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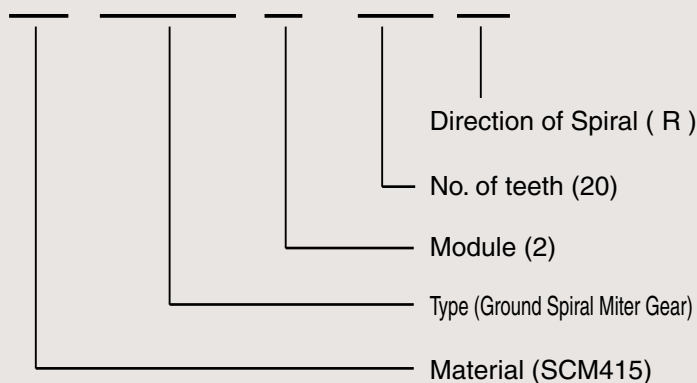
Catalog Number of KHK Stock Gears

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)

Miter Gears

M MSG 2 - 20 R



Material		Type	
S	S45C	M	Miter Gears
M	SCM415	MS	Spiral Miter Gears
SU	SUS303	MSG	Ground Spiral Miter Gears
L	SMF5040	AM	Angular Miter Gears
P	MC901		
D	Duracon(M90-44)		



6

Miter Gears





Miter Gears

Wide Variety from High Precision to Commercial Grades!



Characteristics

Miter gears are a special class of bevel gears where the shafts intersect at 90° and the gear ratio is 1:1. KHK stock miter gears are available in two types, spiral and straight tooth, with high precision grade for demanding torques and speeds, and commercial grade for economical applications.

Main Features of Stock Miter Gears Offered

The following table lists the main features for easy selection.

Type	Catalog No.	Module	No. of teeth () denotes shafts angle	Material	Heat treatment	Tooth surface finish	Precision JIS B 1704	Secondary Operations	Features
Spiral Miter Gears	MMSG	2~4	20, 25, 30	SCM415	Carburizing <small>NOTE 3</small>	Ground	2	△	High strength, abrasion-resistant and compact for high speed & torque use.
	SMSG	2~5	20, 25, 30	S45C	Gear teeth induction hardened	Ground	2	△	Reasonably priced ground gear, yet remachinable except for the gear teeth.
	MMSA(B) <small>NOTE 1</small>	1~10	20	SCM415	Overall Carburizing <small>NOTE 4</small>	Cut	4	×	Ready to use without performing secondary operations. Strong and abrasion resistant.
	MMS	2~5	20, 25	SCM415	Carburizing <small>NOTE 3</small>	Cut	4	△	Only teeth are induction hardened, allowing user to perform secondary operations elsewhere.
	SMS	1~8	20, 25, 30	S45C	Gear teeth induction hardened	Cut	4	△	Large numbers of teeth and modules are offered in these affordable spiral miter gears.
Straight Miter Gears	SMA(B)(C) <small>NOTE 1</small>	1~8	20, 25, 30	S45C	Gear teeth induction hardened	Cut	4	△	Usable without remachining, offered in 3 bore sizes.
	MM	2~5	20, 25	SCM415	Carburizing <small>NOTE 3</small>	Cut	4	△	Compared to SM miters, these are stronger and less abrasive, and allow secondary operations.
	LM <small>NOTE 2</small>	0.8~1.5	20	SMF5040 (Equiv. to S45C)	—	Sintered	5	○	Mass-produced, low cost sintered products. Small and light weight.
	SM	1~8	16, 20, 25, 30	S45C	—	Cut	3	○	Popular straight miter for many uses.
	SAM	1.5~3	20 (45°, 60°, 120°)	S45C	—	Cut	3	○	3 types are available for shafts at 45°, 60° and 120°.
	SUM	1~3	20, 25	SUS303	—	Cut	3	○	Suitable for food machinery due to SUS303's rust-resistant quality.
	PM	1~4	20, 25	MC901	—	Cut	4	○	MC nylon products are light and can be used without lubricant.
DM	0.5~1.5	20	M90-44	—	Injection molded	8	△	Injection molded, mass-produced products, suitable for office machines.	

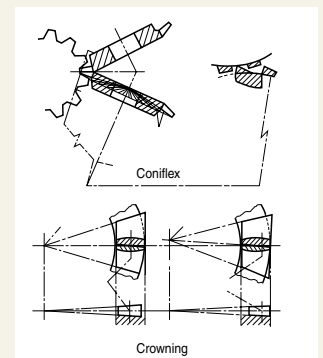
NOTE 1: The letters "B" and "C" at the end of catalog numbers designate same items except for changes in the bore and keyway sizes.

NOTE 2: Sintered metal Miter Gears are manufactured by mixing powdered metal and pressing them in a mold under heat to fuse, sizing and impregnating with oil.

NOTE 3: Even though the bore and the hub portions are masked during the carburization and they can be modified, care should be exercised since the hardness is somewhat higher.

NOTE 4: MMSA(B) spiral miter gears are carburized throughout so that they do not permit any secondary operations. However, the back surface of B7 style gears is masked during the process so that it is possible to drill and pin on this surface.

○ Possible △ Possible on some areas
× Not possible



KHK utilizes Gleason Coniflex No. 104, 102 and 114 bevel gear generating machinery and is well-equipped for mass production of straight miter gears. You can count on an economically priced, stable supply of straight miter gears from KHK.

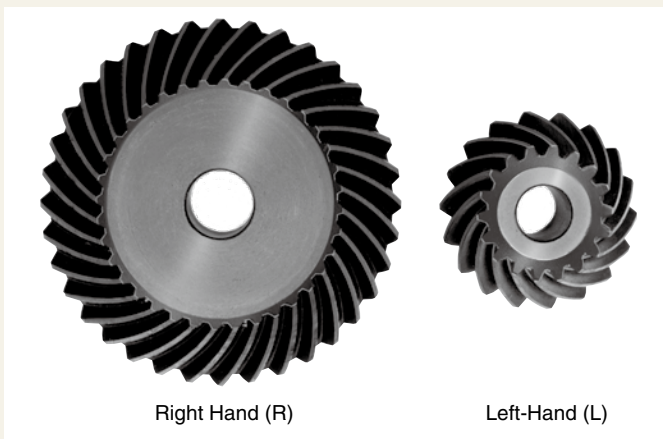


Selection Hints

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. Use of catalog numbers when ordering will simplify and expedite the processing of your order.

1. Caution in Selecting the Mating Gears

① Among KHK stock miter gears, there are products which are not interchangeable even when the module and the number of teeth are the same. Also, spiral miter gears require additional consideration since the right-hand mates with the left-hand spiral as shown in the table below.



■ Spiral Miter (○ Allowable △ Allowable in certain cases × Not allowable)

Catalog No.& Spiral hand	MMSG (R)	SMSG (R)	MMSA(B) (R)	MMS (R)	SMS (R)
MMSG(L)	○	×	×	×	×
SMSG(L)	×	○	×	×	×
MMSA(B)-(L)	×	×	○	△	△
MMS(L)	×	×	△	○	△
SMS(L)	×	×	△	△	○

CAUTION: Spiral miter gears are paired to the items with the same catalog number except the last characters are “R” and “L”. For selecting items in the “△” category, please reconfirm with your nearest KHK dealer that the pair can work.

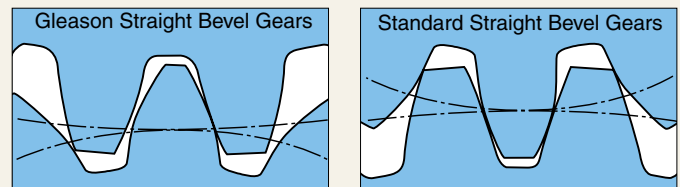
■ Straight Miter (○ Allowable × Not allowable)

Catalog No.	SMA (B)(C)	MM	SM	SUM	PM	DM	LM	SAM
SMA(B)(C)	○	○	○	○	○	×	×	×
MM	○	○	○	○	○	×	×	×
SM	○	○	○	○	○	×	×	×
SUM	○	○	○	○	○	×	×	×
PM	○	○	○	○	○	×	×	×
DM	×	×	×	×	×	○	×	×
LM	×	×	×	×	×	×	○	×
SAM	×	×	×	×	×	×	×	○

② Miter gears are bevel gears with 1:1 gear ratio. Needless to say, they mate only with gears of the same module and number of teeth. Also, since KHK uses the Gleason system, our miter gears may not mesh with those made by another company or custom-made. It is best to order as a set.

Difference between Gleason Straight Bevel Gears and Standard Straight Bevel Gears

There are differences in the gear blank shapes between the two systems. In the table below, we illustrate the differences in various angles and dimensions for typical straight bevel gear pairs.



<Example>

Module $m = 3$, No. of teeth of pinion $z_1 = 20$,
Gear $z_2 = 40$, Face width $b = 22$, Pressure angle $\alpha_0 = 20^\circ$

		Gleason straight bevel system		Standard straight bevel system	
		$z_1=20$	$z_2=40$	$z_1=20$	$z_2=40$
1	d_o	60	120	60	120
2	δ_o	$26^\circ 34'$	$63^\circ 26'$	$26^\circ 34'$	$63^\circ 26'$
3	R_o	67.083		67.083	
*4	h_k	4.035	1.965	3.00	
*5	h_f	2.529	4.599	3.75	
*6	δ_k	$30^\circ 29'$	$65^\circ 36'$	$29^\circ 08'$	$66^\circ 00'$
*7	δ_r	$24^\circ 24'$	$59^\circ 31'$	$23^\circ 22'$	$60^\circ 14'$
*8	d_k	67.218	121.758	65.367	122.683
*9	X	58.197	28.242	58.658	27.317

CAUTION: In items 4 through 9 (marked with *), dimensions and angles are different in two systems.



Miter Gears

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

Definition of bending strength

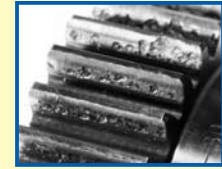
The allowable bending strength of a gear is defined as the allowable tangential force at the pitch circle based on the mutually allowable root stress of two meshing gears under load.



Example of the failure due to insufficient bending strength.

Definition of surface durability

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.

Calculation of Bending Strength of Gears

Catalog No. Item	MMSG MMS MM	MMSA(B)	SMSG SMS SMA(B)(C)	SM SAM	SUM LM	PM	DM
Formula <small>NOTE 1</small>	Formula of bevel gears on bending strength (JGMA403-01)					The Lewis formula	
No. of teeth of mating gears	Same number of teeth					—	
Rotation	100min ⁻¹ (600min ⁻¹ for MMSG & SMSG)					100min ⁻¹	
Durability	Over 10 ⁷ cycles					—	
Impact from motor	Uniform load					Allowable bending stress	
Impact from load	Uniform load					1.15kgf/mm ² (40°C with no lubricant)	<small>NOTE 3</small> m0.5 4.5 m0.8 4.0 m1.0 3.5 m1.5 1.8 kgf/mm ²
Direction of load	Bidirectional						
Allowable bending stress at root σ_{Flim} <small>NOTE 2</small>	31.33kgf/mm ²	31.33kgf/mm ²	14kgf/mm ²	12.67kgf/mm ²	7kgf/mm ²		
Safety factor K_R	1.2						

Calculation of Surface Durability (Except those in common with bending strength)

Formula <small>NOTE 1</small>	Formula of bevel gears on bending strength (JGMA404-01)				
Kinematic viscosity of lubricant	100cSt (50°C)				
Gear support	Shafts & gear box have normal stiffness, and gears are supported on one end				
Allowable Hertz stress σ_{Hlim}	166kgf/mm ²	166kgf/mm ²	90kgf/mm ²	49kgf/mm ²	41.3kgf/mm ²
Safety factor C_R	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 of number of rotations (min⁻¹) and the stress (kgf/mm²) are adjusted to the units needed in the formula.

NOTE 2: Since the load is bidirectional, the allowable bending stress at root σ_{Flim} , used in JGMA 403-01 formula is set to 2/3 of the value.

NOTE 3: The values of the allowable bending stresses for DM m0.5 and m1.5 and the allowable root bending stress for LM gears are our own estimates.

3. Caution with Regard to the Special Characteristics of Miter Gears

- MMSA(B) spiral miter gears are carburized throughout so that they do not permit any secondary operations. However, the back surface of B7 style gears is masked during the process so that it is possible to drill and pin on this surface.
- The keyway sizes of MMSA(B) finished bore spiral miter gears are made according to JIS B 1301, medium quality, but the final heat treating may cause some deformation.
- The bore of SMS spiral miter gears may somewhat be deformed due to heat treatment and does not reach H7 tolerance.
- Due to the characteristics of the material, PM plastic miter gears' product quality may be affected by heat or moisture absorption.
- Items with black oxide finish are somewhat effective in resisting rust but are not totally rustproof.
- SUM stainless steel miter gears use material which is especially resistant to rust but still is not 100% rustproof.
- The bore tolerance of DM injection molded miter gears is generally -0.05 to -0.10, but may be plus values at the central portion of the hole. Remachining the bore is not recommended since reworking may expose voids in the plastic.

4. Other Points to Consider in the Selection Process

- There are various footnotes to the product pages under the headings of "CAUTION" and "NOTE". Please consider them carefully when selecting these products.
- There may be slight differences in color or shape of products shown in the photographs from the actual products.
- KHK reserves the right to make changes in specifications and dimensions without notice.
- KHK is ready to produce and supply custom order products. When you require specific gears different from KHK Stock Gears please contact our distributor for quotation. Also, please refer to page 16 "KHK Custom Order Products".



