BRIAN DENGEL
GENERAL MANAGER • KHK-USA

The key to a proper fit for keyways

Selecting the proper size keyway is determined by the shaft size. Sometimes you can put a square peg in a round hole.

Did you ever have someone tell you that you cannot fit a square peg into a round hole? This common phrase is misleading because it details the dimensions of neither the peg nor the hole. Clearly if the peg is 1-inch square and the hole is 4 inches in diameter, then the peg will easily fit in the hole, albeit useless. However, if that same peg was 25 mm square with a tolerance 0/-0.01mm on each side and the hole was Ø25mm with a tolerance of +0.01/0mm, it would slide in easily and grab the hole at the corners.

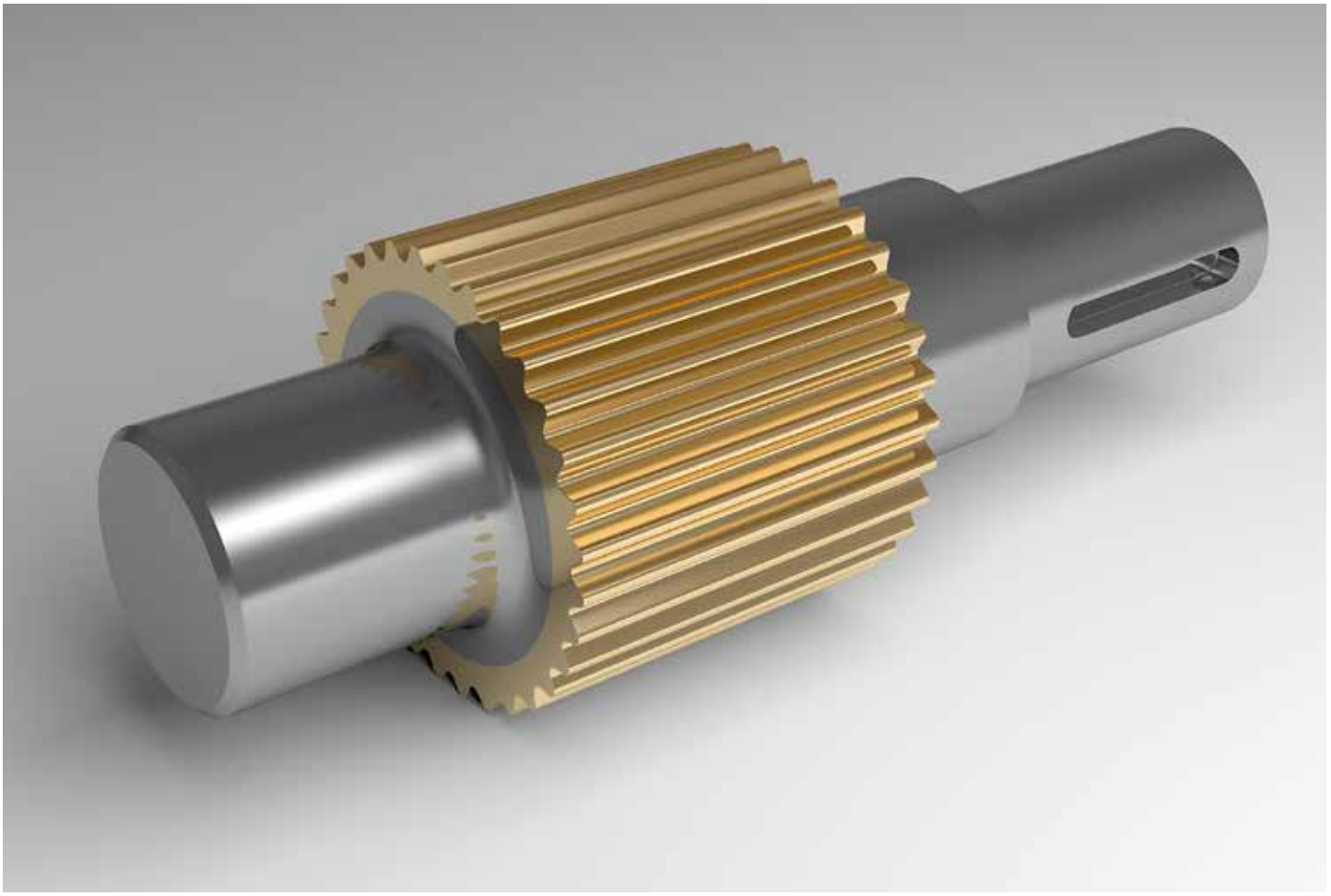
In October's column, I mentioned the typical tolerance for keyways. Table 1 details the appropriate key slot and key sizes for various metric bores. Please note that the key sizes in parentheses are older sizes that are no longer commonly used.

As noted above, when selecting a keyway tolerance, there are two common selections in the metric system. The first is Js9. This is a +/- band clearance; the value of the tolerance is equally oversized or undersized. The second is a P9 tolerance. This is an undersized clearance. The advantage of the Js9 tolerance is that the key can be inserted and the gear manipulated without much difficulty. Whereas the P9 tolerance is a press fit tolerance. Once the key is inserted into the keyway, it is not going to move.

