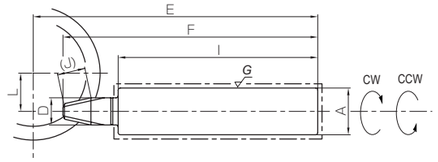
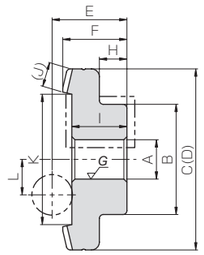
Specifications	
Precision grade	JIS B 1704: 1978 grade 3
Gear teeth	Gleason
Pressure angle	20° ＊
Material	SCM415
Heat treatment	Carburizing
Tooth hardness	60 ～ 63HRC

＊ 22° 30′ for MHP1.5-0453R/3045L and MHP1.5-0451R/1045L



B8



B9

Catalog No.	Reduction ratio	Nominal module	Actual module	No. of teeth	Direction of spiral	Shape	Bore • Shaft Dia. A (Bore: H7 • Shaft: h7)	Hub dia. B	Pitch dia. C	Outside dia. D	Mounting distance E	Total length F	Hub width H	Length of bore and shaft I
MHP1-0453R	15	***m*1**	1.067	45	R	B9	12	30	48	48	19	16.3	7	14
MHP1-3045L				3	L	B8	22.1	—	10.3	10.3	127	113	—	94
MHP1.5-0453R	15	***m*1.5**	1.733	45	R	B9	14	40	78	78	28	23.7	10	20
MHP1.5-3045L				3	L	B8	31.1	—	17.6	17.6	170	148	—	116
MHP1.5-0603R	20	***m*1.5**	1.633	60	R	B9	20	50	98	98	33	28.7	13	25
MHP1.5-3060L				3	L	B8	36.1	—	15.7	15.7	199	168	—	135
MHP1-0602R	30	***m*1**	1.05	60	R	B9	12	34	63	63	21	17.8	8	16
MHP1-2060L				2	L	B8	22.1	—	12.8	12.8	134	120	—	94
MHP1-0451R	45	***m*1**	1.067	45	R	B9	12	30	48	48	19	16.5	7	14
MHP1-1045L				1	L	B8	20.1	—	10.1	10.1	115	104	—	85
MHP1.5-0451R	45	***m*1.5**	1.733	45	R	B9	14	40	78	78	28	23.9	10	20
MHP1.5-1045L				1	L	B8	26.1	—	18.3	18.3	152	138	—	102
MHP1-0601R	60	***m*1**	1.05	60	R	B9	12	34	63	63	21	17.9	8	16
MHP1-1060L				1	L	B8	22.1	—	12.9	12.9	134	122	—	94
MHP1.5-0601R	60	***m*1.5**	1.633	60	R	B9	20	50	98	98	33	28.2	13	25
MHP1.5-1060L				1	L	B8	31.1	—	17.7	17.7	175	151	—	116

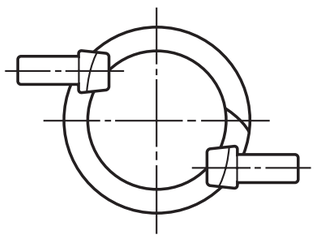
Face width	Holding surface dia.	Offset	Radial load coefficient		Thrust load coefficient		Allowable transmission	Allowable transmission	Backlash	Weight	Catalog No.
(J)	K	L	CW	CCW	CW	CCW	torque (N·m)	torque (kgf·m)	(mm)	(kg)	
(6)	35.1	10	48.48	−37.67	13	31.74	10.3	1.05	0.05~0.15	0.15	**MHP1-0453R**
	—		147.3	523.74	969.92	−831.16				0.29	**MHP1-3045L**
(10)	56.5	18	26.78	−18.67	8.98	21.19	41.2	4.20	0.10~0.20	0.50	**MHP1.5-0453R**
	—		100.09	338.45	566.72	−466.63				0.73	**MHP1.5-3045L**
(10)	76.8	22	20.44	−16.54	7.15	13.95	82.4	8.40	0.10~0.20	0.94	**MHP1.5-0603R**
	—		119.32	302.18	577.56	−511.77				1.15	**MHP1.5-3060L**
(8)	46.4	18	33.59	−24.15	8.21	24.77	24.1	2.46	0.05~0.15	0.29	**MHP1-0602R**
	—		186.59	784.31	1461.23	−1248.6				0.28	**MHP1-2060L**
(6)	34.9	14	48.04	−35.58	11.13	34.11	11.3	1.15	0.05~0.15	0.16	**MHP1-0451R**
	—		400.81	1579.79	3014.6	−2605.26				0.22	**MHP1-1045L**
(10)	56	25	26.36	−16.04	6.88	22.02	46.6	4.75	0.10~0.20	0.50	**MHP1.5-0451R**
	—		233.59	1034.08	1755.84	−1439.58				0.48	**MHP1.5-1045L**
(8)	46.3	20	33.34	−23.12	7.41	25.14	25.3	2.58	0.05~0.15	0.29	**MHP1-0601R**
	—		357.61	1564.81	2936.72	−2514.09				0.28	**MHP1-1060L**
(10)	76.8	30	22.63	−17.19	5.82	15.81	94.0	9.58	0.10~0.20	0.94	**MHP1.5-0601R**
	—		303.06	974.4	1912.11	−1675.65				0.77	**MHP1.5-1060L**