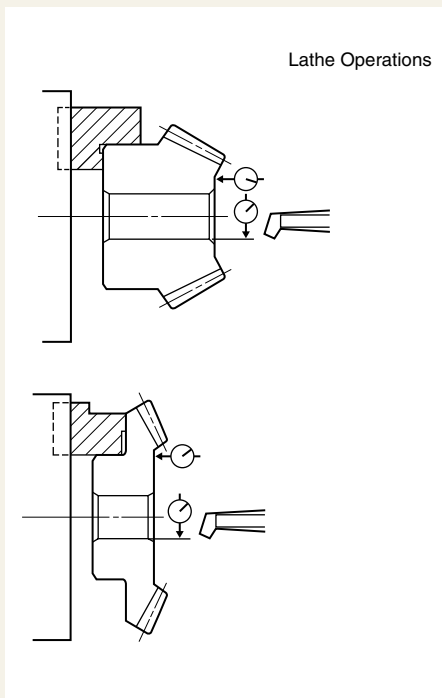
Application Hints

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.

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

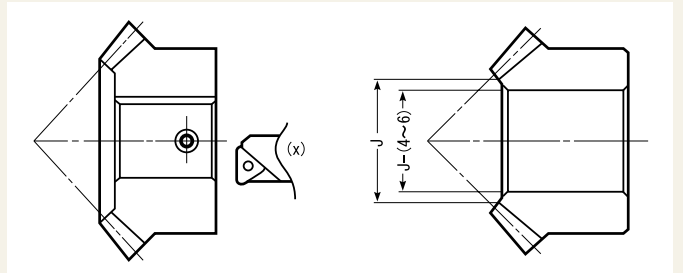
1. Caution on Performing Secondary Operations

- ① If you are reborring, 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, it is best to 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.

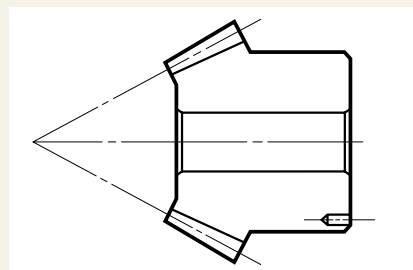


- ④ Starting in August 2003, the tooling holes on the hub face of the spiral miter gears (except ground gears) module 2.5 and above have been eliminated. However, we may have some items in stock with the hole.

- ⑤ MMSA(B) spiral miter gears are carburized throughout, so that no secondary operations can be performed (except B7 style items). For items with induction hardened teeth, such as SMSG and SMS series, the hardness is high near the tooth root. When machining the front face, the machined area should be 4 to 6mm smaller than the dimension, J.



- ⑥ For tapping and keyway operations, see the examples given in “1. Caution on Performing Secondary Operations” in KHK Stock Spur Gear section. When cutting keyways, to avoid stress concentration, always leave radii on corners.
- ⑦ PM plastic miter gears are susceptible to changes due to temperature and humidity. Dimensions may change between during and after remachining operations.
- ⑧ When heat treating S45C products, it is possible to get thermal stress cracks. It is best to subject them to penetrant inspection afterwards. While the teeth strength may increase four fold, the precision of the gear will drop approximately one grade.

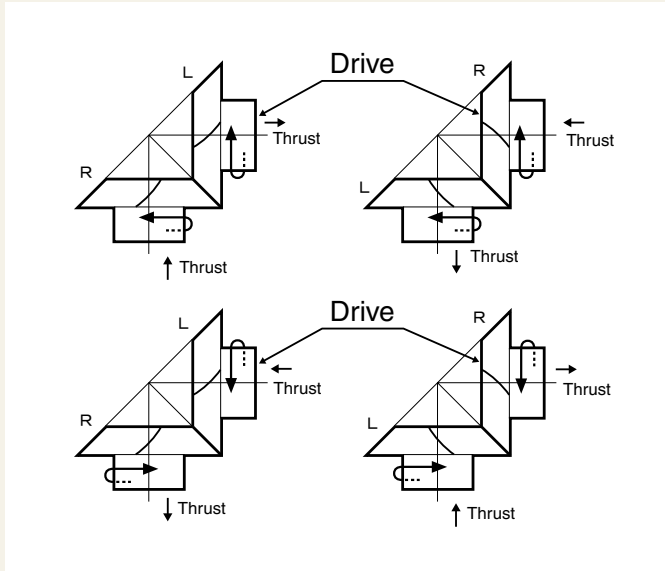




Miter Gears

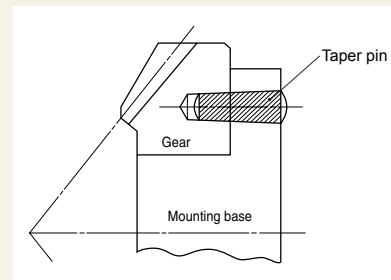
2. Points of Caution in Assembling

① Since miter gears are cone shaped, they produce axial thrust forces. Specifically with regard to spiral miter gears, the directions of thrust change with the hand of spiral and the direction of rotation. This is illustrated below. The bearings must be selected properly to be able to handle these thrust forces.



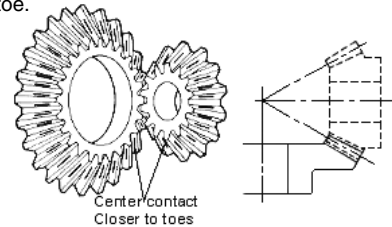
② KHK stock miter gears are designed such that, when assembled according to the specified mounting distance with a tolerance of H7~H8, the backlash shown in the table are obtained. Mounting distance error, offset error and shaft angle error must be minimized to avoid excessive noise and wear. Inaccurate assembly will lead to irregular noises and uneven wear. Various conditions of teeth contact are shown below.

- ③ If a miter gear is mounted on a shaft far from the bearings, the shaft may bend. We recommend mounting bevel gears as close to the bearings as possible. This is especially important since most miter gears are supported on one end. The bending of shafts will cause abnormal noise and wear, and may even cause fatigue failure of the shafts. Both shafts and bearings must be designed with sufficient strength.
- ④ Due to the thrust load of miter gears, the gears, shafts and bearings have the tendency to loosen up during operation. Miter gears should be fastened to the shaft with keys and set screws, taper pins, step shafts, etc.
- ⑤ When installing MMSA(B) finished bore spiral miter gears in B7 style (ring type), always secure the gears onto the mounting base with taper pins to absorb the rotational loads. It is dangerous to secure with bolts only.



Correct Tooth Contact

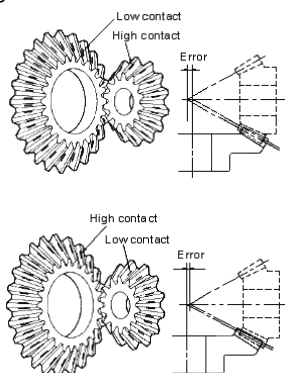
- When assembled correctly, the contact will occur on both gears in the middle of the flank and center of face width but somewhat closer to the toe.



Incorrect Tooth Contact

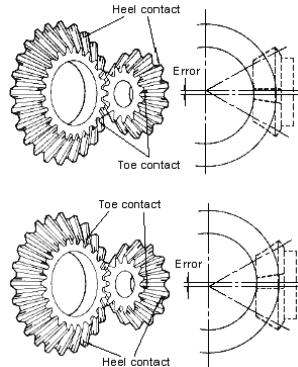
Mounting Distance Error

- When the mounting distance of the pinion is incorrect, the contact will occur too high on the flank on one gear and too low on the other.



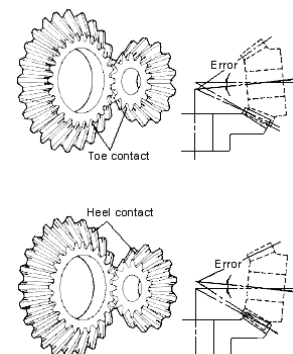
Offset Error

- When the pinion shaft is offset, the contact surface is near the toe of one gear and near the heel of the other.



Shaft Angle Error

- When there is an angular error of shafts, the gears will contact at the toes or heels depending on whether the angle is greater or less than 90°.





3. Notes on Starting Operations

- ① Before operating, check the following:
 - Are the gears firmly mounted on the shafts?
 - Have you eliminated uneven tooth contact?
 - Does the gear mesh have a proper amount of backlash?
(Please avoid the condition of no backlash)
 - Is there sufficient lubrication?
- ② If the gears are exposed, install a safety cover for protection.
- ③ Check the noise and vibration while the machine is in operation for any unusual conditions. If an abnormality is encountered, recheck the gears and assembly conditions. Also, check lubrication after start-up. Sometimes, when the unit is initially being operated, lubricating oil deteriorates rapidly.

4. Other Points to Consider in Applications

- ① KHK products are individually packaged to avoid damages. Depending on how they are handled, it is still possible to deform or break them. It is important to exercise care in handling these parts.
- ② Check the products as they are being taken out of the boxes. If any of them are rusted, scratched or dented, please return to the dealer where they were bought, for exchange.
- ③ KHK cannot guarantee the precision of gears once the customer performs a secondary operation on them.

PRODUCT IMPROVEMENT ANNOUNCEMENT

In order to increase the gear strength of KHK standard Miter Gears, starting in June 2004, the following changes have been introduced. During this transition, some of the specifications will change.

1. Applicable Series

- ① MMSG Ground Spiral Miter Gears –(30 Items)
- ② MMS Spiral Miter Gears – (20 Items)
- ③ MM Miter Gears – (10 Items)

2. Improvement Details

Increase in gear strength (Approximately 15% higher bending strength compared to previous one)

3. Change in the specifications

	Before	After
Heat treatment	Teeth induction hardened after carburizing	Carburizing (bore & hub portion masked)
Surface Treatment	Black oxide	No black Oxide

The corner tips of the gear-teeth of KHK stock Miter Gears are machine chamfered for safety and for prevention of damages.

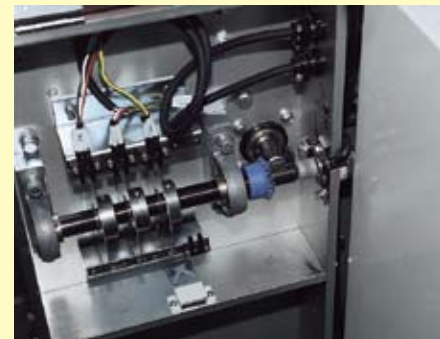
■ The chamfering of the corner gear tips for miter gear (unit: mm)

Module	Outside edge R	Inside edge R
0.5 up to 1	0.5	all burrs removed
1 up to 2.5	1	0.5
2.5 up to 5	2	1
over 5	3	1.5

Example of KHK Gear Applications



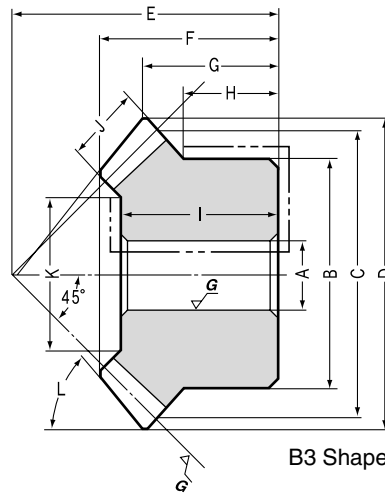
Automatic packaging machine (Spur gears)
(Miter gears - inset)



Electric components assembly line
(Miter gears <SM and PM>)



MMSG Ground Spiral Miter Gears Modules 2~4



Modules 2~4

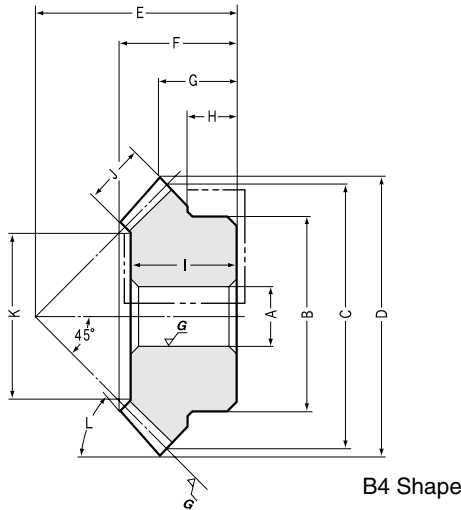
Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
						A _{H7}	B	C	D	E	F	G
MMSG2-20R MMSG2-20L	1	m2	20	R L	B3	12	35	40	42.7	35	21.98	16.35
MMSG2.5-20R MMSG2.5-20L		m2.5	20	R L	B3	14	42	50	53.2	45	28.63	21.6
MMSG3-20R MMSG3-20L		m3	20	R L	B3	16	52	60	63.99	50	30.78	21.99
MMSG3.5-20R MMSG3.5-20L		m3.5	20	R L	B4	20	50	70	74.53	55	32.45	22.26
MMSG4-20R MMSG4-20L		m4	20	R L	B4	20	55	80	84.99	65	39.13	27.5
MMSG2-25R MMSG2-25L	1	m2	25	R L	B4	12	38	50	52.5	40	23.43	16.25
MMSG2.5-25R MMSG2.5-25L		m2.5	25	R L	B4	16	45	62.5	65.54	50	29.57	20.27
MMSG3-25R MMSG3-25L		m3	25	R L	B4	20	55	75	78.78	60	35.6	24.39
MMSG3.5-25R MMSG3.5-25L		m3.5	25	R L	B4	25	65	87.5	91.81	70	41.65	28.41
MMSG4-25R MMSG4-25L		m4	25	R L	B4	28	75	100	104.7	80	47.8	32.35
MMSG2-30R MMSG2-30L	1	m2	30	R L	B4	14	45	60	62.42	50	29.27	21.21
MMSG2.5-30R MMSG2.5-30L		m2.5	30	R L	B4	16	55	75	78.04	60	34.08	24.02
MMSG3-30R MMSG3-30L		m3	30	R L	B4	20	65	90	93.61	70	40.25	26.8
MMSG3.5-30R MMSG3.5-30L		m3.5	30	R L	B4	25	80	105	109.21	80	44.4	29.6
MMSG4-30R MMSG4-30L		m4	30	R L	B4	28	90	120	124.7	90	49.27	32.35

CAUTION: A set of miter gears must be identical in module and number of teeth, but opposite in spiral hands.

