPN2.5-15L KPN2.5-20R KPN2.5-20L	—	1.27	—	0.13	0~0.44	0.031
		2.68		0.27		0.055
		4.03		0.41		0.075
		9.07		0.92		0.15
KPN3-10R KPN3-10L KPN3-13R KPN3-13L KPN3-15R KPN3-15L KPN3-20R KPN3-20L	—	2.14	—	0.22	0~0.52	0.054
		4.51		0.46		0.094
		6.75		0.69		0.12
		15.0		1.53		0.21

- [Caution on Product Characteristics]
- ① Significant variations in temperature or humidity can cause dimensional changes in plastic gears, including bore size (H8 when produced), tooth diameter, and backlash. Please see the section "Design of Plastic Gears" in our separate technical reference book. (Page 100).
 - ② When mating screw gears are made of the same material, they may cause abrasion and scoring. It is recommended to mate screw gears composed of different materials.
 - ③ The allowable torque shown in the table are calculated values according to the assumed usage conditions. Please see Page 342 for more details.
 - ④ 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.
 - ⑤ For offset shaft applications, match a RH with a RH, or LH with a LH, to make a set of screw gears. For parallel shaft applications, mesh opposite hands (RH and LH) of helical gear sets. Please see Page 342 for more details.

- [Caution on Secondary Operations]
- ① Please read "Cautions on Performing Secondary Operations" (Page 343) when performing modifications and/or secondary operations for safety concerns.
 - ② Avoid performing secondary operations that narrow the tooth width, as it affects precision and strength.
 - ③ Plastic gears are susceptible to the effects of temperature and moisture. Dimensional changes may occur while performing secondary operations and during post-machining operations.

* In regard to MC Nylon gears, other materials are available for plastic gears, including Ultra High Molecular Weight Polyethylene (U-PE), which has excellent abrasion resistance and resin conforming to the Plastic Implementation Measure (PIM). A single piece order is acceptable and will be produced as a custom-made gear.

Features

KHK stock screw gears come in four materials, S45C, SUS303, CAC702 (old JIS A ℓ BC2) and MC nylon, in modules 1~4 and numbers of teeth from 10 to 30.

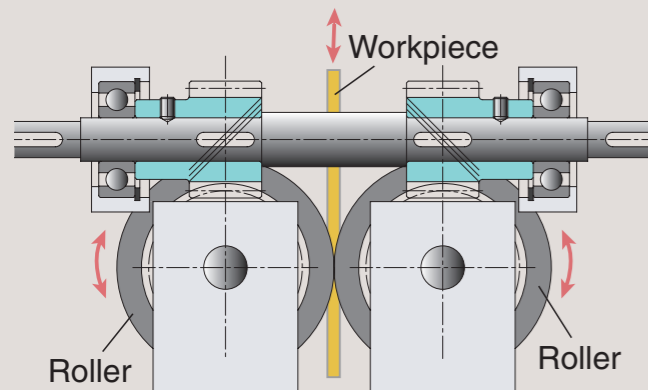
Catalog Number	Module	Material	Heat Treatment	Tooth Surface Finish	Precision JIS B 1702-1:1998	Secondary Operations	Features
KSN	1 to 4	S45C	—	Cut	N9	○	Popular screw gears. Additionally, gear tooth induction hardening secondary operations can be performed. J Series products are also available.
KSUN	1 to 3	SUS303	—	Cut	N9	○	Suitable for food machinery due to SUS303's rust-resistant qualities.
KAN	1 to 4	CAC702 (A ℓ BC2)	—	Cut	N9	○	Aluminum bronze made products have excellent wear resistance.
KPN	1 to 3	MC901	—	Cut	N9	○	Light-weight products made of MC Nylon can be used without lubrication.

○ Possible △ Partly possible × Not possible

Application Examples

KHK stock screw gears are used in various labor-saving machines including feeding devices.