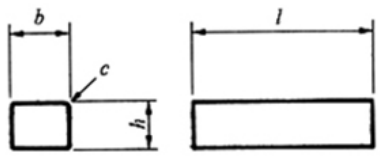
For those engineers who wish to put a square peg in a round hole, please consider the following:

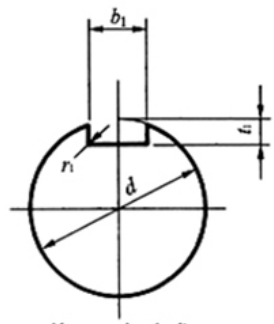
A square consists of four angles, each being 90 degrees. Therefore, there are 360 degrees in a square.

There are 360 degrees in a circle. Therefore, a square is a circle?

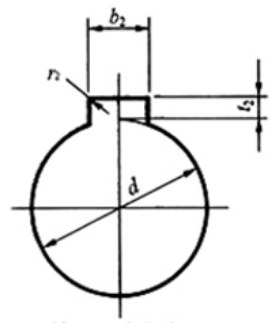


ABOUT THE AUTHOR Brian Dengel is general manager of KHK-USA, which is based in Mineola, New York. Go online to www.khkgears.us





Keyway in shaft



Keyway in hole

Unit: mm

Nominal size of key $b \times h$	Dimension of key							Dimension of keyway								
	b		h			c	l	Basic dimenson of b_1 and b_2	Tight-fit	Normal fit		r_1 and r_2	Basic dimenson of t_1	Basic dimenson of t_2	Tolerance of t_1 and t_2	Suitable shaft dia. d
	Basic dimension	Tolerance (h9)	Basic dimension	Tolerance					b_1 and b_2	b_1	b_2					
									Tolerance (P9)	Tolerance (N9)	Tolerance (Js9)					
2× 2	2	0	2	0		0.16	6～ 20	2	−0.004	−0.004	±0.0125	0.08	1.2	1.0		6～ 8
3× 3	3	−0.025	3	−0.025		～0.25	6～ 36	3	−0.031	−0.029		～0.16	1.8	1.4		8～ 10
4× 4	4		4				8～ 45	4					2.5	1.8	+0.1	10～ 12
5× 5	5	0	5	0	h 9		10～ 56	5	−0.012	0	±0.0150		3.0	2.3	0	12～ 17
6× 6	6	−0.0300	6	−0.030		0.25	14～ 70	6	−0.042	−0.030		0.16	3.5	2.8		17～ 22
(7× 7)	7		7.2	$^{0}_{-0.036}$		～0.40	16～ 80	7				～0.25	4.0	3.3		20～ 25
8× 7	8	0	7				18～ 90	8	−0.015	0	±0.0180		4.0	3.3		22～ 30
10× 8	10	−0.036	8	0	h11		22～110	10	−0.051	−0.036			5.0	3.3		30～ 38
12× 8	12		8	−0.090			28～140	12					5.0	3.3		38～ 44
14× 9	14	0	9			0.40	36～160	14	−0.018	0	±0.0215	0.25	5.5	3.8		44～ 50
(15×10)	15	−0.043	10.2	$^{0}_{-0.070}$	h10	～0.60	40～180	15	−0.061	−0.043		～0.40	5.0	5.3		50～ 55
16×10	16		10	$^{0}_{-0.090}$	h11		45～180	16					6.0	4.3	+0.2	50～ 58
18×11	18		11	0			50～200	18					7.0	4.4	0	58～ 65
20×12	20		12	−0.110			56～220	20					7.5	4.9		65～ 75
22×14	22	0	14				63～250	22	v0.022	0	±0.0260		9.0	5.4		75～ 85
(24×16)	24	−0.052	16.2	$^{0}_{-0.070}$	h10	0.60	70～280	24	−0.074	−0.052		0.40	8.0	8.4		80～ 90
25×14	25		14	0		～0.80	70～280	25				～0.60	9.0	5.4		85～ 95
28×16	28		16	−0.110	h11		80～320	28					10.0	6.4		95～110
32×18	32		18				90～360	32					11.0	7.4		110～130
(35×22)	35		22.3	$^{0}_{-0.084}$	h10		100～400	35					11.0	11.4		125～140
36×20	36		20	$^{0}_{-0.130}$	h11		—	36					12.0	8.4		130～150
(38×24)	38	0	24.3	$^{0}_{-0.084}$	h10	1.00	—	38	−0.026	0	±0.0310	0.70	12.0	12.4		140～160
40×22	40	−0.062	22	$^{0}_{-0.130}$	h11	～1.20	—	40	−0.088	−0.062		～1.000	13.0	9.4		150～170
(42×26)	42		26.3	$^{0}_{-0.084}$	h10		—	42					13.0	13.4		160～180
45×25	45		25	0			—	45					15.0	10.4	+0.3	170～200
50×28	50		28	−0.130			—	50					17.0	11.4	0	200～230
56×32	56		32			1.60	—	56				1.20	20.0	12.4		230～260
63×32	63	0	32			～2.00	—	63	−0.032	0	±0.0370	～1.60	20.0	12.4		260～290
70×36	70	−0.074	36	0	h11		—	70	−0.106	−0.074			22.0	14.4		290～330
80×40	80		40	−0.160		2.50	—	80				2.00	25.0	15.4		330～380
90×45	90	0	45			～3.00	—	90	−0.037	0	±0.0435	～2.50	28.0	17.4		380～440
100×50	100	−0.087	50				—	100	−0.124	−0.087			31.0	19.5		440～500

Table 1: Flat keys and keyways