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.



Ground Spiral Miter Gears



Specifications

Precision grade	JIS B 1704 grade 2	Tooth hardness	55~60HRC
Gear teeth	Gleason	Surface treatment	—
Pressure angle	20°	Tooth surface finish	Ground
Helix angle	35°	Datum reference surface for gear grinding	Bore
Material	SCM415	Secondary Operations	Possible where masking for carburizing
Heat treatment	Carburizing NOTE 1		

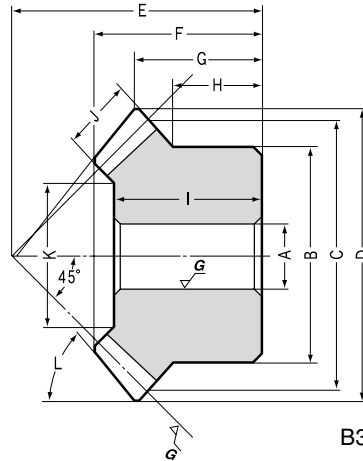
NOTE 1: The areas marked with ---- on the diagram are masked during the carburizing and can be modified, even though the hardness is somewhat higher.

Hub width H	Length of bore I	Face width J	Holding surface dia. K	Allowable torque (N · m) NOTE2		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
12.5	20	9	24.54	15.6	21.7	1.59	2.21	0.05~0.11	0.14	MMSG2-20R MMSG2-20L
16	26	11	30.89	30.0	42.6	3.06	4.35	0.06~0.12	0.26	MMSG2.5-20R MMSG2.5-20L
16	27	14	34.4	53.8	77.6	5.48	7.91	0.07~0.13	0.44	MMSG3-20R MMSG3-20L
14	29	16	42.75	84.3	124	8.60	12.6	0.08~0.14	0.50	MMSG3.5-20R MMSG3.5-20L
17	35	18	49.08	125	185	12.7	18.9	0.10~0.16	0.72	MMSG4-20R MMSG4-20L
11	21	11	30.89	25.3	43.5	2.57	4.44	0.05~0.11	0.20	MMSG2-25R MMSG2-25L
14	26	14	37.4	49.9	87.6	5.09	8.94	0.06~0.12	0.40	MMSG2.5-25R MMSG2.5-25L
17	31	17	43.92	86.8	155	8.85	15.8	0.07~0.13	0.70	MMSG3-25R MMSG3-25L
19	37	20	52.43	139	251	14.1	25.6	0.08~0.14	1.10	MMSG3.5-25R MMSG3.5-25L
22	42	23	58.95	192	353	19.6	36.0	0.10~0.16	1.70	MMSG4-25R MMSG4-25L
15	26	12	38.06	35.4	72.9	3.61	7.43	0.05~0.11	0.37	MMSG2-30R MMSG2-30L
16	30	15	47.57	69.1	145	7.05	14.8	0.06~0.12	0.77	MMSG2.5-30R MMSG2.5-30L
18	36	20	55.43	128	274	13.0	27.9	0.07~0.13	1.30	MMSG3-30R MMSG3-30L
20	40	22	67.77	181	393	18.4	40.1	0.08~0.14	2.30	MMSG3.5-30R MMSG3.5-30L
22	44	25	77.29	268	593	27.4	60.5	0.10~0.16	3.20	MMSG4-30R MMSG4-30L

NOTE2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



SMSG Ground Spiral Miter Gears Module 2~5



Modules 2~5

Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
						AH7	B	C	D	E	F	G
SMSG2-20R SMSG2-20L	1	m2	20	R L	B3	12	34	40	42.4	37	24.75	18.2
SMSG2.5-20R SMSG2.5-20L		m2.5	20	R L	B3	14	42	50	52.94	48	32.42	24.47
SMSG3-20R SMSG3-20L		m3	20	R L	B3	16	50	60	63.72	58	39.6	29.86
SMSG3.5-20R SMSG3.5-20L		m3.5	20	R L	B3	20	60	70	74.47	65	43.81	32.23
SMSG4-20R SMSG4-20L		m4	20	R L	B3	20	64	80	84.88	75	50.51	37.44
SMSG5-20R SMSG5-20L		m5	20	R L	B3	25	80	100	105.9	90	60.16	42.95
SMSG2-25R SMSG2-25L	1	m2	25	R L	B3	12	40	50	52.4	40	24.19	16.2
SMSG2.5-25R SMSG2.5-25L		m2.5	25	R L	B3	16	50	62.5	65.54	50	30.24	20.27
SMSG3-25R SMSG3-25L		m3	25	R L	B3	20	60	75	78.77	60	37.57	24.39
SMSG3.5-25R SMSG3.5-25L		m3.5	25	R L	B3	25	70	87.5	91.81	70	42.98	28.41
SMSG4-25R SMSG4-25L		m4	25	R L	B3	28	80	100	104.7	80	49.14	32.35
SMSG5-25R SMSG5-25L		m5	25	R L	B3	28	100	125	130.86	100	60.59	40.43
SMSG2-30R SMSG2-30L	1	m2	30	R L	B3	12	45	60	62.42	50	29.27	21.21
SMSG2.5-30R SMSG2.5-30L		m2.5	30	R L	B3	16	60	75	78.04	62	36.08	26.02
SMSG3-30R SMSG3-30L		m3	30	R L	B3	20	70	90	93.61	75	45.25	31.8
SMSG3.5-30R SMSG3.5-30L		m3.5	30	R L	B3	25	90	105	109.21	85	49.4	34.6
SMSG4-30R SMSG4-30L		m4	30	R L	B3	28	100	120	124.71	95	54.28	37.35

CAUTION: A set of miter gears must be identical in module and number of teeth, but opposite in spiral hands.

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

Miter Gears SMSG



Ground Spiral Miter Gears

Specifications

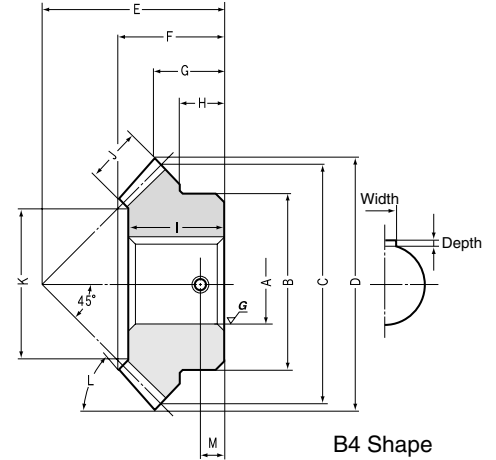
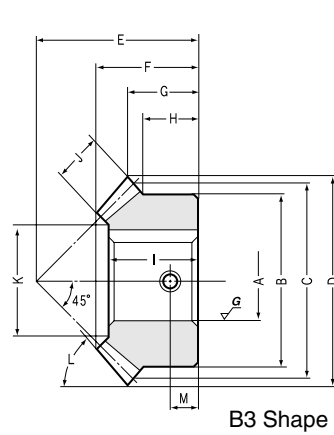
Precision grade	JIS B 1704 grade 2	Tooth hardness	48~53HRC
Gear teeth	Gleason	Surface treatment	Black oxide except Ground surface
Pressure angle	20°	Tooth surface finish	Ground
Helix angle	35°	Datum reference surface for gear grinding	Bore
Material	S45C	Secondary Operations	Possible except tooth areas
Heat treatment	Teeth induction hardened		

Hub width H	Length of bore I	Face width J	Holding surface dia. K	Allowable torque (N · m) <small>NOTE 1</small>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
14	22	10	21.72	7.83	6.79	0.80	0.69	0.05~0.11	0.15	SMSG2-20R SMSG2-20L
19	29	12	28.06	14.9	13.2	1.52	1.35	0.06~0.12	0.30	SMSG2.5-20R SMSG2.5-20L
23	35	15	31.57	26.4	23.7	2.69	2.42	0.07~0.13	0.50	SMSG3-20R SMSG3-20L
25	40	18	39.09	42.6	38.8	4.35	3.96	0.08~0.14	0.80	SMSG3.5-20R SMSG3.5-20L
27	45	20	43.43	62.6	57.8	6.39	5.90	0.10~0.16	1.10	SMSG4-20R SMSG4-20L
30	54	26	54.46	115	109	11.8	11.1	0.10~0.16	2.10	SMSG5-20R SMSG5-20L
10	20	12	26.06	12.6	13.5	1.28	1.37	0.05~0.11	0.20	SMSG2-25R SMSG2-25L
12.5	26	15	34.57	24.5	26.8	2.50	2.74	0.06~0.12	0.40	SMSG2.5-25R SMSG2.5-25L
15	32	20	37.43	45.0	50.0	4.59	5.10	0.07~0.13	0.70	SMSG3-25R SMSG3-25L
17.5	37	22	46.77	69.2	78.1	7.05	7.97	0.08~0.14	1.10	SMSG3.5-25R SMSG3.5-25L
20	43	25	55.29	95.0	109	9.68	11.1	0.10~0.16	1.70	SMSG4-25R SMSG4-25L
25	50	30	65.15	181	213	18.5	21.7	0.12~0.18	3.40	SMSG5-25R SMSG5-25L
12.5	25	12	36.06	16.7	21.4	1.70	2.18	0.05~0.11	0.37	SMSG2-30R SMSG2-30L
17	32	15	47.57	32.6	42.7	3.32	4.36	0.06~0.12	0.77	SMSG2.5-30R SMSG2.5-30L
20	40	20	53.43	60.3	80.4	6.15	8.20	0.07~0.13	1.30	SMSG3-30R SMSG3-30L
25	45	22	67.77	85.1	115	8.68	11.8	0.08~0.14	2.30	SMSG3.5-30R SMSG3.5-30L
25	50	25	79.29	127	174	12.9	17.8	0.10~0.16	3.20	SMSG4-30R SMSG4-30L

NOTE 1: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



MMSA(B) Finished Bore Spiral Miter Gears Modules 1 ~ 10



Modules 1 ~ 10

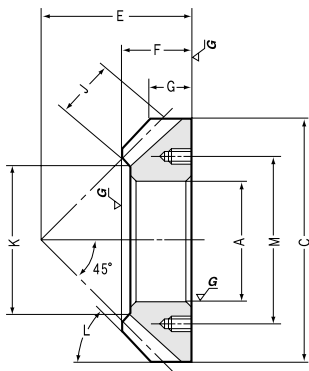
Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length	Hub width	Length of bore
						A _{H7}	B	C	D	E	F	G	H	I
MMSA1-20R MMSB1-20R MMSA1-20L MMSB1-20L	1	<i>m1</i>	20	R	BT	8 10	17	20	21.29	20	13.53	10.64	8.5	12.2
		<i>m1</i>	20	L	BT	8 10	17	20	21.29	20	13.53	10.64	8.5	12.2
MMSA1.5-20R MMSB1.5-20R MMSA1.5-20L MMSB1.5-20L		<i>m1.5</i>	20	R	BT BK	10 12	25	30	31.9	28	18.48	13.95	10.5	16.5
		<i>m1.5</i>	20	L	BT BK	10 12	25	30	31.9	28	18.48	13.95	10.5	16.5
MMSA2-20R MMSB2-20R MMSA2-20L MMSB2-20L		<i>m2</i>	20	R	BK	14 16	35	40	42.52	35	22.09	16.26	12.5	20
		<i>m2</i>	20	L	BK	14 16	35	40	42.52	35	22.09	16.26	12.5	20
MMSA2.5-20R MMSB2.5-20R MMSA2.5-20L MMSB2.5-20L		<i>m2.5</i>	20	R	BK	18 20	42	50	53.2	45	28.63	21.6	16	26
		<i>m2.5</i>	20	L	BK	18 20	42	50	53.2	45	28.63	21.6	16	26
MMSA3-20R MMSB3-20R MMSA3-20L MMSB3-20L		<i>m3</i>	20	R	BK	20 22	52	60	63.99	50	30.78	21.99	16	27
		<i>m3</i>	20	L	BK	20 22	52	60	63.99	50	30.78	21.99	16	27
MMSA3.5-20R MMSB3.5-20R MMSA3.5-20L MMSB3.5-20L		<i>m3.5</i>	20	R	B4	25 28	50	70	74.53	55	32.45	22.26	14	29
		<i>m3.5</i>	20	L	B4	25 28	50	70	74.53	55	32.45	22.26	14	29
MMSA4-20R MMSB4-20R MMSA4-20L MMSB4-20L		<i>m4</i>	20	R	B4	28 30	55	80	84.99	65	39.13	27.5	17	35
		<i>m4</i>	20	L	B4	28 30	55	80	84.99	65	39.13	27.5	17	35
MMSA5-20R MMSB5-20R MMSA5-20L MMSB5-20L		<i>m5</i>	20	R	B4	30 35	70	100	106.25	75	42.99	28.13	17	38
		<i>m5</i>	20	L	B4	30 35	70	100	106.25	75	42.99	28.13	17	38
MMSA6-20R MMSB6-20R MMSA6-20L MMSB6-20L		<i>m6</i>	20	R	B4	40 45	80	120	127.59	90	51.13	33.8	20	45
		<i>m6</i>	20	L	B4	40 45	80	120	127.59	90	51.13	33.8	20	45
MMSA8-20R MMSA8-20L		<i>m8</i>	20	R L	B7	80 80	—	160	—	100	45	29.16	—	40
MMSA10-20R MMSA10-20L		<i>m10</i>	20	R L	B7	100 100	—	200	—	125	58	36.48	—	50

CAUTION: These products which are hardened by carburizing allow no secondary machining. However, the back surface of B7 type gears is masked during the process so that it is possible to drill and pin on this surface.

