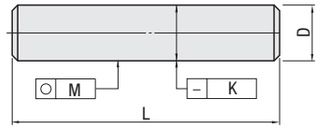
Accuracy Standards

Circularity / Straightness / L Dimension Accuracy



D Section Circularity

Shaft Dia. (Over)	Shaft Dia. (Less Than)	Shaft Tolerance h8 (C–VALUE)	Shaft Tolerance g6	Shaft Tolerance f8
2	5	-	0.004	-
5	10	0.012	0.004	0.011
10	13	0.012	0.004	0.014
13	18	0.016	0.005	0.014
18	20	0.016	0.005	0.017
20	30	0.020	0.006	0.017
30	40	-	0.006	-
40	50	-	0.007	-

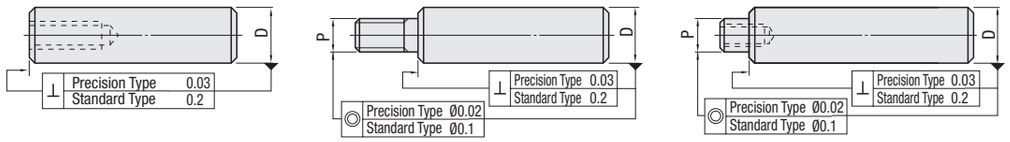
Straightness

Shaft Dia.	Overall Length	Shaft Tolerance h8 (C–VALUE)	Shaft Tolerance g6	Shaft Tolerance f8
3, 4	≤100	-	(L/100)x0.05 or Less	-
	>100			
5	≤100		(L/100)x0.03 or Less	
	>100			
6~50	≤100	0.025 or Less	0.01 or Less	0.025 or Less
	>100	(L/100)x0.025 or Less	(L/100)x0.01 or Less	(L/100)x0.025 or Less

Tolerance of L / Y dimension Tolerance

Dimension (Over)	Dimension (Less Than)	Shaft Tolerance h8 (C–VALUE)	Shaft Tolerance g6	Shaft Tolerance f8
2	6	±0.1		
6	30	±0.2		
30	120	±0.3		
120	400	±0.5		
400	1000	±0.8		
1000	1500	±1.2		

Concentricity / Perpendicularity



• Straightness Measuring Method

Shaft ends are supported on V-blocks and turned 360 degrees to measure shaft runout using a dial indicator.
1/2 of measured runout is defined as the straightness.

Hardness and Surface Treatment Standards

Hardness

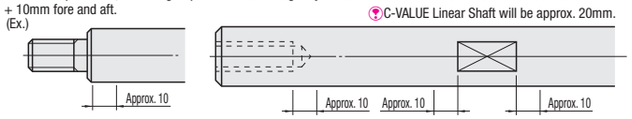
Effective Hardening Depth of Hardened Shafts

O.D. (D)	Effective Hardening Depth		
	Shaft Tolerance h8 (C-VALUE)	Shaft Tolerance g6	
	S45C Equivalent	SUJ2 Equivalent	SUS440C Equivalent
3	-	0.5 or More	0.5 or More
4	-		
5	-		
6~10	0.3 or More		
12, 13	0.5 or More	0.7 or More	0.5 or More
15~20			0.7 or More
25~50	0.8 or More	1.0 or More	

Reduced Hardness around Machined Areas

Alterations will be is applied after base materials are case hardened.
In the example below, annealing required for machining may result in reduced hardness of the machined area + 10mm fore and aft.
Ⓨ C-VALUE Linear Shaft will be approx. 20mm.

(Ex.)

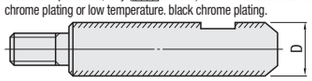


Annealing required for machining may lower hardness of following parts:
- All threaded shafts
- All stepped shafts
- Female Thread Holes: if M≥D/2, two tapped holes on ends, hard chrome plated SUS440C products
- Wrench Flats (SC, WSC, SX)
- Set Screw Flats (FC, WFC)
- V Groove (VC, WVC)

Ⓨ Excluding "Full Length Hardness Guaranteed Type".

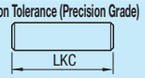
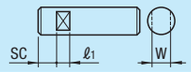
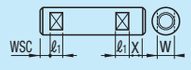
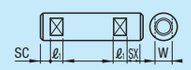
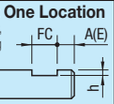
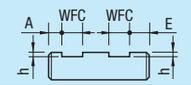
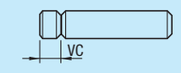
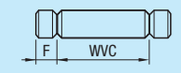
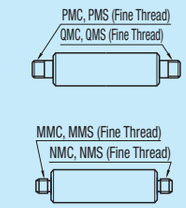
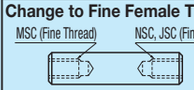
Surface Treatment base Plating Layers

Alterations will be is applied after base materials are surface treated.
In the example below, only (▨ Shaded) D area is treated with hard chrome plating or low temperature. black chrome plating.



Other plating finished shapes are:
- Stepped Part
- Male Thread
- Female Thread
- Wrench flats, V Groove, Screw Flats, Cut End Face

Ⓨ Hollow shaft interior surfaces are not hard chrome plated, and may rust.

