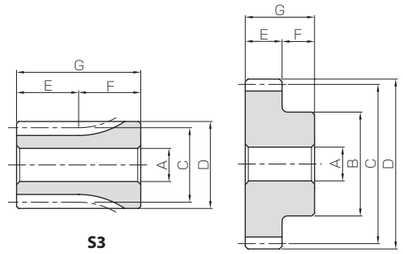
Stainless Steel Spur Gears J Series

Specifications	
Precision grade	JIS grade N8 (JIS B1702-1: 1998)*
Gear teeth	Standard full depth
Pressure angle	20°
Material	SUS303
Heat Treatment	—
Tooth hardness	(less than 187HB)

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



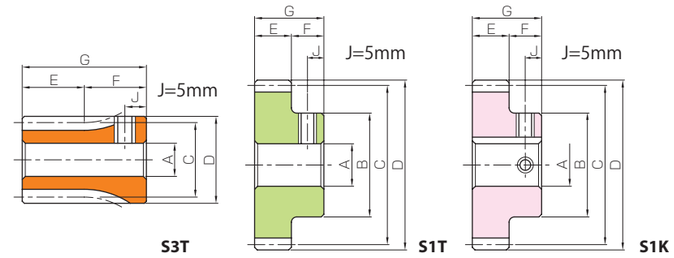
Catalog Number	No. of teeth	Shape	Bore A_{H7}	Hub dia. B	Pitch dia. C	Outside dia. D	Face width E	Hub width F	Total Length G	Allowable torque (N·m) Bending strength	Allowable torque (N·m) Surface durability	Allowable torque (kgf·m) Bending strength	Allowable torque (kgf·m) Surface durability	Backlash (mm)	Weight (kg)
KSUS1-15	15	S3	8	17	15	17	10	20	30	2.04	0.12	0.21	0.013	0.08~0.18	0.037
KSUS1-16	16			18	16	18				2.26	0.14	0.23	0.015		0.044
KSUS1-18	18			20	18	20				2.71	0.18	0.28	0.019		0.057
KSUS1-20	20	S1		16	20	22		10	20	3.18	0.23	0.32	0.024		0.032
KSUS1-22	22			18	22	24				3.65	0.29	0.37	0.029		0.042
KSUS1-24	24			20	24	26				4.13	0.35	0.42	0.036		0.052
KSUS1-25	25			20	25	27				4.37	0.38	0.45	0.039		0.055
KSUS1-28	28			23	28	30				5.11	0.48	0.52	0.049		0.073
KSUS1-30	30			25	30	32				5.60	0.56	0.57	0.057		0.086
KSUS1-32	32			26	32	34				6.11	0.64	0.62	0.066		0.096
KSUS1-35	35			26	35	37				6.87	0.78	0.70	0.079		0.11
KSUS1-36	36			28	36	38				7.12	0.82	0.73	0.084		0.12
KSUS1-40	40			35	40	42				8.15	1.03	0.83	0.11		0.16
KSUS1-42	42			35	42	44				8.66	1.14	0.88	0.12		0.17
KSUS1-45	45			35	45	47				9.44	1.32	0.96	0.13		0.19
KSUS1-48	48			35	48	50				10.2	1.51	1.04	0.15		0.20
KSUS1-50	50			35	50	52				10.8	1.65	1.10	0.17		0.22
KSUS1-55	55			40	55	57				12.1	2.01	1.23	0.21		0.27
KSUS1-56	56		10	40	56	58				12.3	2.09	1.26	0.21		0.28
KSUS1-60	60			40	60	62				13.4	2.42	1.37	0.25		0.31
KSUS1-64	64			45	64	66				14.5	2.77	1.47	0.28		0.36
KSUS1-70	70			50	70	72				16.1	3.34	1.64	0.34		0.44
KSUS1-75	75			55	75	77				17.4	3.86	1.77	0.39		0.52
KSUS1-80	80			60	80	82				18.7	4.42	1.91	0.45		0.60
KSUS1-90	90			60	90	92				21.4	5.67	2.19	0.58		0.70
KSUS1-100	100		12	60	100	102				24.1	7.08	2.46	0.72		0.82
KSUS1-120	120			60	120	122				29.6	10.4	3.01	1.06		1.09

[Caution on Product Characteristics]
① The allowable torques shown in the table are calculated values according to the assumed usage conditions. Please see Page 24 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.