CAUTION: Dimensions of the diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

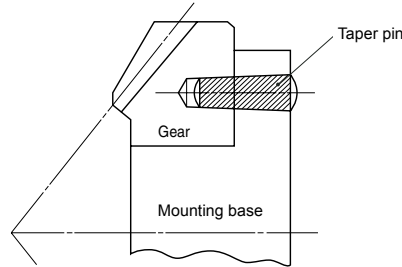


Finished Bore Spiral Miter Gears



B7 Shape

When installing MMSA(B) spiral miter gears in B7 style (ring type), always secure the gears onto the mounting base with taper pins to absorb the rotational loads. It is dangerous to secure with bolts only.



Specifications

Precision grade	JIS B 1704 grade 4	Tooth hardness	55~60HRC
Gear teeth	Gleason	Surface treatment	—
Pressure angle	20°	Tooth surface finish	Cut
Helix angle	35°	Datum reference surface for gear cutting	Bore
Material	SCM415	Secondary Operations	Not Possible (Except the mounting surface on B7 shape)
Heat treatment	Overall Carburizing <small>NOTE4</small>		

NOTE 4: It is possible to perform secondary operations on the mounting surface of style B7 due to masking during carburizing.

Face width J	Holding surface dia. K	Keyway <small>NOTE1</small> Width × Depth	Threaded hole <small>NOTE2</small> Thread size	L	Allowable torque (N · m) <small>NOTE3</small>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
					Bending strength	Surface durability	Bending strength	Surface durability			
4.5	11.67	—	M4 M4	4.5	2.24	2.09	0.23	0.21	0.03~0.13	0.02 0.02	MMSA1-20R MMSB1-20R MMSA1-20L MMSB1-20L
4.5	11.67	—	M4 M4	4.5	2.24	2.09	0.23	0.21	0.03~0.13	0.02 0.02	MMSA1-20R MMSB1-20R MMSA1-20L MMSB1-20L
7	17.2	—	M4 M5	6	7.74	7.34	0.79	0.75	0.05~0.15	0.06 0.05	MMSA1.5-20R MMSB1.5-20R MMSA1.5-20L MMSB1.5-20L
7	17.2	4 x 1.8	M4 M5	6	7.74	7.34	0.79	0.75	0.05~0.15	0.06 0.05	MMSA1.5-20R MMSB1.5-20R MMSA1.5-20L MMSB1.5-20L
9	24.54	5 x 2.3 5 x 2.3	M5 M5	7	18.0	17.3	1.83	1.76	0.06~0.16	0.14 0.13	MMSA2-20R MMSB2-20R MMSA2-20L MMSB2-20L
9	24.54	5 x 2.3 5 x 2.3	M5 M5	7	18.0	17.3	1.83	1.76	0.06~0.16	0.14 0.13	MMSA2-20R MMSB2-20R MMSA2-20L MMSB2-20L
11	30.89	6 x 2.8 6 x 2.8	M6 M6	8	34.6	33.7	3.52	3.44	0.07~0.17	0.26 0.24	MMSA2.5-20R MMSB2.5-20R MMSA2.5-20L MMSB2.5-20L
11	30.89	6 x 2.8 6 x 2.8	M6 M6	8	34.6	33.7	3.52	3.44	0.07~0.17	0.26 0.24	MMSA2.5-20R MMSB2.5-20R MMSA2.5-20L MMSB2.5-20L
14	34.4	6 x 2.8 6 x 2.8	M6 M6	8	61.9	61.1	6.32	6.23	0.08~0.18	0.44 0.42	MMSA3-20R MMSB3-20R MMSA3-20L MMSB3-20L
14	34.4	6 x 2.8 6 x 2.8	M6 M6	8	61.9	61.1	6.32	6.23	0.08~0.18	0.44 0.42	MMSA3-20R MMSB3-20R MMSA3-20L MMSB3-20L
16	42.75	8 x 3.3 8 x 3.3	M8 M8	8	97.1	96.7	9.90	9.86	0.10~0.25	0.50 0.47	MMSA3.5-20R MMSB3.5-20R MMSA3.5-20L MMSB3.5-20L
16	42.75	8 x 3.3 8 x 3.3	M8 M8	8	97.1	96.7	9.90	9.86	0.10~0.25	0.50 0.47	MMSA3.5-20R MMSB3.5-20R MMSA3.5-20L MMSB3.5-20L
18	49.08	8 x 3.3 8 x 3.3	M8 M8	9	144	144	14.6	14.7	0.12~0.27	0.72 0.70	MMSA4-20R MMSB4-20R MMSA4-20L MMSB4-20L
18	49.08	8 x 3.3 8 x 3.3	M8 M8	9	144	144	14.6	14.7	0.12~0.27	0.72 0.70	MMSA4-20R MMSB4-20R MMSA4-20L MMSB4-20L
23	60.95	8 x 3.3 10 x 3.3	M8 M8	9	284	288	29.0	29.4	0.14~0.34	1.40 1.30	MMSA5-20R MMSB5-20R MMSA5-20L MMSB5-20L
23	60.95	8 x 3.3 10 x 3.3	M8 M8	9	284	288	29.0	29.4	0.14~0.34	1.40 1.30	MMSA5-20R MMSB5-20R MMSA5-20L MMSB5-20L
27	73.63	12 x 3.3 14 x 3.8	M8 M8	10	475	496	48.4	50.6	0.16~0.36	2.30 2.20	MMSA6-20R MMSB6-20R MMSA6-20L MMSB6-20L
27	73.63	12 x 3.3 14 x 3.8	M8 M8	10	475	496	48.4	50.6	0.16~0.36	2.30 2.20	MMSA6-20R MMSB6-20R MMSA6-20L MMSB6-20L
35	101	—	6-M10 6-M10	110	1080	1170	111	119	0.20~0.45	4.00 4.00	MMSA8-20R MMSA8-20L
45	122.72	—	6-M10 6-M10	130	1660	1840	169	188	0.25~0.50	8.10 8.10	MMSA10-20R MMSA10-20L

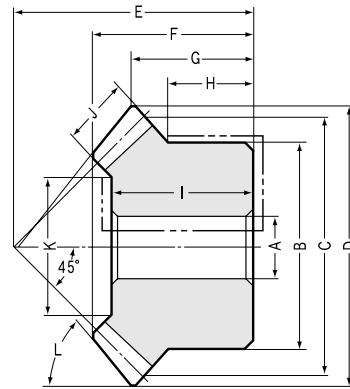
NOTE 1: Although the dimensions of the keyway are made to the Js9 tolerance, there may be some deviations due to the effects of the heat treatment.

NOTE 2: A set screw comes with these products.

NOTE 3: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



MMS Spiral Miter Gears Modules 2~5



B3 Shape

Modules 2~5

Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
						A _{H7}	B	C	D	E	F	G
MMS2-20R MMS2-20L	1	m2	20	R L	B3	12	34	40	42.31	35	22.14	16.15
MMS2.5-20R MMS2.5-20L		m2.5	20	R L	B3	15	42	50	53.2	45	28.63	21.6
MMS3-20R MMS3-20L		m3	20	R L	B3	16	52	60	63.99	50	30.78	21.99
MMS4-20R MMS4-20L		m4	20	R L	B3	20	65	80	84.99	65	39.13	27.5
MMS5-20R MMS5-20L		m5	20	R L	B3	25	85	100	106.25	75	42.99	28.13
MMS2-25R MMS2-25L	1	m2	25	R L	B3	12	45	50	52.4	40	24.19	16.2
MMS2.5-25R MMS2.5-25L		m2.5	25	R L	B3	16	55	62.5	65.54	50	30.24	20.27
MMS3-25R MMS3-25L		m3	25	R L	B3	20	65	75	78.77	60	37.57	24.39
MMS4-25R MMS4-25L		m4	25	R L	B3	25	85	100	104.7	80	49.14	32.35
MMS5-25R MMS5-25L		m5	25	R L	B3	28	100	125	130.86	100	60.59	40.43

CAUTION: A set of miter gears must be identical in module and number of teeth, but opposite in spiral hands.

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

MMS
Miter Gears



Specifications

Precision grade	JIS B 1704 grade 4	Tooth hardness	55~60HRC
Gear teeth	Gleason	Surface treatment	---
Pressure angle	20°	Tooth surface finish	Cut
Helix angle	35°	Datum reference surface for gear cutting	Bore
Material	SCM415	Secondary Operations	Possible where masking for carburizing
Heat treatment	Carburizing NOTE 1		

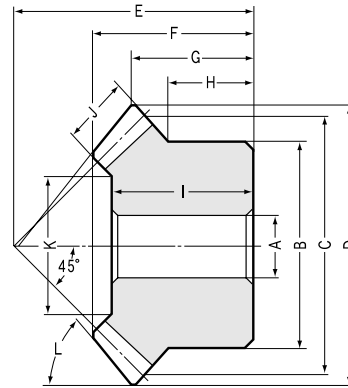
NOTE 1: The areas marked with ---- on the diagram are masked during the carburizing and can be modified, even though the hardness is somewhat higher.

Hub width H	Length of bore I	Face width J	Holding surface dia. K	Allowable torque (N · m) NOTE 2		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
12	20	9	24.54	17.0	17.3	1.73	1.76	0.06~0.16	0.13	MMS2-20R MMS2-20L
16	26	11	30.89	32.7	33.7	3.34	3.44	0.07~0.17	0.26	MMS2.5-20R MMS2.5-20L
16	27	14	34.4	58.7	61.1	5.98	6.23	0.08~0.18	0.43	MMS3-20R MMS3-20L
17.5	35	18	49.08	136	144	13.9	14.7	0.12~0.27	0.97	MMS4-20R MMS4-20L
17.5	38	23	60.95	269	288	27.5	29.4	0.14~0.34	1.70	MMS5-20R MMS5-20L
12.5	21	12	28.06	29.1	36.3	2.96	3.70	0.06~0.16	0.22	MMS2-25R MMS2-25L
15	27	15	36.57	56.7	71.8	5.79	7.32	0.07~0.17	0.42	MMS2.5-25R MMS2.5-25L
17.5	33	20	39.43	104	133	10.6	13.6	0.08~0.18	0.81	MMS3-25R MMS3-25L
22.5	44	25	57.29	238	309	24.3	31.5	0.12~0.27	1.90	MMS4-25R MMS4-25L
25	50	30	65.15	454	595	46.3	60.7	0.14~0.34	3.40	MMS5-25R MMS5-25L

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



SMS Spiral Miter Gears Modules 1~8



B3 Shape

20 Tooth Miter Gears Modules 1~8

Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore <small>NOTE 1</small>	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
						A	B	C	D	E	F	G
SMS1-20R SMS1-20L	1	m1	20	R L	B3	6	16	20	21.3	20	13.84	10.65
SMS1.5-20R SMS1.5-20L		m1.5	20	R L	B3	8	26	30	31.74	30	21.18	15.87
SMS2-20R SMS2-20L		m2	20	R L	B3	12	34	40	42.4	37	24.75	18.2
SMS2.5-20R SMS2.5-20L		m2.5	20	R L	B3	14	42	50	52.94	48	32.42	24.47
SMS3-20R SMS3-20L		m3	20	R L	B3	16	50	60	63.72	58	39.6	29.86
SMS3.5-20R SMS3.5-20L		m3.5	20	R L	B3	20	60	70	74.47	65	43.81	32.23
SMS4-20R SMS4-20L		m4	20	R L	B3	20	64	80	84.88	75	50.51	37.44
SMS5-20R SMS5-20L		m5	20	R L	B3	25	80	100	105.9	90	60.16	42.95
SMS6-20R SMS6-20L		m6	20	R L	B3	28	100	120	127.16	104	67.35	47.58
SMS8-20R SMS8-20L		m8	20	R L	B3	30	130	160	169.94	125	72.6	49.97

CAUTION: A set of miter gears must be identical in module and number of teeth, but opposite in spiral hands.

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

NOTE 1: Due to heat treating, some deformation of the bore may occur. It may be necessary to ream the bore to bring it to the stated dimensions.



