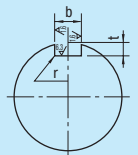




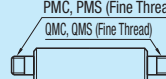

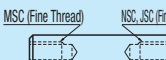
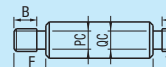


# Shaft Alterations - Overview -

## Shaft Alterations - Overview

Alteration Type	Alterations	Code	Spec.	Price Adder																											
Tolerance Change	L Dimension Tolerance Change (Precision) 	LKC	Changes "L Tolerance" to a higher precision level. (Ordering Code) LKC L dimensions can be specified in 0.1mm increment for LKC. (Application Notes) See each product page for details.	$L < 200 \rightarrow L \pm 0.03$ $200 \leq L < 500 \rightarrow L \pm 0.05$ $L \geq 500 \rightarrow L \pm 0.1$																											
	Revise O.D. Tolerance to h5 	DKC	O.D. tolerance is altered to h5. (Ordering Code) DKC (Application Notes) Available only for Hollow Shafts	<table><tr><th>D</th><th>h5 Tolerance</th></tr><tr><td>6</td><td>0 -0.005</td></tr><tr><td>8, 10</td><td>0 -0.006</td></tr><tr><td>12~16</td><td>0 -0.008</td></tr><tr><td>20~30</td><td>0 -0.009</td></tr><tr><td>35~50</td><td>0 -0.011</td></tr></table>	D	h5 Tolerance	6	0 -0.005	8, 10	0 -0.006	12~16	0 -0.008	20~30	0 -0.009	35~50	0 -0.011															
D	h5 Tolerance																														
6	0 -0.005																														
8, 10	0 -0.006																														
12~16	0 -0.008																														
20~30	0 -0.009																														
35~50	0 -0.011																														
Wrench Flats	Wrench Flats at One Location 	SC	Adds Wrench Flats at one location. (Ordering Code) SC5 SC=1mm Increment SC+l1≤L SC≥0 (Application Notes) Applicable to D=6 or more Not available in combination with WSC.	<table><tr><th>D</th><th>W</th><th>l1</th></tr><tr><td>6 (7)</td><td>5</td><td>20 (22)</td></tr><tr><td>8 (9)</td><td>7</td><td>24 (25) (26)</td></tr><tr><td>10</td><td>8</td><td>28 (30) (31, 32)</td></tr><tr><td>12</td><td>10</td><td>35</td></tr><tr><td>13</td><td>11</td><td>35</td></tr><tr><td>(14) 15</td><td>13</td><td>38 (40) (45)</td></tr><tr><td>16 (17)</td><td>14</td><td>50</td></tr><tr><td>18 (19)</td><td>16</td><td>41</td></tr></table> D dimensions in ( ) are only applied to Shaft End Configurable Type on P.187.	D	W	l1	6 (7)	5	20 (22)	8 (9)	7	24 (25) (26)	10	8	28 (30) (31, 32)	12	10	35	13	11	35	(14) 15	13	38 (40) (45)	16 (17)	14	50	18 (19)	16	41
	D	W	l1																												
	6 (7)	5	20 (22)																												
8 (9)	7	24 (25) (26)																													
10	8	28 (30) (31, 32)																													
12	10	35																													
13	11	35																													
(14) 15	13	38 (40) (45)																													
16 (17)	14	50																													
18 (19)	16	41																													
Wrench Flats at Two Locations 	WSC	Adds Wrench Flats at two locations. (Ordering Code) WSC12-X8 WSC, X=1mm Increment WSC+X+l1+l2<L WSC (X)≥0 (Application Notes) Applicable to D=6 or more Orientation between wrench flat features is random. Not available in combination with SC or SX.	<table><tr><th>D</th><th>W</th><th>l1</th></tr><tr><td>6 (7)</td><td>5</td><td>20 (22)</td></tr><tr><td>8 (9)</td><td>7</td><td>24 (25) (26)</td></tr><tr><td>10</td><td>8</td><td>28 (30) (31, 32)</td></tr><tr><td>12</td><td>10</td><td>35</td></tr><tr><td>13</td><td>11</td><td>35</td></tr><tr><td>(14) 15</td><td>13</td><td>38 (40) (45)</td></tr><tr><td>16 (17)</td><td>14</td><td>50</td></tr><tr><td>18 (19)</td><td>16</td><td>41</td></tr></table> D dimensions in ( ) are only applied to Shaft End Configurable Type on P.187.	D	W	l1	6 (7)	5	20 (22)	8 (9)	7	24 (25) (26)	10	8	28 (30) (31, 32)	12	10	35	13	11	35	(14) 15	13	38 (40) (45)	16 (17)	14	50	18 (19)	16	41	
D	W	l1																													
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10	8	28 (30) (31, 32)																													
12	10	35																													
13	11	35																													
(14) 15	13	38 (40) (45)																													
16 (17)	14	50																													
18 (19)	16	41																													
Second Set of Wrench Flats 	SX	Adds a second set of Wrench Flats. (Ordering Code) SX15 SX=1mm Increment SC+SX+l1+l2<L SX≥0 (Application Notes) Applicable to D=6 or more, only to Shafts With Wrench Flats Type. Orientation between wrench flat features is random. Not available in combination with WSC.	<table><tr><th>D</th><th>W</th><th>l1</th></tr><tr><td>6</td><td>5</td><td>18</td></tr><tr><td>8</td><td>7</td><td>20</td></tr><tr><td>10</td><td>8</td><td>25</td></tr><tr><td>12</td><td>10</td><td>30</td></tr><tr><td>13</td><td>11</td><td>35</td></tr><tr><td>15</td><td>13</td><td>40</td></tr><tr><td>16</td><td>14</td><td>50</td></tr></table>	D	W	l1	6	5	18	8	7	20	10	8	25	12	10	30	13	11	35	15	13	40	16	14	50				