■ Design example of feeding device (not a design for machinery or a device in actual use)



Rotate the rollers in reverse with one input shaft and move the pinched workpiece vertically

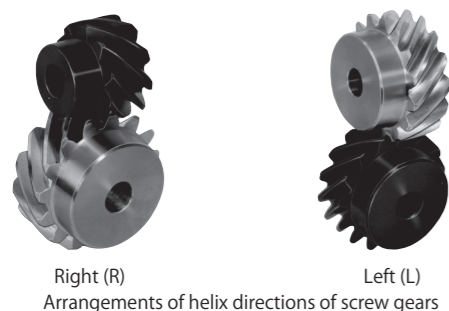
Selection Hints

Please select the most suitable products by carefully considering the characteristics of items and contents of the product tables. Since screw gears come in right- or left-hand helix, make sure to include the letter "R" or "L" in the catalog number when you order.

1. Caution in Selecting the Mating Gears

Screw gears are used for offset shafts. Whether the shafts are paralleled offset or skewed offset depends on the helix directions of the mating gears.

Direction of shaft	Arrangement of helix hands
Skewed Axes	RH-RH or LH-LH
Parallel Axes	RH-LH



Right (R) Left (L)
Arrangements of helix directions of screw gears

2. Caution in Selecting Gears Based on Gear Strength

The allowable surface strengths listed in the product pages were derived using the Niemann formula as reference values. (Used with skewed axes)

There is a paucity of data on the strength of screw gears. The values of constant K_0 used in the calculations, which depend on the material of the mating gears, are our estimates. The mathematic expression below shows the Niemann formula to determine allowable tangential force F_t (kgf) and allowable torque T (kgf·m) on a basic circle.

$$F_t = 1.43 d_1^2 f_z K_s$$

$$T = \frac{F_t d_1}{2000}$$

Here, d_1 : standard pitch diameter of pinion (mm)
 f_z : coefficient based on no. of teeth combination
 K_s : coefficient based on materials and sliding speed

$$K_s = K_0 \frac{2}{2 + V_s}$$

Here, K_0 : coefficient based on material selection
 V_s : sliding speed (m/s)

$$V_s = \frac{\pi n d_1}{60000 \cos \beta}$$

Here, n : rotational speed (rpm)
 β : helix angle (45°)

■ f_z value

Z ₂ \ Z ₁	10	13	15	20	26	30
10	1.538					
13	2.005	1.538				
15	2.279	1.786	1.538			
20	2.963	2.329	2.053	1.538		
26	3.695	2.963	2.588	2.005	1.538	
30	4.161	3.350	2.963	2.279	1.786	1.538

■ Setting values depending on usage conditions

Catalog Number	Mating gear	K_0 value	Maximum allowable sliding speed m/s	No. of teeth of mating gears	Rotational Speed
KSN	SN	0.0030	2.5	Same no. of teeth	100 rpm
KSUN	SN	0.0030 Note 1	2.5 Note 1		
KAN	SN	0.0050	5		
KPN	SN	0.0030 Note 1 (0.0021)	2.5 Note 1 (1.0)		

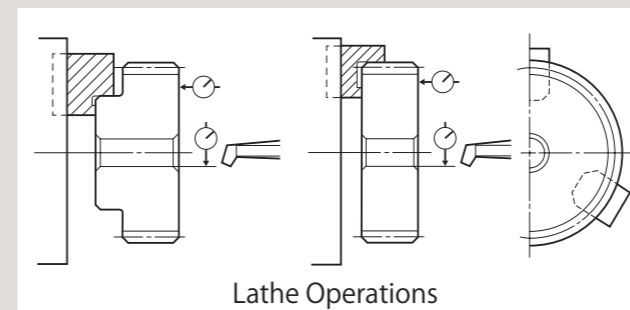
[NOTE 1] K_0 values and the maximum allowable sliding speed of KSUN & KPN products are set by KHK. Screw gears are basically used with lubrication. When using PN products without lubrication, the parenthetical values shown in the table are applied.