Specifications

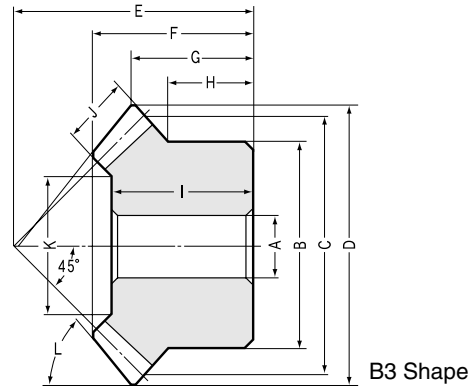
Precision grade	JIS B 1704 grade 4	Tooth hardness	48~53HRC
Gear teeth	Gleason	Surface treatment	Black oxide
Pressure angle	20°	Tooth surface finish	Cut
Helix angle	35°	Datum reference surface for gear cutting	Bore
Material	S45C	Secondary Operations	Possible except tooth areas
Heat treatment	Teeth induction hardened		

Hub width H	Length of bore I	Face width J	Holding surface dia. K	Allowable torque (N · m) <i>NOTE 2</i>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
8	12	5	9.86	1.07	0.65	0.11	0.067	0.03~0.13	0.02	SMS1-20R SMS1-20L
13	19	8	15.37	3.73	2.33	0.38	0.24	0.05~0.15	0.07	SMS1.5-20R SMS1.5-20L
14	22	10	21.72	8.54	5.40	0.87	0.55	0.06~0.16	0.15	SMS2-20R SMS2-20L
19	29	12	28.06	16.3	10.5	1.66	1.07	0.07~0.17	0.30	SMS2.5-20R SMS2.5-20L
23	35	15	31.57	28.8	18.7	2.94	1.91	0.08~0.18	0.50	SMS3-20R SMS3-20L
25	40	18	39.09	46.5	30.4	4.74	3.10	0.10~0.25	0.80	SMS3.5-20R SMS3.5-20L
27	45	20	43.43	68.3	45.0	6.97	4.59	0.12~0.27	1.10	SMS4-20R SMS4-20L
30	54	26	54.46	136	90.9	13.9	9.27	0.14~0.34	2.10	SMS5-20R SMS5-20L
34	60	30	67.15	226	155	23.0	15.8	0.16~0.36	3.60	SMS6-20R SMS6-20L
30	62	35	95	484	344	49.4	35.1	0.20~0.45	7.10	SMS8-20R SMS8-20L

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



SMS Spiral Miter Gears Module 1~6



Miter Gears
SMS

25 Tooth Miter Gears Modules 1~6

Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore <small>NOTE 1</small>	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
						A	B	C	D	E	F	G
SMS1-25R SMS1-25L	1	m1	25	R L	B3	6	20	25	26.22	23	15.08	11.11
SMS1.5-25R SMS1.5-25L		m1.5	25	R L	B3	10	30	37.5	39.3	34	22.14	16.15
SMS2-25R SMS2-25L		m2	25	R L	B3	12	40	50	52.38	40	24.2	16.19
SMS2.5-25R SMS2.5-25L		m2.5	25	R L	B3	16	50	62.5	65.54	50	30.24	20.27
SMS3-25R SMS3-25L		m3	25	R L	B3	20	60	75	78.77	60	37.57	24.39
SMS3.5-25R SMS3.5-25L		m3.5	25	R L	B3	25	70	87.5	91.81	70	42.98	28.41
SMS4-25R SMS4-25L		m4	25	R L	B3	28	80	100	104.7	80	49.14	32.35
SMS5-25R SMS5-25L		m5	25	R L	B3	28	100	125	130.86	100	60.59	40.43
SMS6-25R SMS6-25L		m6	25	R L	B3	28	120	150	157.17	120	71.97	48.58

30 Tooth Miter Gears Modules 1~5

Catalog No.	Gear ratio	Module	No. of teeth	Direction of spiral	Shape	Bore <small>NOTE 1</small>	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
						A	B	C	D	E	F	G
SMS1-30R SMS1-30L	1	m1	30	R L	B3	8	24	30	31.26	28	17.61	13.63
SMS1.5-30R SMS1.5-30L		m1.5	30	R L	B3	10	36	45	46.84	43	28.11	21.42
SMS2-30R SMS2-30L		m2	30	R L	B3	12	45	60	62.42	50	29.27	21.21
SMS2.5-30R SMS2.5-30L		m2.5	30	R L	B3	16	60	75	78.04	62	36.08	26.02
SMS3-30R SMS3-30L		m3	30	R L	B3	20	70	90	93.61	75	45.25	31.8
SMS3.5-30R SMS3.5-30L		m3.5	30	R L	B3	25	90	105	109.21	85	49.4	34.6
SMS4-30R SMS4-30L		m4	30	R L	B3	28	100	120	124.71	95	54.28	37.35
SMS5-30R SMS5-30L		m5	30	R L	B3	28	130	150	155.89	120	68.2	47.95

CAUTION: A set of miter gears must be identical in module and number of teeth, but opposite in spiral hands.

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

NOTE1: Due to heat treating, some deformation of the bore may occur. It may be necessary to ream the bore to bring it to the stated dimensions.



Specifications

Precision grade	JIS B 1704 grade 4	Tooth hardness	48~53HRC
Gear teeth	Gleason	Surface treatment	Black oxide
Pressure angle	20°	Tooth surface finish	Cut
Helix angle	35°	Datum reference surface for gear cutting	Bore
Material	S45C	Secondary Operations	Possible except tooth areas
Heat treatment	Teeth induction hardened		

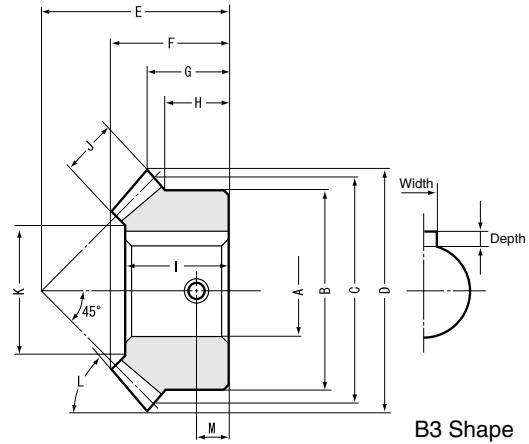
Hub width H	Length of bore I	Face width J	Holding surface dia. K	Allowable torque (N · m) <small>NOTE 2</small>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
8	14	6	15.03	1.71	1.28	0.17	0.13	0.03~0.13	0.05	SMS1-25R SMS1-25L
11.5	19	9	19.54	5.78	4.42	0.59	0.45	0.05~0.15	0.12	SMS1.5-25R SMS1.5-25L
10	20	12	26.06	13.7	10.7	1.40	1.09	0.06~0.16	0.20	SMS2-25R SMS2-25L
12.5	26	15	34.57	26.8	21.1	2.73	2.15	0.07~0.17	0.40	SMS2.5-25R SMS2.5-25L
15	32	20	37.43	49.1	39.1	5.00	3.98	0.08~0.18	0.70	SMS3-25R SMS3-25L
17.5	37	22	46.77	75.4	60.6	7.69	6.18	0.10~0.25	1.10	SMS3.5-25R SMS3.5-25L
20	43	25	55.29	112	90.7	11.5	9.25	0.12~0.27	1.70	SMS4-25R SMS4-25L
25	50	30	65.15	214	175	21.8	17.8	0.14~0.34	3.40	SMS5-25R SMS5-25L
30	61	35	83	357	300	36.4	30.6	0.16~0.36	5.40	SMS6-25R SMS6-25L

Hub width H	Length of bore I	Face width J	Holding surface dia. K	Allowable torque (N · m) <small>NOTE 2</small>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
10	16	6	19.03	2.28	2.03	0.23	0.21	0.03~0.13	0.05	SMS1-30R SMS1-30L
16	25	10	25.72	8.22	7.48	0.84	0.76	0.05~0.15	0.20	SMS1.5-30R SMS1.5-30L
12.5	25	12	36.06	18.2	16.9	1.86	1.72	0.06~0.16	0.37	SMS2-30R SMS2-30L
17	32	15	47.57	35.6	33.4	3.63	3.40	0.07~0.17	0.77	SMS2.5-30R SMS2.5-30L
20	40	20	53.43	65.8	62.3	6.71	6.35	0.08~0.18	1.30	SMS3-30R SMS3-30L
25	45	22	67.77	101	96.0	10.3	9.79	0.10~0.25	2.30	SMS3.5-30R SMS3.5-30L
25	50	25	79.29	150	144	15.3	14.7	0.12~0.27	3.20	SMS4-30R SMS4-30L
35	62	30	99.15	284	276	29.0	28.1	0.14~0.34	6.00	SMS5-30R SMS5-30L

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



SMA(B)(C) Finished Bore Miter Gears Module 1 ~ 8



20 Tooth Miter Gears Modules 1 ~ 8

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore <small>NOTE 1</small>	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length	Hub width	Length of bore
					A _{H7}	B	C	D	E	F	G	H	I
SMA1-20 SMB1-20	1	m1	20	BT BT	8 10	16	20	21.41	20	13.95	10.71	8	12 12.07
SMA1.5-20 SMB1.5-20		m1.5	20	BT BK	10 12	26	30	32.12	30	21.24	16.06	13	19 19
SMA2-20 SMB2-20		m2	20	BK BK	14 15	34	40	42.83	37	24.89	18.41	14	22 22
SMA2.5-20 SMB2.5-20		m2.5	20	BK BK	18 20	42	50	53.54	48	32.54	24.77	19	29 29
SMA3-20 SMB3-20 SMC3-20		m3	20	BK BK BK	22 25 20	50	60	64.24	58	39.84	30.12	23	35 35 35
SMA3.5-20 SMB3.5-20		m3.5	20	BK BK	28 30	60	70	74.95	65	44.13	32.47	25	40 40
SMA4-20 SMB4-20 SMC4-20		m4	20	BK BK BK	30 32 25	64	80	85.65	75	50.78	37.83	27	45 45 45
SMA5-20 SMB5-20 SMC5-20		m5	20	BK BK BK	40 30 35	80	100	107.07	90	60.38	43.54	30	54 54 54
SMA6-20 SMB6-20 SMC6-20		m6	20	BK BK BK	45 50 40	100	120	128.48	104	67.67	48.24	34	60 60 60
SMA8-20		m8	20	BK	60	130	160	171.31	125	73.33	50.66	30	62

CAUTION: SMA, SMB and SMC gears are identical in all features except for bore and keyway dimensions.

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

Miter Gears
SMA · SMB · SMC



Specifications

Precision grade	JIS B 1704 grade 4	Tooth hardness	48~53HRC
Gear teeth	Gleason	Surface treatment	Black oxide
Pressure angle	20°	Tooth surface finish	Cut
Helix angle	—	Datum reference surface for gear cutting	Bore
Material	S45C	Secondary Operations	Possible except tooth areas and bore
Heat treatment	Teeth induction hardened		

Face width J	Holding surface dia. K	Keyway NOTE 1 Width × Depth	Threaded hole NOTE 2		Allowable torque (N · m) NOTE 3		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Thread size	L	Bending strength	Surface durability	Bending strength	Surface durability			
5	9.86 10	— —	M4 M4	4	0.90	0.37	0.091	0.038	0.03~0.13	0.015 0.015	SMA1-20 SMB1-20
8	15.37 15.37	— 4 × 1.8	M4 M5	6.5	3.13	1.31	0.32	0.13	0.05~0.15	0.070 0.070	SMA1.5-20 SMB1.5-20
10	21.72 21.72	5 × 2.3 5 × 2.3	M5 M5	7	7.17	3.05	0.73	0.31	0.06~0.16	0.14 0.14	SMA2-20 SMB2-20
12	28.06 28.06	5 × 2.3* 6 × 2.8	M6 M6	9.5	13.7	5.90	1.39	0.60	0.07~0.17	0.28 0.25	SMA2.5-20 SMB2.5-20
15	31.57 31.57 31.57	7 × 3* 7 × 3* 6 × 2.8	M6 M8 M6	11.5	24.2	10.5	2.47	1.08	0.08~0.18	0.41 0.39 0.50	SMA3-20 SMB3-20 SMC3-20
18	39.09 39.09	7 × 3* 8 × 3.3	M8 M8	12.5	39.0	17.2	3.98	1.75	0.10~0.25	0.70 0.65	SMA3.5-20 SMB3.5-20
20	43.43 43.43 43.43	7 × 3* 10 × 3.3 8 × 3.3	M8 M8 M8	13.5	57.3	25.4	5.85	2.59	0.12~0.27	1.00 1.00 1.10	SMA4-20 SMB4-20 SMC4-20
26	54.46 54.46 54.46	10 × 3.3* 8 × 3.3 10 × 3.3	M8 M8 M8	15	114	51.3	11.7	5.23	0.14~0.34	2.00 2.10 2.00	SMA5-20 SMB5-20 SMC5-20
30	67.15 67.15 67.15	12 × 3.3* 14 × 3.8 12 × 3.3	M8 M8 M8	17	190	87.5	19.3	8.92	0.16~0.36	3.40 3.30 3.50	SMA6-20 SMB6-20 SMC6-20
35	95	18 × 4.4	M10	15	406	194	41.4	19.8	0.20~0.45	6.00	SMA8-20

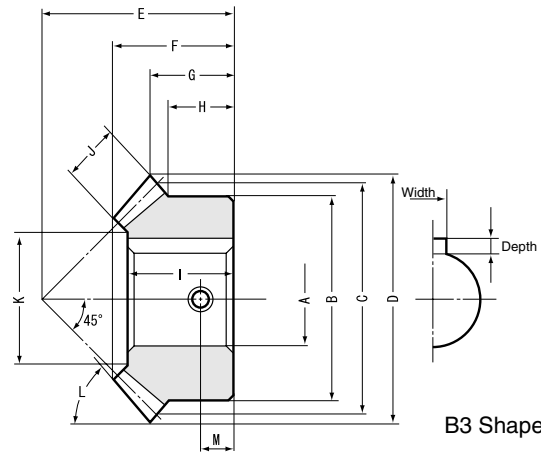
NOTE 1: The keyway dimensions of items with "*" marks do not conform to JIS Standards.

