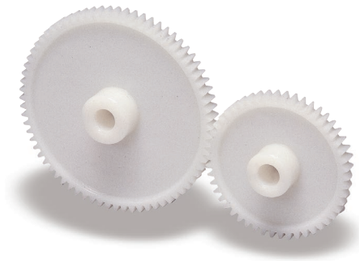
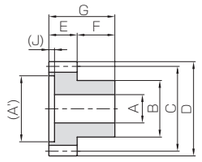
Injection Molded Spur Gears

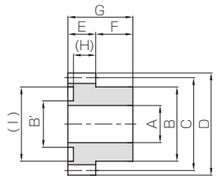


Specifications	
Precision grade	JIS grade N12 (JIS B1702-1: 1998)*
Gear teeth	Standard full depth
Pressure angle	20°
Material	Duracon (M90-44)
Heat Treatment	—
Tooth hardness	(110 to 120HRR)

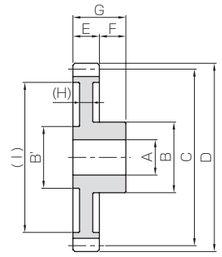
* The precision grade of these products is equivalent to the value shown in the table.



S8



S8B



S9

Catalog Number	Module	No. of teeth	Shape	Bore 1	Bore 2	Hub dia. 1	Hub dia. 2	Pitch dia.	Outside dia.	Face width	Hub width
				A	(A')	B	B'	C	D	E	F
KDS0.5-12	***m*0.5**	12	S8	2	(4)	4.5	—	6	7	3	4
KDS0.5-15		15	S8		(5.5)	4.5	—	7.5	8.5		
KDS0.5-16		16	S8	3	(6)	6	—	8	9		
KDS0.5-20		20	S8B	4	—	8	5	10	11		
KDS0.5-24		24	S9		—	8	5	12	13		
KDS0.5-30		30	S9	5	—	10	7	15	16		
KDS0.5-40		40				12	8	20	21		
KDS0.5-45		45				12	8	22.5	23.5		
KDS0.5-48		48				12	8	24	25		
KDS0.5-50		50				12	8	25	26		
KDS0.5-56		56		6		14	10	28	29		5
KDS0.5-60		60				14	10	30	31		
KDS0.5-70		70				14	10	35	36		
KDS0.5-80		80				14	10	40	41		
KDS0.8-12	***m*0.8**	12	S9	3	—	6	4	9.6	11.2	4	5
KDS0.8-15		15				6	4.5	12	13.6		
KDS0.8-16		16		4		8	6	12.8	14.4		
KDS0.8-20		20		5		10	8	16	17.6		
KDS0.8-24		24				10	8	19.2	20.8		
KDS0.8-30		30		6		12	10	24	25.6		6
KDS0.8-40		40				12	10	32	33.6		
KDS0.8-45		45				12	10	36	37.6		
KDS0.8-48		48				14.5	11.7	38.4	40		
KDS0.8-50		50				14.5	11.7	40	41.6		
KDS0.8-56		56				14.5	11.7	44.8	46.4		
KDS0.8-60		60				14.5	11.7	48	49.6		
KDS0.8-70		70				15.5	11.7	56	57.6		
KDS0.8-80		80				15.5	11.7	64	65.6		