D	W	l1																													
6	5	18																													
8	7	20																													
10	8	25																													
12	10	30																													
13	11	35																													
15	13	40																													
16	14	50																													
Set Screw Flat	Set Screw Flat at One Location  For specified FC locations, reference point varies depending on products. See each product page for details.	FC	Adds Set Screw Flat at one location. (Ordering Code) FC10-A8, FC10-E8 FC, A (E)=1mm Increment FC≤3xD When 1.5xD<FC, FC≤L/2 A (E)=0 or A (E)≥2 Not available in combination with WFC; not applicable to Precision Type.	<table><tr><th>D</th><th>h</th></tr><tr><td>3~5</td><td>0.5</td></tr><tr><td>6~18</td><td>1</td></tr><tr><td>20~40</td><td>2</td></tr><tr><td>50</td><td>3</td></tr></table>	D	h	3~5	0.5	6~18	1	20~40	2	50	3																	
	D	h																													
	3~5	0.5																													
6~18	1																														
20~40	2																														
50	3																														
Set Screw Flats at Two Locations 	WFC	Adds Set Screw Flats at two locations. (Ordering Code) WFC10-A8-E20 WFC, A, E=1mm Increment WFC≤3xD When 1.5xD<WFC, 2WFC≤L/2 A (E)=0 or A (E)≥2 Orientation between set screw flats is random. Not available in combination with FC. Not applicable to Precision Type.	<table><tr><th>D</th><th>h</th></tr><tr><td>3~5</td><td>0.5</td></tr><tr><td>6~18</td><td>1</td></tr><tr><td>20~40</td><td>2</td></tr><tr><td>50</td><td>3</td></tr></table>	D	h	3~5	0.5	6~18	1	20~40	2	50	3																		
D	h																														
3~5	0.5																														
6~18	1																														
20~40	2																														
50	3																														
90-deg. Set Screw Flat at One Location 	RC	Adds 90-deg. Set Screw Flat at one location. (Ordering Code) RC10 RC=1mm Increment RC+b1≤L RC≥2 (Application Notes) Only applicable to D=10 ~ 30. Not available in combination with WRC; not applicable to Precision Type.	<table><tr><th>D</th><th>b1</th><th>h</th></tr><tr><td>10</td><td>6</td><td>0.5</td></tr><tr><td>12~20</td><td>6</td><td>1.0</td></tr><tr><td>25</td><td>10</td><td>1.0</td></tr><tr><td>30</td><td>12</td><td>1.0</td></tr></table>	D	b1	h	10	6	0.5	12~20	6	1.0	25	10	1.0	30	12	1.0													
D	b1	h																													
10	6	0.5																													
12~20	6	1.0																													
25	10	1.0																													
30	12	1.0																													
90-deg. Set Screw Flats at Two Locations 	WRC	Adds 90-deg. Set Screw Flats at two locations. (Ordering Code) WRC10-Y10 WRC=1mm Increment WRC+b1≤L WRC (Y)≥2 (Application Notes) Only applicable to D=10 ~ 30. Orientation between set screw flats is random. Not available in combination with RC. Not applicable to Precision Type.	<table><tr><th>D</th><th>b1</th><th>h</th></tr><tr><td>10</td><td>6</td><td>0.5</td></tr><tr><td>12~20</td><td>6</td><td>1.0</td></tr><tr><td>25</td><td>10</td><td>1.0</td></tr><tr><td>30</td><td>12</td><td>1.0</td></tr></table>	D	b1	h	10	6	0.5	12~20	6	1.0	25	10	1.0	30	12	1.0													
D	b1	h																													
10	6	0.5																													
12~20	6	1.0																													
25	10	1.0																													
30	12	1.0																													
V Groove	V Groove at One Location 	VC	Adds V Groove at one location. VC=1mm Increment VC>W (Application Notes) Applicable to D=6 or more Different from VC Hollow Shafts.	<table><tr><th>D</th><th>W</th></tr><tr><td>6, 8</td><td>2</td></tr><tr><td>10~18</td><td>4</td></tr><tr><td>20~25</td><td>6</td></tr><tr><td>30~35</td><td>8</td></tr><tr><td>40~50</td><td>12</td></tr></table>	D	W	6, 8	2	10~18	4	20~25	6	30~35	8	40~50	12															
	D	W																													
6, 8	2																														
10~18	4																														
20~25	6																														
30~35	8																														
40~50	12																														
V Grooves at Two Locations 	WVC	V Grooves at Two Locations (Ordering Code) WVC180-F8 WVC, F=1mm Increment F>W (Application Notes) Applicable to D=6 or more Different from WVC Hollow Shafts.	<table><tr><th>D</th><th>W</th></tr><tr><td>6, 8</td><td>2</td></tr><tr><td>10~18</td><td>4</td></tr><tr><td>20~25</td><td>6</td></tr><tr><td>30~35</td><td>8</td></tr><tr><td>40~50</td><td>12</td></tr></table>	D	W	6, 8	2	10~18	4	20~25	6	30~35	8	40~50	12																
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6, 8	2																														
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30~35	8																														
40~50	12																														