NOTE 2: A set screw comes with these products.

NOTE 3: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



SMA(B) Finished Bore Miter Gears Modules 1~6



25 Tooth Miter Gears Modules 1~6

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length	Hub width	Length of bore
					A _{H7}	B	C	D	E	F	G	H	I
SMA1-25	1	m1	25	BT	10	20	25	26.41	23	15.16	11.21	8	14
SMA1.5-25		m1.5	25	BK	12	30	37.5	39.62	34	22.25	16.31	11.5	19
SMA2-25 SMB2-25		m2	25	BK BK	18	40	50	52.83	40	24.33	16.41	10	20
SMA2.5-25 SMB2.5-25					15	40	50	52.83	40	24.33	16.41	10	20
SMA3-25 SMB3-25		m3	25	BK BK	20	50	62.5	66.04	50	30.41	20.52	12.5	26
SMA3.5-25 SMB3.5-25					18	50	62.5	66.04	50	30.41	20.52	12.5	26
SMA4-25 SMB4-25		m4	25	BK BK	30	60	75	79.24	60	37.81	24.62	15	32
SMA5-25					25	60	75	79.24	60	37.81	24.62	15	32
SMA6-25		m6	25	BK	32	70	87.5	92.45	70	43.23	28.72	17.5	37
					28	70	87.5	92.45	70	43.23	28.72	17.5	37
				35	80	100	105.66	80	49.32	32.83	20	43	
				30	80	100	105.66	80	49.32	32.83	20	43	
				50	100	125	132.07	100	60.82	41.04	25	50	
				55	120	150	158.48	120	72.32	49.24	30	61	

30 Tooth Miter Gears Modules 1~5

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length	Hub width	Length of bore
					A _{H7}	B	C	D	E	F	G	H	I
SMA1-30	1	m1	30	BK	12	24	30	31.41	28	17.71	13.71	10	16
SMA1.5-30		m1.5	30	BK	15	36	45	47.12	43	28.24	21.56	16	25
SMA2-30 SMB2-30		m2	30	BK BK	20	45	60	62.83	50	29.42	21.41	12.5	25
SMA2.5-30 SMB2.5-30					15	45	60	62.83	50	29.42	21.41	12.5	25
SMA3-30 SMB3-30		m3	30	BK BK	25	60	75	78.54	62	36.28	26.27	17	32
SMA3.5-30 SMB3.5-30					20	60	75	78.54	62	36.28	26.27	17	32
SMA4-30 SMB4-30		m4	30	BK BK	32	70	90	94.24	75	45.47	32.12	20	40
SMA5-30					25	70	90	94.24	75	45.47	32.12	20	40
					35	90	105	109.95	85	49.66	34.97	25	45
					30	90	105	109.95	85	49.66	34.97	25	45
				40	100	120	125.66	95	54.52	37.83	25	50	
				30	100	120	125.66	95	54.52	37.83	25	50	
				55	130	150	157.07	120	68.56	48.54	35	62	

CAUTION: SMA and SMB gears are identical in all features except for bore and keyway dimensions.

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

Miter Gears

SMA · SMB



Finished Bore Miter Gears

Specifications

Precision grade	JIS B 1704 grade 4	Tooth hardness	48~53HRC
Gear teeth	Gleason	Surface treatment	Black oxide
Pressure angle	20°	Tooth surface finish	Cut
Helix angle	—	Datum reference surface for gear cutting	Bore
Material	S45C	Secondary Operations	Possible except tooth areas and bore
Heat treatment	Teeth induction hardened		

Face width	Holding surface dia.	Keyway NOTE 1	Threaded hole NOTE 2		Allowable torque (N · m) NOTE 3		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Thread size	L	Bending strength	Surface durability	Bending strength	Surface durability			
J	K	Width × Depth									
6	15.03	—	M4	4	1.48	0.71	0.15	0.072	0.03~0.13	0.04	SMA1-25
9	19.54	4 x 1.8	M5	5.75	4.98	2.44	0.51	0.25	0.05~0.15	0.06	SMA1.5-25
12	26.06	6 x 2.8 5 x 2.3	M6 M5	5	11.8	5.90	1.20	0.60	0.06~0.16	0.17 0.17	SMA2-25 SMB2-25
15	34.57	5 x 2.3* 6 x 2.8	M6 M6	6	23.1	11.7	2.35	1.19	0.07~0.17	0.40 0.40	SMA2.5-25 SMB2.5-25
20	37.43	7 x 3* 8 x 3.3	M8 M8	7.5	42.3	21.6	4.31	2.20	0.08~0.18	0.60 0.60	SMA3-25 SMB3-25
22	46.77	10 x 3.3 8 x 3.3	M8 M8	8.5	65.0	33.5	6.63	3.42	0.10~0.25	1.00 1.00	SMA3.5-25 SMB3.5-25
25	55.29	10 x 3.3 8 x 3.3	M8 M8	10	96.8	50.2	9.87	5.12	0.12~0.27	1.60 1.60	SMA4-25 SMB4-25
30	65.15	12 x 3.3*	M8	12.5	185	96.8	18.8	9.87	0.14~0.34	3.00	SMA5-25
35	83	16 x 4.3	M10	15	307	166	31.3	16.9	0.16~0.36	4.50	SMA6-25

Face width	Holding surface dia.	Keyway NOTE 1	Threaded hole NOTE 2		Allowable torque (N · m) NOTE 3		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Thread size	L	Bending strength	Surface durability	Bending strength	Surface durability			
J	K	Width × Depth									
6	19.03	4 x 1.8	M5	5	2.00	1.11	0.20	0.11	0.03~0.13	0.05	SMA1-30
10	25.71	5 x 2.3	M5	8	7.22	4.08	0.74	0.42	0.05~0.15	0.19	SMA1.5-30
12	36.06	6 x 2.8 5 x 2.3	M6 M5	6.25	16.0	9.20	1.63	0.94	0.06~0.16	0.32 0.32	SMA2-30 SMB2-30
15	47.57	8 x 3.3 6 x 2.8	M8 M6	8.5	31.2	18.2	3.19	1.86	0.07~0.17	0.70 0.70	SMA2.5-30 SMB2.5-30
20	53.43	10 x 3.3 8 x 3.3	M8 M8	10	57.8	34.0	5.89	3.46	0.08~0.18	1.10 1.10	SMA3-30 SMB3-30
22	67.77	10 x 3.3 8 x 3.3	M8 M8	12.5	88.4	52.3	9.01	5.34	0.10~0.25	2.10 2.10	SMA3.5-30 SMB3.5-30
25	79.29	12 x 3.3 8 x 3.3	M8 M8	12.5	131	78.3	13.4	7.99	0.12~0.27	2.90 2.90	SMA4-30 SMB4-30
30	99.15	16 x 4.3	M10	17.5	250	150	25.5	15.3	0.14~0.34	5.20	SMA5-30

NOTE 1: The keyway dimensions of items with "*" marks do not conform to JIS Standards.

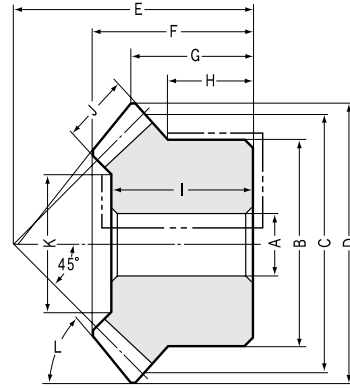
NOTE 2: A set screw comes with these products.

NOTE 3: The allowable torques shown in the table are the calculated values according to the assumed usage conditions.

Please see page 196 for more details.



MM Carburized & Hardened Miter Gears Modules 2~5



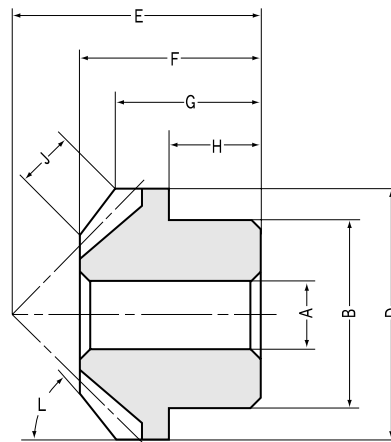
B3 Shape

Modules 2~5

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mourting distance	Total length	Crown to back length	Hub width
					A _{H7}	B	C	D	E	F	G	H
MM2-20	1	m2	20	B3	12	34	40	42.83	35	22.24	16.41	12
MM2.5-20		m2.5	20	B3	15	42	50	53.54	45	28.89	21.77	16
MM3-20		m3	20	B3	16	52	60	64.24	50	31.19	22.12	16
MM4-20		m4	20	B3	20	65	80	85.66	65	39.49	27.83	17.5
MM5-20		m5	20	B3	25	80	100	107.07	90	60.38	43.54	30
MM2-25	1	m2	25	B3	12	45	50	52.83	40	24.33	16.41	12.5
MM2.5-25		m2.5	25	B3	16	55	62.5	66.03	50	30.41	20.52	15
MM3-25		m3	25	B3	20	65	75	79.24	60	37.81	24.62	17.5
MM4-25		m4	25	B3	25	85	100	105.66	80	49.32	32.83	22.5
MM5-25		m5	25	B3	28	100	125	132.07	100	60.82	41.04	25



LM Sintered Metal Miter Gears Modules 0.8~1.5



B1Shape

Modules 0.8~1.5

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mourting distance	Total length	Crown to back length	Hub width
					A _{H8}	B	C	D	E	F	G	H
LM0.8-20	1	m0.8	20	B1	4	12	16	17.13	16	11	8.57	5.5
LM1-20		m1	20	B1	5	16	20	21.41	20	13.5	10.71	6
LM1.25-20		m1.25	20	B1	6	22	25	26.77	23	15	11.38	6
LM1.5-20		m1.5	20	B1	6	26	30	32.12	30	21	16.06	9

CAUTION: Although the sintering process allows for the inclusion of oil to maintain lubricity, these gears have not been oil impregnated.

CAUTION: The rust prevention process involves treating the gears with steam (in effect, creating the surface oxidation). The black oxide treatment cannot be applied to these gears.



Carburized & Hardened Miter Gears

Specifications

Precision grade	JIS B 1704 grade 4	Tooth hardness	55~60HRC
Gear teeth	Gleason	Surface treatment	—
Pressure angle	20°	Tooth surface finish	Cut
Material	SCM415	Datum reference surface for gear cutting	Bore
Heat treatment	Carburizing <small>NOTE 1</small>	Secondary Operations	Possible where masking for carburizing

NOTE 1: The areas marked with ---- on the diagram are masked during the carburizing and can be modified, even though the hardness is somewhat higher.

Length of bore	Face width	Holding surface dia.	Allowable torque (N · m) <small>NOTE 2</small>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Bending strength	Surface durability	Bending strength	Surface durability			
I	J	K							
20	9	24.54	15.1	9.74	1.54	0.99	0.06~0.16	0.13	MM2-20 MM2.5-20 MM3-20 MM4-20 MM5-20
26	11	30.89	29.0	19.0	2.96	1.94	0.07~0.17	0.26	
27	14	34.4	52.0	34.5	5.30	3.52	0.08~0.18	0.43	
35	18	49.09	121	81.2	12.3	8.28	0.12~0.27	0.97	
54	26	54.46	256	175	26.1	17.8	0.14~0.34	2.10	
21	12	28.06	26.4	20.1	2.70	2.05	0.06~0.16	0.22	MM2-25 MM2.5-25 MM3-25 MM4-25 MM5-25
27	15	36.57	51.6	39.7	5.27	4.05	0.07~0.17	0.41	
33	20	39.43	94.7	73.5	9.66	7.49	0.08~0.18	0.81	
44	25	57.29	217	171	22.1	17.4	0.12~0.27	1.90	
50	30	65.15	413	329	42.1	33.6	0.14~0.34	3.40	

NOTE 2: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



Sintered Metal Miter Gears

Specifications

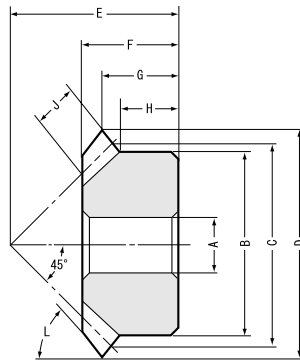
Precision grade	JIS B 1704 grade 5	Tooth hardness	70~95HRB
Gear teeth	Gleason	Surface treatment	Steam treatment
Pressure angle	20°	Tooth surface finish	Sintered
Material	SMF5040	Datum reference surface for gear cutting	Bore
Heat treatment	—	Secondary Operations	Possible

Length of bore	Face width	Holding surface dia.	Allowable torque (N · m) <small>NOTE 1</small>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Bending strength	Surface durability	Bending strength	Surface durability			
I	J	K							
11	4.24	—	0.22	0.027	0.022	0.0027	0~0.16	10	LM0.8-20 LM1-20 LM1.25-20 LM1.5-20
13.5	4.95	—	0.41	0.050	0.042	0.0051	0~0.18	22	
15	6.36	—	0.81	0.099	0.083	0.010	0~0.20	37	
21	8.48	—	1.48	0.19	0.15	0.019	0~0.22	70	