[Caution on Secondary Operations]
① Please read "Cautions on Performing Secondary Operations" (Page 26) 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.

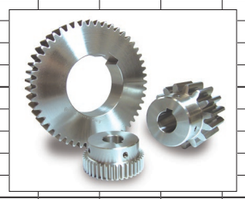
J Series

Stainless Steel Spur Gears



To order J Series products, please specify: Catalog No. + J + BORE.

Bore H7	* The product shapes of J Series items are identified by background color.																
Keyway Js9	8	10	12	14	15	16	17	18	19	20	22	25	28	30	32	35
Screw size	—	4×1.8		5×2.3				6×2.8				8×3.3			10×3.3	
Catalog Number	M5	M4						M5				M6			M8	
KSUS1-15 J BORE	S3T															
KSUS1-16 J BORE	S3T															
KSUS1-18 J BORE	S3T															
KSUS1-20 J BORE	S1T															
KSUS1-22 J BORE	S1T															
KSUS1-24 J BORE	S1T															
KSUS1-25 J BORE	S1T															
KSUS1-28 J BORE	S1T	S1K	S1K													
KSUS1-30 J BORE	S1T	S1K	S1K													
KSUS1-32 J BORE	S1T	S1K	S1K	S1K												
KSUS1-35 J BORE	S1T	S1K	S1K	S1K												
KSUS1-36 J BORE	S1T	S1K	S1K	S1K	S1K	S1K										
KSUS1-40 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K						
KSUS1-42 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K						
KSUS1-45 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K						
KSUS1-48 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K						
KSUS1-50 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K						
KSUS1-55 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K					
KSUS1-56 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K					
KSUS1-60 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K					
KSUS1-64 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K				
KSUS1-70 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K		
KSUS1-75 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	
KSUS1-80 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K
KSUS1-90 J BORE		S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K
KSUS1-100 J BORE			S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K
KSUS1-120 J BORE			S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K	S1K



[Caution on J series]
① As available-on-request products, these require a lead-time for shipping within 2 working days (excludes the day ordered), after placing an order.
② Number of products we can process for one order is 1 to 20 units. For quantities of 21 or more pieces, we need to quote price and lead time.
③ Keyways are made according to JIS B1301 standards, Js9 tolerance.
④ Certain products which would otherwise have a very long tapped hole are counterbored to reduce the length of the tap.
⑤ For products having a tapped hole, a set screw is included.
⑥ When using S3T and S1T set screws for fastening gears to a shaft, only use this method for applications with light load usage. For secure fastening, please use dowel pins in combination.

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 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 of 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 182)

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. Also, KSUSF F-loc hub spur gears, KDSF F-loc hub spur gears and various F series that use the friction coupling method to fasten the gear shaft need addi-tional consideration for 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 Number	KMSGA KMSGB	KSSGS	KSSG KSSAG	KSSS,KSS KSSA,KSSY KSSAY,KSSR	KSUS KSUSA KSUSF	KBSS	KKSG	KKS	KNSU	KPU KPS KPSA	KDSF KDS
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 KSSGS, KSSS, KSSR)						Racks		—		
Rotational speed	600rpm			100rpm					100 rpm		
Design life (durability)	Over 10^7cycles								—		
Impact from motor	Uniform load								Allowable bending stress (kgf/mm²)		
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 stress at root σ_{Flim} (kgf/mm²) NOTE 2	47	24.5	19 (24.5) Note 3	19 (24.5) Note 4	10.5	4	30	32			
Safety factor S_F	1.2										

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

Item								
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						Supported on one end	
Allowable Hertz stress σ_{Hlim} (kgf/mm²)	166	99	90 (62.5) Note 3	49 (62.5) Note 4	41.3	—	112	79
Safety factor S_H	1.15							

[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 rotational speed (rpm) and the stress (kgf/mm²) are adjusted to the units needed in the formula.