[Caution on Product Characteristics] ① The allowable torques are obtained from the results of experimentation with the pinion at 600 rpm, lubricated with Kingstar SG-O (NIHON GREASE).
② Radial and thrust load coefficients are the factors used for calculation of those loads. As shown in the figure B8, CW and CCW stand for clockwise and counterclockwise rotation. A plus sign means that the two gears in a set move away each other when load is applied. A minus sign means that two gears in a set approach each other when load is applied. For more details, see the section “How to determine the radial and thrust loads” on Page 306.

[Caution on Secondary Operations] ① Please read “Caution on Performing Secondary Operations” (Page 304) when performing modifications and/or secondary operations for safety concerns. KHK Quick-Mod Gears, the KHK's system for quick modification of KHK stock gears is also available.
② In the illustration, the area surrounded with—– – – line is masked during the carburization process and can be modified. However, care should be exercised since the hardness is high (approx. HRC40, maximum).

■ Helix Hands and Offset Position

MHP High Ratio Hypoid Gears are designed to be right hand helix for gears, left hand helix for pinions. The opposite helix hand gears are not available for these products. Also, the offset position is already set, so please refer to the illustration bellow when designing or assembling.



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: 1-516-437-6700 FAX: 1-516-328-3343 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. Caution on Performing Secondary Operations

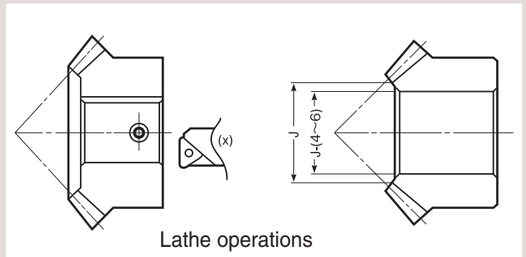
①If you are reboring, it is important to pay special attention to locating the center in order to avoid runout.

② The reference datum for gear cutting is the bore. Therefore, 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.

Lathe operations

④ For items with induction hardened teeth, such as KSBSG and KSBS series, the hardness is high near the tooth root. When ma-chining the front end, the machined area should be 4 to 6mm smaller than the dimension, J.



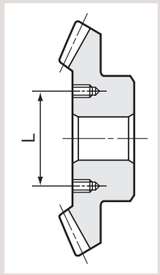
Lathe operations

⑤ 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 concentrations, always leave radii on corners.

⑥ PB plastic bevel gears are susceptible to changes due to temperature and humidity. Dimensions may change between, during, and after re-machining operations.

⑦ 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.

⑧ For the handling conveniences, the KSB and KSBY series listed below have the tapped holes (180° apart, 2 places) on the holding surface.

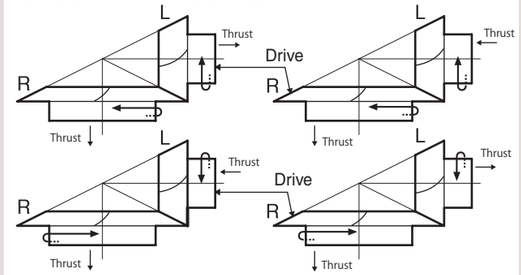


Catalog No.	L (mm)	Tap Size
KSB6-4515	130	M10 deep 20
KSBY8-4020	160	M10 deep 20
KSBY8-4515	210	M10 deep 20
KSBY5-6015	160	M10 deep 20
KSBY6-6015	220	M10 deep 20

3. Points of Caution in Assembling

①Since bevel gears are cone shaped, they produce axial thrust forces. Especially for spiral bevel gears, the directions of thrust changes 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. For details, please refer to separate technical reference book, section of “Gear Forces” (Page 107).