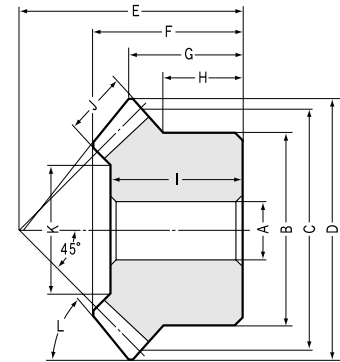
NOTE 1: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



SM Miter Gears Module 1~8



B2 Shape



B3 Shape

Modules 1~8

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length	Hub width
					AH7	B	C	D	E	F	G	H
SM2-16	1	<i>m2</i>	16	B2	10	27	32	34.83	30	19	15.41	11.5
SM2.5-16		<i>m2.5</i>	16	B2	12	34	40	43.53	35	21	16.77	12
SM3-16		<i>m3</i>	16	B2	14	42	48	52.24	40	23	18.12	13
SM4-16		<i>m4</i>	16	B2	16	55	64	69.66	50	28	20.83	13.5
SM5-16		<i>m5</i>	16	B2	20	70	80	87.07	65	37	28.53	20
SM1-20	1	<i>m1</i>	20	B3	6	16	20	21.41	20	13.94	10.71	8
SM1.25-20		<i>m1.25</i>	20	B3	8	22	25	26.77	23	15.27	11.38	9
SM1.5-20		<i>m1.5</i>	20	B3	8	26	30	32.12	30	21.24	16.06	13
SM2-20		<i>m2</i>	20	B3	12	34	40	42.83	37	24.89	18.41	14
SM2.5-20		<i>m2.5</i>	20	B3	14	42	50	53.54	48	32.54	24.77	19
SM3-20		<i>m3</i>	20	B3	16	50	60	64.24	58	39.84	30.12	23
SM3.5-20		<i>m3.5</i>	20	B3	20	60	70	74.95	65	44.13	32.47	25
SM4-20		<i>m4</i>	20	B3	20	64	80	85.65	75	50.78	37.83	27
SM5-20		<i>m5</i>	20	B3	25	80	100	107.07	90	60.38	43.54	30
SM6-20		<i>m6</i>	20	B3	28	100	120	128.48	104	67.67	48.24	34
SM8-20	<i>m8</i>	20	B3	30	130	160	171.31	125	73.33	50.66	30	
SM1-25	1	<i>m1</i>	25	B3	6	20	25	26.41	23	15.16	11.21	8
SM1.25-25		<i>m1.25</i>	25	B3	8	25	31.25	33.02	28	17.88	13.26	9.25
SM1.5-25		<i>m1.5</i>	25	B3	10	30	37.5	39.62	34	22.25	16.31	11.5
SM2-25		<i>m2</i>	25	B3	12	40	50	52.83	40	24.33	16.41	10
SM2.5-25		<i>m2.5</i>	25	B3	16	50	62.5	66.04	50	30.41	20.52	12.5
SM3-25		<i>m3</i>	25	B3	20	60	75	79.24	60	37.81	24.62	15
SM3.5-25		<i>m3.5</i>	25	B3	25	70	87.5	92.45	70	43.23	28.72	17.5
SM4-25		<i>m4</i>	25	B3	28	80	100	105.66	80	49.32	32.83	20
SM5-25		<i>m5</i>	25	B3	28	100	125	132.07	100	60.82	41.04	25
SM6-25		<i>m6</i>	25	B3	28	120	150	158.48	120	72.32	49.24	30
SM1-30	1	<i>m1</i>	30	B3	8	24	30	31.41	28	17.71	13.71	10
SM1.25-30		<i>m1.25</i>	30	B3	10	30	37.5	39.27	36	23.47	18.13	13.5
SM1.5-30		<i>m1.5</i>	30	B3	10	36	45	47.12	43	28.24	21.56	16
SM2-30		<i>m2</i>	30	B3	12	45	60	62.83	50	29.42	21.41	12.5
SM2.5-30		<i>m2.5</i>	30	B3	16	60	75	78.54	62	36.28	26.27	17
SM3-30		<i>m3</i>	30	B3	20	70	90	94.24	75	45.47	32.12	20
SM3.5-30		<i>m3.5</i>	30	B3	25	90	105	109.95	85	49.66	34.97	25
SM4-30		<i>m4</i>	30	B3	28	100	120	125.66	95	54.52	37.83	25
SM5-30		<i>m5</i>	30	B3	28	130	150	157.07	120	68.56	48.54	35

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.



Specifications

Precision grade	JIS B 1704 grade 3	Tooth hardness	Less than 194HB
Gear teeth	Gleason	Surface treatment	Black oxide
Pressure angle	20°	Tooth surface finish	Cut
Material	S45C	Datum reference surface for gear cutting	Bore
Heat treatment	—	Secondary Operations	Possible

Length of bore	Face width	Holding surface dia.	Allowable torque (N · m) <i>NOTE 1</i>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Bending strength	Surface durability	Bending strength	Surface durability			
I	J	K							
19	7	—	3.84	0.33	0.39	0.034	0.06~0.16	0.09	SM2-16
21	9	—	7.63	0.68	0.78	0.069	0.07~0.17	0.13	SM2.5-16
23	11	—	13.3	1.21	1.36	0.12	0.08~0.18	0.22	SM3-16
28	14	—	30.7	2.87	3.13	0.29	0.12~0.27	0.48	SM4-16
37	17	—	58.9	5.62	6.00	0.57	0.14~0.34	1.00	SM5-16
12	5	9.86	0.89	0.084	0.091	0.0086	0.03~0.13	0.02	SM1-20
13	6	13.03	1.70	0.16	0.17	0.017	0.04~0.14	0.04	SM1.25-20
19	8	15.37	3.12	0.30	0.32	0.031	0.05~0.15	0.07	SM1.5-20
22	10	21.72	7.13	0.72	0.73	0.073	0.06~0.16	0.15	SM2-20
29	12	28.06	13.6	1.41	1.39	0.14	0.07~0.17	0.30	SM2.5-20
35	15	31.57	24.1	2.54	2.45	0.26	0.08~0.18	0.50	SM3-20
40	18	39.09	38.8	4.15	3.96	0.42	0.10~0.25	0.80	SM3.5-20
45	20	43.43	57.0	6.19	5.82	0.63	0.12~0.27	1.10	SM4-20
54	26	54.46	114	12.6	11.6	1.29	0.14~0.34	2.10	SM5-20
60	30	67.15	191	21.8	19.4	2.22	0.16~0.36	3.60	SM6-20
62	35	95	413	49.6	42.1	5.06	0.20~0.45	7.10	SM8-20
14	6	15.03	1.47	0.16	0.15	0.017	0.03~0.13	0.04	SM1-25
16	7	18.7	2.75	0.31	0.28	0.032	0.04~0.14	0.06	SM1.25-25
19	9	19.54	4.96	0.57	0.51	0.059	0.05~0.15	0.14	SM1.5-25
20	12	26.06	11.8	1.41	1.20	0.14	0.06~0.16	0.20	SM2-25
26	15	34.57	23.0	2.81	2.34	0.29	0.07~0.17	0.40	SM2.5-25
32	20	37.43	42.1	5.24	4.29	0.53	0.08~0.18	0.70	SM3-25
37	22	46.77	64.7	8.19	6.60	0.83	0.10~0.25	1.10	SM3.5-25
43	25	55.29	96.3	12.4	9.82	1.26	0.12~0.27	1.70	SM4-25
50	30	65.15	184	24.2	18.7	2.47	0.14~0.34	3.40	SM5-25
61	35	83	309	42.1	31.5	4.29	0.16~0.36	5.40	SM6-25
16	6	19.03	1.99	0.26	0.20	0.026	0.03~0.13	0.05	SM1-30
21	8	22.37	4.05	0.54	0.41	0.055	0.04~0.14	0.13	SM1.25-30
25	10	25.71	7.19	0.97	0.73	0.099	0.05~0.15	0.20	SM1.5-30
25	12	36.06	15.9	2.22	1.62	0.23	0.06~0.16	0.37	SM2-30
32	15	47.57	31.1	4.43	3.17	0.45	0.07~0.17	0.77	SM2.5-30
40	20	53.43	57.5	8.33	5.87	0.85	0.08~0.18	1.30	SM3-30
45	22	67.77	88.0	13.0	8.97	1.32	0.10~0.25	2.30	SM3.5-30
50	25	79.29	131	19.6	13.3	2.00	0.12~0.27	3.20	SM4-30
62	30	99.15	249	38.3	25.4	3.91	0.14~0.34	6.00	SM5-30

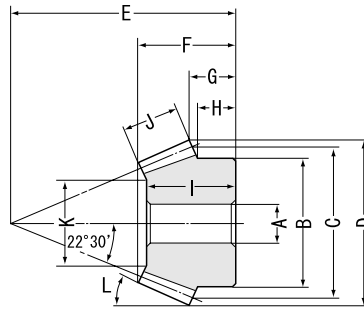
NOTE 1: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details



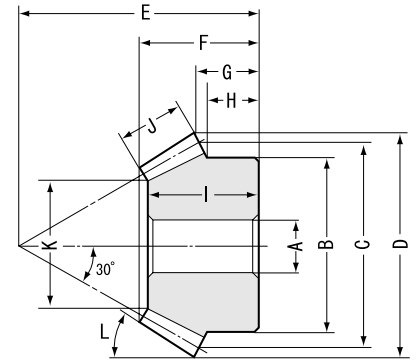
SAM Angular Miter Gears Modules 1.5~3



$\Sigma = 45^\circ$



B3 Shape $\Sigma = 45^\circ$



B3 Shape $\Sigma = 60^\circ$

Modules 1.5~3

Catalog No.	Gear ratio	Module	No. of teeth	Shaft angle	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
						A _{H7}	B	C	D	E	F	G
SAM1.5-20045	1	m1.5	20	45°	B45	8	25	30	32.77	45	19.33	9.36
SAM2-20045		m2	20	45°	B45	10	30	40	43.69	60	26.08	12.48
SAM2.5-20045		m2.5	20	45°	B45	12	40	50	54.62	75	31.92	15.6
SAM3-20045		m3	20	45°	B45	14	50	60	65.54	90	38.66	18.72
SAM1.5-20060	1	m1.5	20	60°	B60	8	25	30	32.59	40	22.3	14.77
SAM2-20060		m2	20	60°	B60	12	32	40	43.46	50	26.39	16.36
SAM2.5-20060		m2.5	20	60°	B60	14	40	50	54.33	60	30.49	17.94
SAM3-20060		m3	20	60°	B60	16	50	60	65.19	70	34.59	19.54
SAM1.5-20120	1	m1.5	20	120°	B120	8	26	30	31.5	26	20.69	18.64
SAM2-20120		m2	20	120°	B120	12	34	40	42	34	26.86	24.18
SAM2.5-20120		m2.5	20	120°	B120	14	42	50	52.5	42	33.22	29.73
SAM3-20120		m3	20	120°	B120	16	50	60	63	50	39.39	35.28

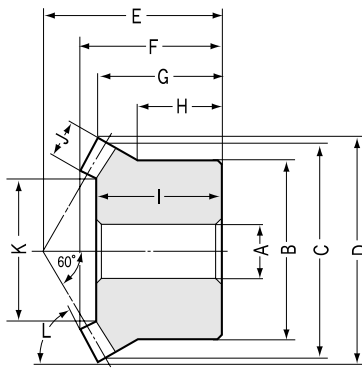
CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.



$\Sigma = 60^\circ$



$\Sigma = 120^\circ$



B3 Shape $\Sigma = 120^\circ$

Specifications

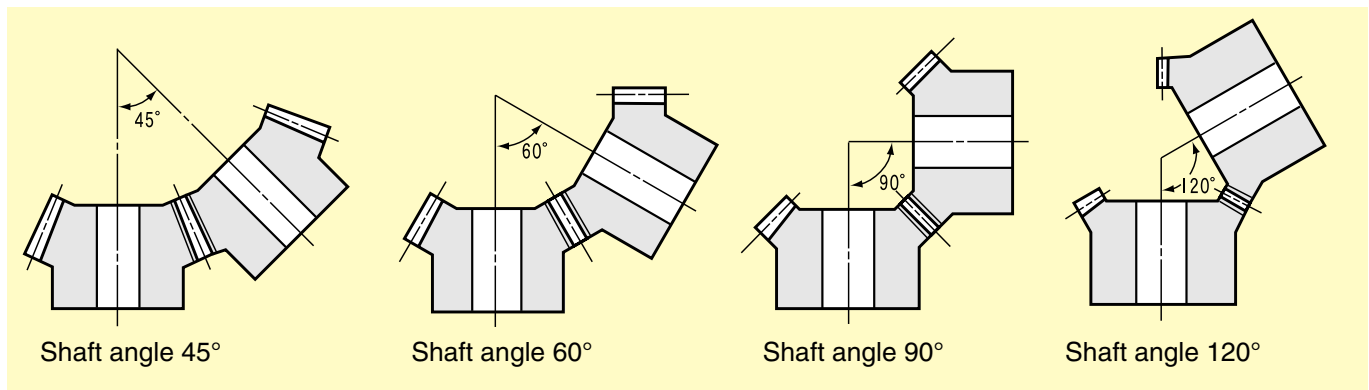
Precision grade	JIS B 1704 grade 3	Tooth hardness	Less than 194HB
Gear teeth	Gleason	Surface treatment	Black oxide
Pressure angle	20°	Tooth surface finish	Cut
Material	S45C	Datum reference surface for gear cutting	Bore
Heat treatment	—	Secondary Operations	Possible

Hub width H	Length of bore I	Face width J	Holding surface dia. K	Allowable torque (N · m)		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Surface durability	Bending strength	Surface durability			
7.75	18	11	17	4.30	0.38	0.44	0.039	0.05~0.15	0.07	SAM1.5-20045
9.65	24	15	20.92	10.3	0.95	1.05	0.097	0.06~0.16	0.15	SAM2-20045
12.58	30	18	30.07	19.6	1.85	2.00	0.19	0.07~0.17	0.31	SAM2.5-20045
15.51	36	22	34	34.4	3.30	3.51	0.34	0.08~0.18	0.55	SAM3-20045
12.58	21	9	18.18	3.54	0.32	0.36	0.033	0.05~0.15	0.08	SAM1.5-20060
13.05	24	12	21.93	8.39	0.78	0.86	0.080	0.06~0.16	0.15	SAM2-20060
13.82	28	15	29.15	16.4	1.56	1.67	0.16	0.07~0.17	0.27	SAM2.5-20060
15.16	32	18	36.36	28.3	2.74	2.89	0.28	0.08~0.18	0.47	SAM3-20060
13.88	18	5	19.22	2.43	0.29	0.25	0.030	0.05~0.15	0.07	SAM1.5-20120
17.26	24	6.5	26.78	5.66	0.70	0.58	0.072	0.06~0.16	0.16	SAM2-20120
20.64	29	8.5	32.03	11.4	1.45	1.16	0.15	0.07~0.17	0.31	SAM2.5-20120
24.02	35	10	39.59	19.4	2.53	1.98	0.26	0.08~0.18	0.53	SAM3-20120

NOTE 1: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 more details.