[NOTE 2] The allowable bending stress at the root σ_{Flim} is calculated from JGMA401-01, 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] For KSSG Ground Spur Gears, with module 0.8 or less, thermal refining is applied. Allowable bending stress and allowable hertz stress values are shown in parentheses.**[NOTE 4]** For KSSS 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] KSSS Spur Pinion Shafts with module 1 or less (KSA configuration) are set to cantilever support as they are single shaft types.

When selecting KHK standard gears, glance over the Cautions on Product Characteristics and Cautions on Performing Secondary Operations in the respective dimension tables.

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 16 for more details about custom-made orders.

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.

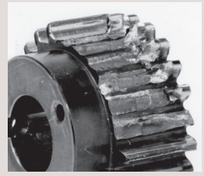
③ The details (specifications, dimensions, prices, etc.) listed in the catalog may be changed without prior notice. Changes are announced on the KHK website.

The most important factor in selecting gears is the gear strength.

Step 1 **Determine the actual load torque applied to the gear and the gear type suitable for the purpose.**

■ Definition of Bending Strength of Gears

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 failure due to insufficient bending strength

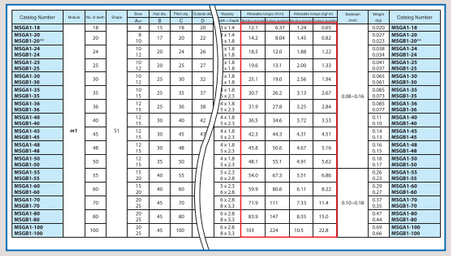
■ Definition of Surface Durability

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. The allowable gear tooth load of a gear is defined as the allowable tangential force at the pitch circle based on the mutual gear tooth strength of two meshing gears under load.

Example of wear due to insufficient surface durability

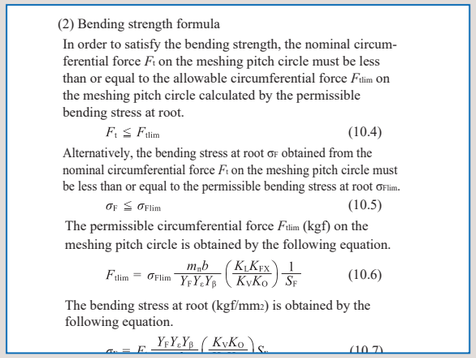
Step 2 **Select provisionally from the allowable torque table of the Master Catalog based on the load torque.**

■ For provisional selection from the Master Catalog



Step 3 **We recommend that each user computes their own values by applying the actual usage conditions to determine the suitability of the gear strength.**

Calculate the strength formally using the various gear strength formulas.
Please see Page 71 of our technical reference book for more details.



(2) Bending strength formula

In order to satisfy the bending strength, the nominal circumferential force F_t on the meshing pitch circle must be less than or equal to the allowable circumferential force F_{tlim} on the meshing pitch circle calculated by the permissible bending stress at root.

$$F_t \leqq F_{tlim} \quad (10.4)$$

Alternatively, the bending stress at root σ_F obtained from the nominal circumferential force F_t on the meshing pitch circle must be less than or equal to the permissible bending stress at root σ_{Flim}.

$$\sigma_F \leqq \sigma_{Flim} \quad (10.5)$$

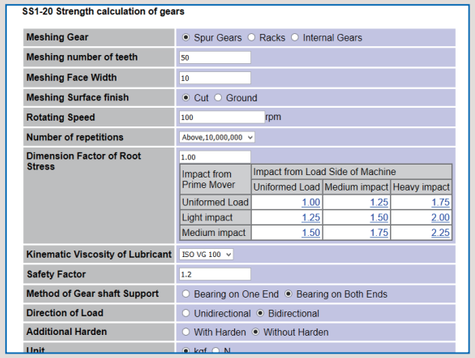
The permissible circumferential force F_{tlim} (kgf) on the meshing pitch circle is obtained by the following equation.

$$F_{tlim} = \sigma_{Flim} \frac{m_n b}{Y_F Y_\varepsilon Y_\beta} \left(\frac{K_t K_{FX}}{K_V K_O} \right) \frac{1}{S_F} \quad (10.6)$$

The bending stress at root (kgf/mm2) is obtained by the following equation.

$$\sigma_F = F_t \frac{Y_F Y_\varepsilon Y_\beta}{} \left(\frac{K_V K_O}{} \right) S_F \quad (10.7)$$

Strength confirmation is simple when using the website.