Direction of rotation and thrust force

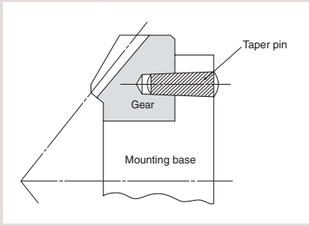


[NOTE] Bevel gears with the gear ratio 1.57 or less, produce a thrust force which is the same as miter gears. For details, see page 274.

② If a bevel 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 bevel 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.

③ Due to the thrust load of bevel gears, the gears, shafts and bearings have the tendency to loosen up during operation. Bevel gears should be fastened to the shaft with keys and set screws, taper pins, step shafts, etc.

④ When installing KMBSA or KMBSB spiral bevel gears produced 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.



⑤ KHK stock bevel gears are designed such that, when assembled according to the specified mounting distance with a tolerance of H7 to H8, the normal direction backlash shown in the table is obtained. Mounting distance error, offset error and shaft angle error must be minimized to avoid excessive noise and wear. For various conditions of teeth contact, please see the following illustrations, “Correct Tooth Contact” and “Incorrect Tooth Contact”.

Gear Ratio (Reduction Ratio)	Normal direction Backlash	Travel in axial direction	
		Pinions	Gears
1.5	j_n	0.81 x j_n	1.22 x j_n
2		0.65 x j_n	1.31 x j_n
2.5		0.54 x j_n	1.36 x j_n
3		0.46 x j_n	1.39 x j_n
4		0.35 x j_n	1.42 x j_n
5		0.29 x j_n	1.43 x j_n
15 or more		1.4 x j_n ÷ Gear Ratio	1.40 x j_n

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?

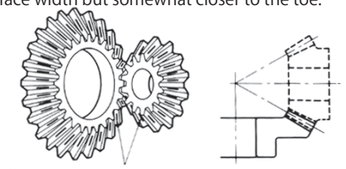
② If gears are exposed, be sure to attach a safety cover to ensure safety. Also, be careful not to touch rotating gears.

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.

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.

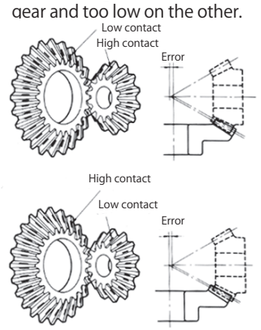


Center contact closer to toes

Incorrect Tooth Contact

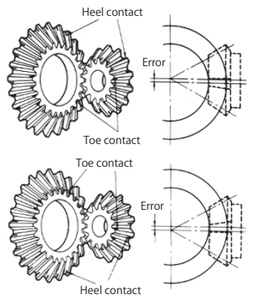
■ Mounting Distance Error

● 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.



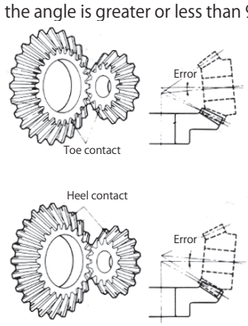
■ Offset Error

● 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

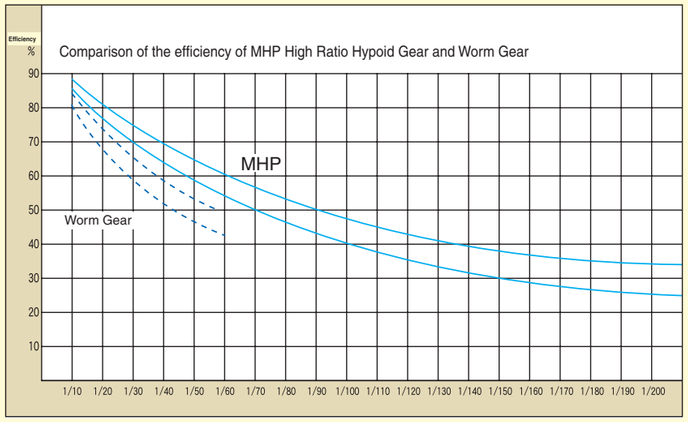
● When there is an angular error of shafts, the gears will contact at the toes or heels depending on whether the angle is greater or less than 90°.