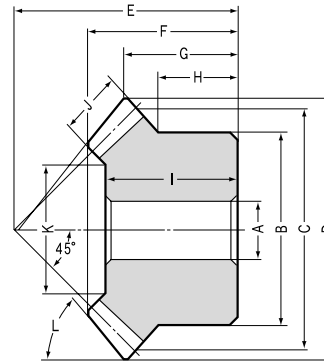
Regarding Angular Miter Gears

The shafts of standard miter gears are at 90°. Miter gears with other angles are called angular miter gears. SAM series of KHK standard angular miter gears are available with 45°, 60° and 120° shaft angles. Other shaft angles may be ordered as custom gears. However, because of the limitations of manufacturing equipment, some gears are not possible to be made.





SUM Stainless Steel Miter Gears Modules 1~3



B3 Shape

Modules 1~3

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore	Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length	Hub width
					A _{H7}	B	C	D	E	F	G	H
SUM1-20	1	m1	20	B3	6	16	20	21.41	20	13.95	10.71	8
SUM1.5-20		m1.5	20	B3	8	26	30	32.12	30	21.24	16.06	13
SUM2-20		m2	20	B3	12	34	40	42.83	37	24.89	18.41	14
SUM2.5-20		m2.5	20	B3	14	42	50	53.54	48	32.54	24.77	19
SUM3-20		m3	20	B3	16	50	60	64.24	58	39.84	30.12	23
SUM4-20		m4	20	B3	20	64	80	85.65	75	50.78	37.83	27
SUM1-25	1	m1	25	B3	6	20	25	26.41	23	15.16	11.21	8
SUM1.5-25		m1.5	25	B3	10	30	37.5	39.62	34	22.25	16.31	11.5
SUM2-25		m2	25	B3	12	45	50	52.83	40	24.33	16.41	12.5
SUM2.5-25		m2.5	25	B3	16	55	62.5	66.04	50	30.41	20.52	15
SUM3-25		m3	25	B3	20	65	75	79.24	60	37.81	24.62	17.5
SUM4-25		m4	25	B3	28	80	100	105.66	80	49.32	32.83	20

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

Miter Gears
MCS



Stainless Steel Miter Gears

Specifications

Precision grade	JIS B 1704 grade 3	Tooth hardness	Less than 187HB
Gear teeth	Gleason	Surface treatment	—
Pressure angle	20°	Tooth surface finish	Cut
Material	SUS303	Datum reference surface for gear cutting	Bore
Heat treatment	—	Secondary Operations	Possible

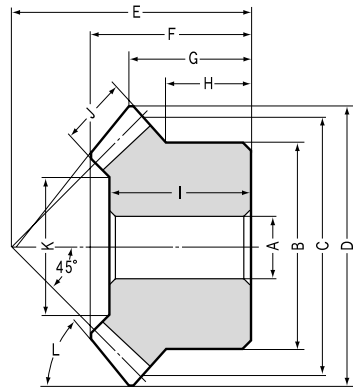
*Available on special order: Same gear made from SUS304.

Length of bore	Face width	Holding surface dia.	Allowable torque (N · m) <i>NOTE 1</i>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Bending strength	Surface durability	Bending strength	Surface durability			
I	J	K							
12	5	9.86	0.49	0.060	0.050	0.0061	0.03~0.13	0.02	SUM1-20
19	8	15.37	1.72	0.22	0.18	0.022	0.05~0.15	0.07	SUM1.5-20
22	10	21.72	3.94	0.51	0.40	0.052	0.06~0.16	0.15	SUM2-20
29	12	28.06	7.52	1.00	0.77	0.10	0.07~0.17	0.30	SUM2.5-20
35	15	31.57	13.3	1.80	1.36	0.18	0.08~0.18	0.50	SUM3-20
45	20	43.43	31.5	4.39	3.22	0.45	0.12~0.27	1.10	SUM4-20
14	6	15.03	0.81	0.12	0.083	0.012	0.03~0.13	0.03	SUM1-25
19	9	19.54	2.74	0.41	0.28	0.042	0.05~0.15	0.13	SUM1.5-25
20	12	26.06	6.50	1.00	0.66	0.10	0.06~0.16	0.22	SUM2-25
26	15	34.57	12.7	2.00	1.29	0.20	0.07~0.17	0.41	SUM2.5-25
32	20	37.43	23.3	3.73	2.37	0.38	0.08~0.18	0.81	SUM3-25
43	25	55.29	53.2	8.79	5.43	0.90	0.12~0.27	1.70	SUM4-25

NOTE1: The allowable torques shown in the table are the calculated values according to the assumed usage conditions. Please see page 196 for more details.



PM Plastic Miter Gears Modules 1~4



B3 Shape

Modules 1~4

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore <small>NOTE 1</small>		Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length	Hub width	
					A	B						C	D
PM1-20	1	m1	20	B3	6	16	20	21.41	20	13.95	10.71	8	
PM1.25-20		m1.25	20	B3	8	22	25	26.77	23	15.27	11.38	9	
PM1.5-20		m1.5	20	B3	8	26	30	32.12	30	21.24	16.06	13	
PM2-20		m2	20	B3	10	34	40	42.83	37	24.89	18.41	14	
PM2.5-20		m2.5	20	B3	12	42	50	53.54	48	32.54	24.77	19	
PM3-20		m3	20	B3	14	50	60	64.24	58	39.84	30.12	23	
PM3.5-20	1	m3.5	20	B3	20	60	70	74.95	65	44.13	32.47	25	
PM4-20		m4	20	B3	20	64	80	85.66	75	50.78	37.83	27	
PM1-25		1	m1	25	B3	6	20	25	26.41	23	15.16	11.21	8
PM1.25-25			m1.25	25	B3	8	25	31.25	33.02	28	17.88	13.26	9.25
PM1.5-25			m1.5	25	B3	8	30	37.5	39.62	34	22.25	16.31	11.5
PM2-25			m2	25	B3	10	40	50	52.83	40	24.33	16.41	10
PM2.5-25	m2.5		25	B3	14	50	62.5	66.04	50	30.41	20.52	12.5	
PM3-25	m3		25	B3	15	60	75	79.24	60	37.81	24.62	15	

CAUTION: Dimensions of the outside diameter, the overall length and crown to back length are all theoretical values, and some differences will occur due to the corner chamfering of the gear tips.

NOTE 1: Significant variation in temperature or humidity can cause dimensional changes in plastic gears (MC Nylon gears). Please see the technical section on the characteristics of plastic gears (page 32).



Specifications

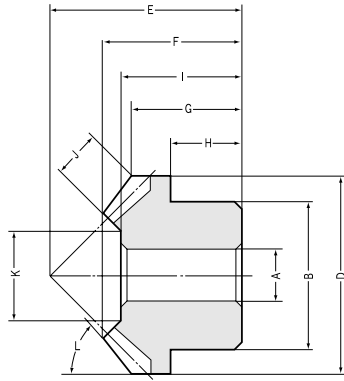
Precision grade	JIS B 1704 grade 4	Tooth hardness	115~120HRR
Gear teeth	Gleason	Surface treatment	—
Pressure angle	20°	Tooth surface finish	Cut
Material	MC901	Datum reference surface for gear cutting	Bore
Heat treatment	—	Secondary Operations	Possible

Length of bore	Face width	Holding surface dia.	Allowable torque (N · m) <i>NOTE 2</i>		Allowable torque (kgf · m)		Backlash (mm)	Weight (kg)	Catalog No.
			Bending strength	Surface durability	Bending strength	Surface durability			
I	J	K							
12	5	9.86	0.18	—	0.018	—	0.08~0.18	0.01	PM1-20
13	6	13.03	0.35	—	0.035	—	0.09~0.19	0.01	PM1.25-20
19	8	15.37	0.61	—	0.063	—	0.10~0.20	0.01	PM1.5-20
22	10	21.72	1.44	—	0.15	—	0.11~0.21	0.02	PM2-20
29	12	28.06	2.78	—	0.28	—	0.12~0.22	0.04	PM2.5-20
35	15	31.57	4.85	—	0.49	—	0.13~0.23	0.07	PM3-20
40	18	39.09	7.75	—	0.79	—	0.15~0.25	0.12	PM3.5-20
45	20	43.43	11.5	—	1.17	—	0.17~0.27	0.16	PM4-20
14	6	15.03	0.30	—	0.030	—	0.08~0.18	0.01	PM1-25
16	7	18.7	0.56	—	0.058	—	0.09~0.19	0.01	PM1.25-25
19	9	19.54	1.00	—	0.10	—	0.10~0.20	0.02	PM1.5-25
20	12	26.06	2.36	—	0.24	—	0.11~0.21	0.03	PM2-25
26	15	34.57	4.61	—	0.47	—	0.12~0.22	0.06	PM2.5-25
32	20	37.43	8.15	—	0.83	—	0.13~0.23	0.10	PM3-25

NOTE 2: The allowable torques shown in the table are the calculated values using the Lewis formula.



DM Injection Molded Miter Gears Modules 0.5~1.5



B1 Shape

Dimensional tolerance table (unit: mm)

Range	Tolerance
Below 3mm	±0.2
3 up to 6 mm	±0.25
6 up to 10 mm	±0.3
10 up to 18 mm	±0.35
18 up to 30 mm	±0.4
30 mm up	±0.5

Specifications

Precision grade	JIS B 1704 grade 8
Gear teeth	Gleason
Pressure angle	20°
Material	Duracon(M90-44)
Heat treatment	—
Tooth hardness	110~120HRR
Surface treatment	—
Tooth surface finish	Injection molded
Datum reference surface for tooth forming	Bore
Secondary Operations	Not recommended

Modules 0.5~1.5

Catalog No.	Gear ratio	Module	No. of teeth	Shape	Bore <i>NOTE 1</i>		Hub dia.	Pitch dia.	Outside dia.	Mounting distance	Total length	Crown to back length
					A	B						
DM0.5-20	1	m0.5	20	B1	3	8	10	10.71	11	7.97	6.35	
DM0.8-20		m0.8	20	B1	5	12	16	17.13	16	10.83	8.56	
DM1-20		m1	20	B1	6	16	20	21.41	21	14.62	11.71	
DM1.5-20		m1.5	20	B1	8	20	30	32.12	30	20.59	16.06	

NOTE 1: The bore tolerance is generally -0.05 to -0.1 but may be + value at the central portion of the hole. Re-machining the bore is not recommended since reworking material may expose voids.

Hub width	Length of bore	Face width	Holding surface dia.	Allowable torque (N·m) <i>NOTE 2</i>		Backlash (mm)	Weight (kg)	Catalog No.
				Bending strength	Bending strength			
H	I	J	K					
4	7	2.5	4.93	0.082	0.0083	0.04~0.14	1	DM0.5-20
5	10	3.5	10.1	0.31	0.032	0.06~0.16	2	DM0.8-20
7	13	4.5	11.27	0.54	0.055	0.08~0.18	4	DM1-20
10	19	7	18.2	0.96	0.098	0.10~0.20	13	DM1.5-20

NOTE 2: The allowable torques shown in the table are the calculated values using the Lewis formula.



BB Sintered Metal Bushings

The table shows a series of standard metal bushings that can be pressed into standard injection molded gears. They can be used as bearing metal on idler gears or to reduce the bore of the gears.

(unit: mm)

Catalog No.	I.D. of bushing	O.D. of bushing	Length	Products that can use the bushing
	$d_{+0.02/0}$	$D_{+0.02/-0.01}$	$L_{-0.3}^0$	
BB30507	3	5	7	DS0.5, DM0.8, DB0.8
BB30608	3	6	8	DS0.5, DS0.8, DM1
BB40609	4	6	9	DS0.8, DM1
BB40612	4	6	12	DS1, DB1
BB50812	5	8	12	DS1
BB50814	5	8	14	DS1, DM1.5

Material: Oil impregnated sintered bronze.