Total Length	Web thickness	Web O.D.	Hole depth	Allowable torque (N·m)	Allowable torque (kgf·m)	Backlash	Weight	Catalog Number
G	(H)	(I)	(J)	Bending strength	Bending strength	(mm)	(g)	
7	—	—	(0.6)	0.063	0.0064	0~0.30	0.17	**KDS0.5-12**
	—	—	(0.6)	0.092	0.0094		0.23	**KDS0.5-15**
	—	—	(0.6)	0.10	0.010		0.28	**KDS0.5-16**
	(2.4)	(8)	—	0.14	0.014		0.47	**KDS0.5-20**
	(1.8)	(9.5)	—	0.17	0.018		0.58	**KDS0.5-24**
	(1.8)	(12)	—	0.23	0.023		0.90	**KDS0.5-30**
		(16.5)		0.33	0.034		1.53	**KDS0.5-40**
		(19)		0.38	0.039		1.78	**KDS0.5-45**
		(21)		0.42	0.043		1.91	**KDS0.5-48**
		(21.5)		0.44	0.045		2.02	**KDS0.5-50**
8		(24.5)		0.50	0.051		2.77	**KDS0.5-56**
		(26.5)		0.54	0.055		3.02	**KDS0.5-60**
		(31.5)		0.64	0.066		3.71	**KDS0.5-70**
		(36.5)		0.75	0.076		4.51	**KDS0.5-80**
9	(2)	(19.5)	—	0.79	0.080	0~0.48	2.37	**KDS0.8-30**
		(27.5)		1.13	0.12		3.47	**KDS0.8-40**
		(31)		1.31	0.13		4.18	**KDS0.8-45**
		(33.5)		1.42	0.15		5.31	**KDS0.8-48**
		(35)		1.50	0.15		5.60	**KDS0.8-50**
10		(39.5)		1.70	0.17		6.55	**KDS0.8-56**
		(42.5)		1.85	0.19		7.30	**KDS0.8-60**
		(50.5)		2.20	0.22		9.52	**KDS0.8-70**
		(55.5)		2.55	0.26		11.8	**KDS0.8-80**

[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.
③ The bore tolerance is -0.05 to -0.30, but it may be slightly higher at the center of the hole.
④ For the dimensional accuracy of each part, see the dimensional tolerance of molded items in the separate table.

[Caution on Secondary Operations]
① As it is a molded item, bubbles may form inside the material. Avoid performing secondary operations.

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.

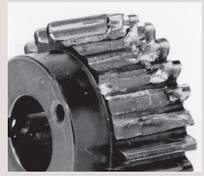
③ The details (specifications, dimensions, prices, etc.) listed in the catalog may be changed without prior notice. Changes are announced on the KHK website.

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

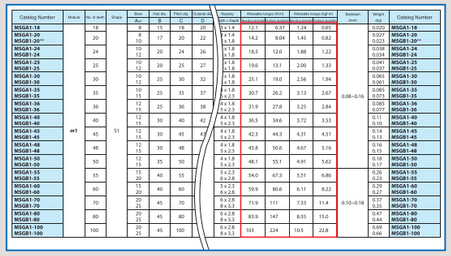
■ Definition of Surface Durability

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

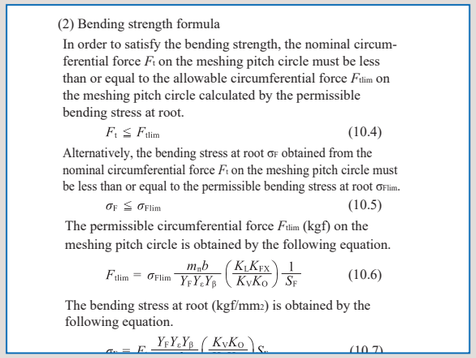
Step 2 **Select provisionally from the allowable torque table of the Master Catalog based on the load torque.**

■ 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.

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

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}.

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

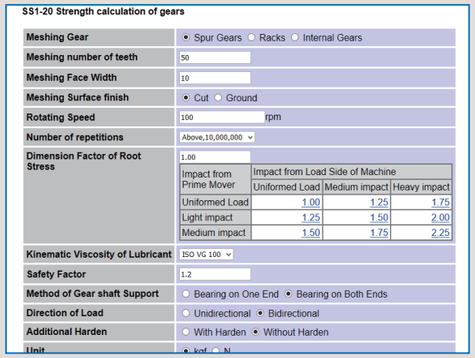
The permissible circumferential force F_{tlim} (kgf) on the meshing pitch circle is obtained by the following equation.

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

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

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

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