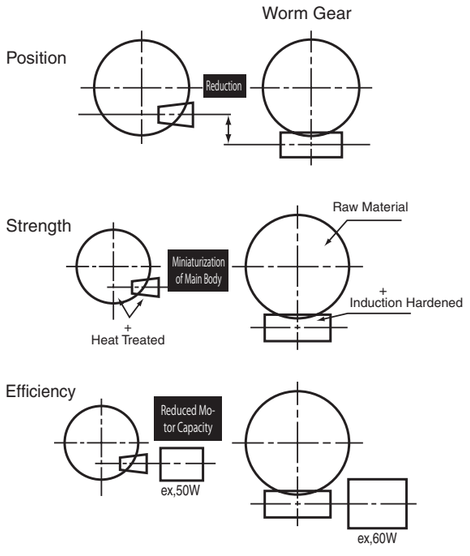
■ Features of KMHP High Ratio Hypoid Gears

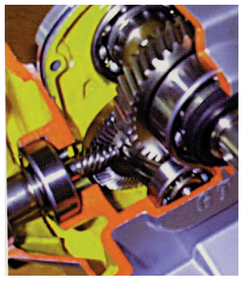
A pair of KMHP high-ratio hypoid gears are able to produce an amazing reduction of speed of 60:1 in one stage.

1. Total-cost reduction
   The KMHP provides a compact gearing body replacing several stages of reduction gears. This reduces the cost sharply.
2. High efficiency
   Compared to worm gear drives, the KMHP has less sliding contact. The resulting higher efficiency allows the use of smaller motors (See the graph on the right).
3. High rigidity
   The carburized hypoid gears lead to smaller size than comparable worms gears.
4. Compact gear assembly
   The size of the gear housing is nearly the same as outer diameter of the large gear. (See the diagrams below)



Comparison of KMHP and Worm Gear





■ How to determine the radial and thrust loads

Before using the KMHP high-ratio hypoid gears, be sure to confirm the direction of radial and thrust loads. Following equations are used to compute these loads. The radial and thrust load coefficients are given on the product pages.

Radial load calculation

W_{RP} : Radial load on the pinion or L(N)

$$W_{RP} = W_{KP} \times T_G \times \frac{n}{z}$$

W_{KP} : Radial load coefficient of pinion or L (given on the product pages)
T_G : Torque of gear or R(N·m)
n : Number of teeth of pinion or L
z : Number of teeth of gear or R

W_{RG} : Radial load on the gear or R(N)

$$W_{RG} = W_{KG} \times T_G$$

W_{KG} : Radial load coefficient of gear or R (given on the product pages)
T_G : Torque of gear or R(N·m)

Thrust load calculation

W_{XP} : Thrust load on the pinion or L(N)

$$W_{XP} = W_{NP} \times T_G \times \frac{n}{z}$$

W_{NP} : Thrust load coefficient of pinion or L (given on the product page)
T_G : Torque of gear or R(N·m)
n : Number of teeth of pinion or L
z : Number of teeth of gear or R

W_{XG} : Thrust load of gear or R(N)

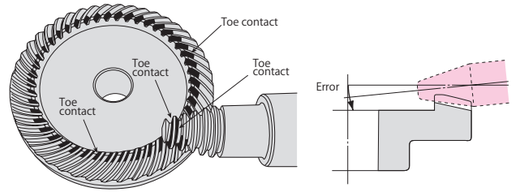
$$W_{XG} = W_{NG} \times T_G$$

W_{NG} : Thrust load coefficient of gear or R (given on the product pages)
T_G : Torque of gear or R(N·m)

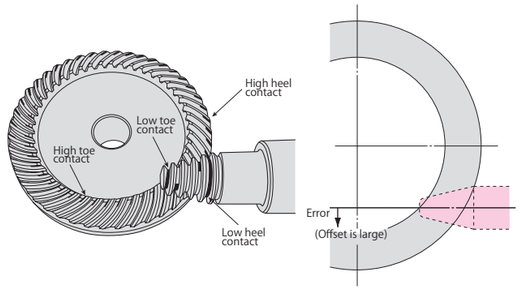
■ Variations in tooth contact due to poor alignment of gears

If the gear engagement position is out of the normal position, variations in tooth contact, as illustrated below, may appear.

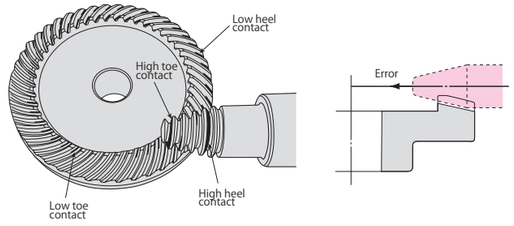
(1) Tooth contact in case of a shaft-angle error



(2) Tooth contact in case of a shaft-offset error



(3) Tooth contact in case of a pinion set position error



(4) Tooth contact in case of a gear set position error