## Shaft Alterations - Overview

Alteration Type	Alterations	Code	Spec.	Price Adder																																																									
Keyway	<b>Keyway</b> A wide variety of Shafts with keyway alterations are available on the Rotary Shaft pages. <b>P.709~768</b>		<b>KC:</b> Adds Keyway at one location. <u>[Ordering Code]</u> KC10-G10 <b>WKC:</b> Adds Keyways at two locations. <u>[Ordering Code]</u> WKC10-C8-KC10-G10 KC, WKC, G, C=1mm Increment 4≤G (C)≤30 G (C)≤L/3 2≤KC (WKC)≤L/3 G+C≤L/3 Mx2<KC+F For One End / Both Ends Stepped and Tapped Type, Mx2<KC+F. <u>[Application Notes]</u> Only applicable to D=12, 16, 20, 25 and 30. For WKC, keyways cannot be machined coplanar. Not applicable to precision shafts.	<table><tr><th>Shaft Dia.</th><th>b</th><th>t</th><th>r</th></tr><tr><td>12</td><td>4</td><td>2.5</td><td>0.08~0.16</td></tr><tr><td>16</td><td>5</td><td>3.0</td><td>+0.1</td></tr><tr><td>20</td><td>6</td><td>3.5</td><td>0</td></tr><tr><td>25</td><td>8</td><td>4.0</td><td>+0.2</td></tr><tr><td>30</td><td></td><td>-0.036</td><td>0</td></tr></table> 	Shaft Dia.	b	t	r	12	4	2.5	0.08~0.16	16	5	3.0	+0.1	20	6	3.5	0	25	8	4.0	+0.2	30		-0.036	0																																	
	Shaft Dia.	b	t	r																																																									
12	4	2.5	0.08~0.16																																																										
16	5	3.0	+0.1																																																										
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25	8	4.0	+0.2																																																										
30		-0.036	0																																																										
<b>Keyway at One Location: KC</b>  <b>Keyways at Two Locations: WKC</b>  For specifying KC locations, starting point varies depending on products. See details on related pages.	<b>KC</b> <b>WKC</b>		<div>When KC=0, keyway is shaped as the drawing on right. Ex.) </div> <div>When KC+G≥L, keyway is shaped as the drawing on right. Ex.) </div>																																																										
Thread Alterations	<b>Change to Fine Thread</b>  	<b>PMC</b> <b>PMS</b> <b>QMC</b> <b>QMS</b> <b>MMC</b> <b>MMS</b> <b>NMC</b> <b>NMS</b>	Changes the threads to fine threads shown in the table below. (PMC, QMC, MMC, NMC → Applicable to bearing nut fine thread pitches) (PMS, QMS, MMS, NMS → Applicable to cylinder fine thread pitches) <u>[Ordering Code]</u> PMC15 Ex.) When requesting M15 with D20 and 1.0 bearing nut fine thread pitch <table><tr><th>D</th><th>PMC, QMC, MMC, NMC</th><th>PMS, QMS, MMS, NMS</th></tr><tr><td>*3</td><td>3</td><td></td></tr><tr><td>*4</td><td>3 4</td><td></td></tr><tr><td>5</td><td>3 *4 *5</td><td></td></tr><tr><td>6 (7)</td><td>3 4 *5 *6</td><td></td></tr><tr><td>8 (9)</td><td>3 4 5 6 *8</td><td></td></tr><tr><td>10</td><td>4 5 6 8 *10</td><td>*10</td></tr><tr><td>12</td><td>5 6 8 10 *12</td><td>10 *12</td></tr><tr><td>13</td><td>5 6 8 10 *12</td><td>10</td></tr><tr><td>15</td><td>5 6 8 10 12 *15</td><td>10 12</td></tr><tr><td>(14) 16 (17)</td><td>5 6 8 10 12 *15</td><td>10 12 14</td></tr><tr><td>18 (19)</td><td>5 6 8 10 12 15 *17</td><td>10 12 14 *18</td></tr><tr><td>20 (22)</td><td>6 8 10 12 15 17 *20</td><td>10 12 14 18</td></tr><tr><td>(24) 25 (26)</td><td>8 10 12 15 17 20 *25</td><td>10 12 14 18</td></tr><tr><td>(28) 30 (31, 32)</td><td>8 10 12 15 17 20 25 *30</td><td>10 12 14 18</td></tr><tr><td>*35</td><td>10 12 15 17 20 25 30</td><td>10 12 14 18</td></tr><tr><td>(38) *40 (45)</td><td>12 15 17 20 25 30</td><td>12 14 18</td></tr><tr><td>*50</td><td>15 17 20 25 30</td><td>14 18</td></tr><tr><td>Pitch</td><td>0.35 0.5 0.75 1.0 1.5 1.25 1.5</td><td></td></tr></table> D dimensions in ( ) are only applied to Shaft End Configurable Type on <b>P.187</b> . * marked sizes are not applicable to Precision Type.	