Application Hints

In order to use KHK stock screw gears safely, read the Application Hints carefully before proceeding. Please refer to Page 26 for "Cautions on Handling" and Page 27 for "Cautions on Starting".

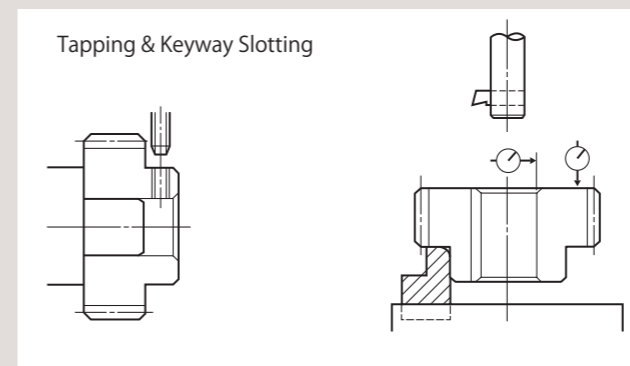
1. Cautions on Performing Secondary Operations

- If re boring, it is important to pay special attention to locating the center in order to avoid runout.
- 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.
- If reworking using scroll chucks, we recommend the use of new or re bored jaws for improved precision. Please exercise caution not to crush the teeth by applying too much pressure. Any scarring will cause noise during operation.



Lathe Operations

- 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.
- In order to avoid stress concentration, round the keyway corners.



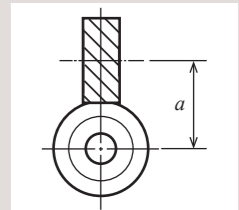
Tapping & Keyway Slotting

2. Points of Caution during Assembly

- KHK stock screw gears are designed to give the proper normal direction backlash when assembled using the center distance given by the formula below with a tolerance of H7 to H8. The amount of backlash is given in the product table for each gear.

$$a = \frac{d_1 + d_2}{2}$$

Where
 a : Center distance
 d_1 : Pitch diameter of pinion
 d_2 : Pitch diameter of gear



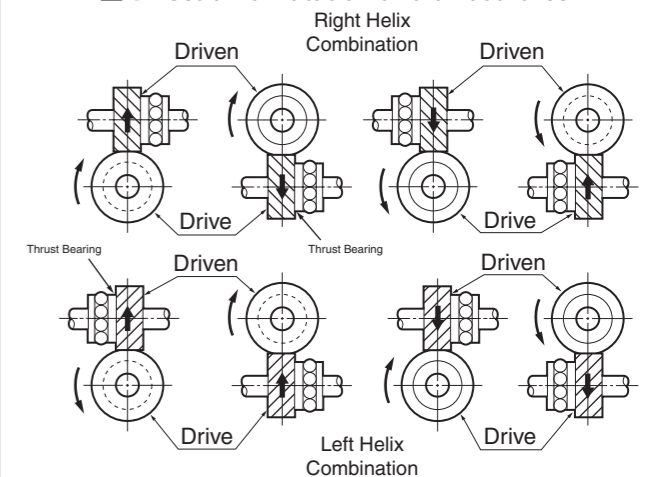
② Total Length Tolerance for Screw Gears

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

[NOTE] KPN Plastic Screw Gears are excluded.

- Due to the helix of screw gears, they produce axial thrust forces. The bearings must be selected properly to be able to handle these thrust forces. The directions of thrust change with the direction of helix and the direction of rotation as illustrated below.

■ Direction of rotation and thrust force



[NOTE] For parallel shaft applications, see the Application Hints for KHK Helical Gears (Page 167).

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

- When using KHK products, follow relevant safety regulations (Occupational Safety and Health Regulations, etc.).
- 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.
 - Wear appropriate clothing and protective equipment for the work.

⚠ Caution Cautions in Preventing Accidents

- 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.
- 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.