SS1-20 Strength calculation of gears

Meshing Gear	◉ Spur Gears ○ Racks ○ Internal Gears
Meshing number of teeth	50
Meshing Face Width	10
Meshing Surface finish	◉ Cut ○ Ground
Rotating Speed	100 rpm
Number of repetitions	Above,10,000,000
Dimension Factor of Root Stress	1.00

Impact from Prime Mover \ Impact from Load Side of Machine	Uniformed Load	Medium impact	Heavy impact
Uniformed Load	1.00	1.25	1.75
Light impact	1.25	1.50	2.00
Medium impact	1.50	1.75	2.25

Kinematic Viscosity of Lubricant	ISO VG 100
Safety Factor	1.2
Method of Gear shaft Support	○ Bearing on One End ◉ Bearing on Both Ends
Direction of Load	○ Unidirectional ◉ Bidirectional
Additional Harden	○ With Harden ◉ Without Harden
Unit	◉ kgf ○ N

Application Hints

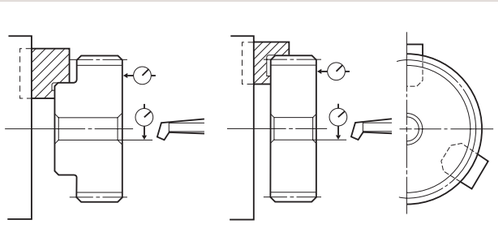
In order to use KHK stock gears safely, carefully read the Application Hints before proceeding.
If there are questions or you require clarifications, please contact our technical department or your nearest distributor.
TEL: (646) 396-GEAR FAX: (516) 437-6700 E-mail: qtcsupport@qtcgears.com

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. Cautions on Performing Secondary Operations

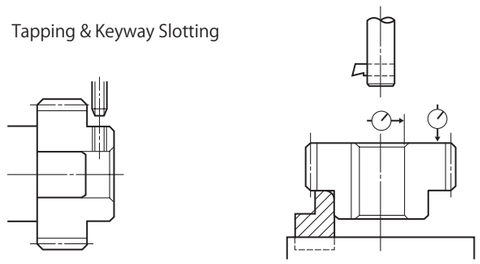
① If reboring, it is important to pay special attention to locating the center in order to avoid runout.
② The reference datum for gear cutting is the bore. Therefore, use the bore for locating the center. If it is too difficult to do for small bores, the alternative is to use one spot on the bore and the runout of the side surface.
③ If 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.



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 tooth root diameter), and 50% to 60% for keyway applied modifications.
⑤ In order to avoid stress concentration, round 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 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:

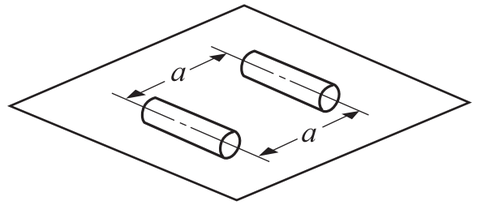
● Common Specifications for Heat Treatment
Hardening location: Gear tooth surface or tooth surface and tooth root
Hardness: Within the range of 45 to 60 HRC and 10 HRC width
(Example: 48 to 58 HRC)

● 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 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 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.

3. Points of Caution during Assembly

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). For the backlash of each product, please refer to the dimension table.
Backlash may be adjusted by changing the center distance of mating gears. For more information, please consult the technical section on gear backlash (page 56) in our separate technical reference book.



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

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.

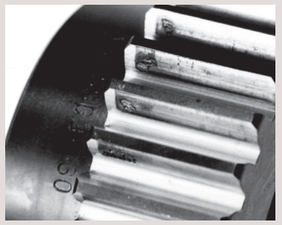
■ Total Length Tolerance for Spur and Helical Gears

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: 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 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 Mecha-Lock, a POSI-LOCK, or a Spannring, which are 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. (Check the assembly 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 KSSG3-30 due to poor edge contact (only 30% with proper contact).



Poor tooth contact and pitting

Gear oil (equivalent to 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 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.

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.
① Turn off the power switch.
② 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.
2. 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.