D	PMC, QMC, MMC, NMC	PMS, QMS, MMS, NMS	*3	3		*4	3 4		5	3 *4 *5		6 (7)	3 4 *5 *6		8 (9)	3 4 5 6 *8		10	4 5 6 8 *10	*10	12	5 6 8 10 *12	10 *12	13	5 6 8 10 *12	10	15	5 6 8 10 12 *15	10 12	(14) 16 (17)	5 6 8 10 12 *15	10 12 14	18 (19)	5 6 8 10 12 15 *17	10 12 14 *18	20 (22)	6 8 10 12 15 17 *20	10 12 14 18	(24) 25 (26)	8 10 12 15 17 20 *25	10 12 14 18	(28) 30 (31, 32)	8 10 12 15 17 20 25 *30	10 12 14 18	*35	10 12 15 17 20 25 30	10 12 14 18	(38) *40 (45)	12 15 17 20 25 30	12 14 18	*50	15 17 20 25 30	14 18	Pitch	0.35 0.5 0.75 1.0 1.5 1.25 1.5		
	D	PMC, QMC, MMC, NMC	PMS, QMS, MMS, NMS																																																										
*3	3																																																												
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5	3 *4 *5																																																												
6 (7)	3 4 *5 *6																																																												
8 (9)	3 4 5 6 *8																																																												
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12	5 6 8 10 *12	10 *12																																																											
13	5 6 8 10 *12	10																																																											
15	5 6 8 10 12 *15	10 12																																																											
(14) 16 (17)	5 6 8 10 12 *15	10 12 14																																																											
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(28) 30 (31, 32)	8 10 12 15 17 20 25 *30	10 12 14 18																																																											
*35	10 12 15 17 20 25 30	10 12 14 18																																																											
(38) *40 (45)	12 15 17 20 25 30	12 14 18																																																											
*50	15 17 20 25 30	14 18																																																											
Pitch	0.35 0.5 0.75 1.0 1.5 1.25 1.5																																																												
<b>Change to Fine Tapped Thread</b> 	<b>MSC</b> <b>NSC</b> <b>JSC</b>	Changes tapped threads to fine tapped threads shown in the table below. <u>[Ordering Code]</u> MSC14 Ex.) When requesting M14 with D20 and 1.5 fine thread pitch <u>[Application Notes]</u> Applicable to D=12 or more Not applicable to D=35 and more for precision shafts. <table><tr><th>D</th><th>MSC, NSC, JSC</th></tr><tr><td>12, 13</td><td>8</td></tr><tr><td>15, 16</td><td>8 10</td></tr><tr><td>18</td><td>8 10 12</td></tr><tr><td>20</td><td>8 10 12 14</td></tr><tr><td>25~35</td><td>8 10 12 14 18</td></tr><tr><td>40</td><td>10 12 14 18</td></tr><tr><td>50</td><td>12 14 18</td></tr><tr><td>Pitch</td><td>1.0 1.25 1.5</td></tr></table>	D	MSC, NSC, JSC	12, 13	8	15, 16	8 10	18	8 10 12	20	8 10 12 14	25~35	8 10 12 14 18	40	10 12 14 18	50	12 14 18	Pitch	1.0 1.25 1.5																																									
D	MSC, NSC, JSC																																																												
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50	12 14 18																																																												
Pitch	1.0 1.25 1.5																																																												
<b>Undercut</b> 	<b>PC</b> <b>QC</b>	PC: Adds undercut(s) on P dimension area. QC: Adds undercut(s) on Q dimension area. <u>[Ordering Code]</u> PC For detailed undercut dimensions, please see <b>P.97</b> <u>[Application Notes]</u> Applicable to M=6 or more. Not applicable to D=Q and D=P.																																																											

### Cautions for Alteration Selections

- Alterations may lower hardness. Please see P.98
- When selecting multiple alteration additions, the distance between machined areas should be greater than 2mm (See below).

Ex. 1  
Wrench Flats (SC)  
When the flats are to start from the ends, specify as "SC0".

Keyway (KC)  
See Rotary Shaft pages for more variations.  
P.709~P.768 (Rotary Shaft Index)

Ex. 2  
Threads  
Correlation between F and B:  
When P≤6, B≤F-2;  
when P=8, 10, B≤F-3;  
when P=6, B≤F-5

Undercut (PC, QC)  
For the following types, PC and QC alterations are no longer available. Please see pages below.  
One End Threaded with Undercut P.123, 125, 141, 143  
Both Ends Threaded with Undercuts P.133, 135

Hex Wrench  
Both Ends Threaded Shafts with Cross-Drilled Hole

When Selecting Multiple Alterations  
The distance between machined areas should be greater than 2mm.

Set Screw Flat  
Orientation between set screw flats is random.  
WFC (Set Screw Flats at Two Locations)  
WSC (Wrench Flats at Two Locations)  
WRC (90-deg. Set Screw Flats at Two Locations)  
WKC (Keyways at Two Locations)

90-deg. Set Screw Flat (RC)  
Orientation between set screw flats is random.  
Recommended to use with Shaft Collar P.229.

Cross-Drilled Hole

Shafts with Cross-Drilled Hole are suitable for narrow work space.