Alteration Type	Alterations	Code	Spec.
Tolerance Change	Changes L Dimension Tolerance (Precision Grade) 	LKC	Change "L Tolerance" to a higher precision level. <Ordering Code> LKC <Application Notes> See each product page for details. L dimensions can be specified in 0.1mm increments for LKC. Ⓨ L<200 ⋯›L±0.03 200≤L<500 ⋯›L±0.05 L≥500 ⋯›L±0.1
Wrench Flats	**Wrench Flat at One Location** 	SC	Add Wrench Flat at one location. <Ordering Code> SC5 <Application Notes> Applicable to D=6 or More Ⓨ SC=1mm Increments Ⓨ SC+ℓ1≤LⓎSC≥0 Ⓧ Cannot be used with WSC. D: 6, 8, 10, 12, 13, 15, 16 — W: 5, 7, 8, 10, 11, 13, 14 — ℓ1: 8, 10 D: 18, 20, 25, 30, 35, 40, 50 — W: 16, 17, 22, 27, 30, 36, 41 — ℓ1: 10, 15, 20
	Wrench Flat at Two Locations 	WSC	Adds Wrench Flats at two locations. <Ordering Code> WSC12-X8 <Application Notes> Applicable to D=6 or More Ⓨ WSC and X=1mm Increments Ⓨ WSC+X+ℓ1×2<LⓎWSC(X)≥0 Ⓧ Cannot be machined on the same plane. Cannot be used with SC or SX. D: 6, 8, 10, 12, 13, 15, 16 — W: 5, 7, 8, 10, 11, 13, 14 — ℓ1: 8, 10 D: 18, 20, 25, 30, 35, 40, 50 — W: 16, 17, 22, 27, 30, 36, 41 — ℓ1: 10, 15, 20
	Second Set of Wrench Flats 	SX	Adds a second set of Wrench Flats. <Ordering Code> SX15 <Application Notes> Applicable to D=6 or More, only with Wrench Flats. Ⓨ SX=1mm Increments Ⓨ SC+SX+ℓ1x2<LⓎSX≥0 Ⓧ Cannot be machined on the same plane. Cannot be used with WSC. D: 6, 8, 10, 12, 13, 15, 16 — W: 5, 7, 8, 10, 11, 13, 14 — ℓ1: 8, 10 D: 18, 20, 25, 30, 35, 40, 50 — W: 16, 17, 22, 27, 30, 36, 41 — ℓ1: 10, 15, 20
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	Add a set screw flat at one location. <Ordering Code> FC10-A8, FC10-E8 Ⓨ FC and A (E) =1mm Increments Ⓨ FC≤3xDⓎWhen 1.5xD<FC, FC≤L/2 Ⓨ A(E)=0 or A(E)≥2Ⓧ Not available in combination with WFC. D: 3~5, 6~18, 20~40, 50 — h: 0.5, 1, 2, 3
	Set Screw Flats at Two Locations 	WFC	Add a set screw flat at two locations. <Ordering Code> WFC10-A8-E20 Ⓨ WFC, A and E=1mm Increments Ⓨ WFC≤3xDⓎWhen 1.5xD<WFC, 2WFC≤L/2 Ⓨ A(E)=0 or A(E)≥2 Ⓧ Orientation between set screw flats is not coplanar. Not available in combination with FC. D: 3~5, 6~18, 20~40, 50 — h: 0.5, 1, 2, 3
V Groove	**V Groove at One Location** 	VC	Adds V Groove at one location. <Ordering Code> VC8 <Application Notes> Applicable to D=6 or More Ⓨ VC=1mm Increments Ⓨ VC>W Ⓧ Different from VC Hollow Shafts. D: 6~8, 10~18, 20~25, 30~35, 40~50 — W: 2, 4, 6, 8, 12
	V Grooves at Two Locations 	WVC	V Grooves at Two Locations <Ordering Code> WVC180-F8 <Application Notes> Applicable to D=6 or More Ⓨ WVC and F=1mm IncrementsⓎF>W Ⓧ Different from WVC Hollow Shafts. D: 6~8, 10~18, 20~25, 30~35, 40~50 — W: 2, 4, 6, 8, 12
Thread Modifications	**Change to Fine Male Thread** 	PMC PMS QMC QMS MMC MMS NMC NMS	Change Male threads to fine threads shown in the table below. (PMC, QMC, MMC, NMC→ Applicable for Bearing Nut fine thread pitches) (PMS, QMS, MMS, NMS→ Applicable for Cylinder fine thread pitches) <Ordering Code> PMC15 Ⓨ Ex.) When requesting M15 with D20 and 1.0 bearing nut fine thread pitch Ⓨ *Marked sizes are not applicable for Precision Type.
	Change to Fine Female Thread 	MSC NSC JSC	Change Female threads to fine threads shown in the table below. <Ordering Code> MSC14 Ⓨ Ex.) When requesting M14 with D20 and 1.5 fine thread pitch <Application Notes> Applicable to D=12 or More
	Undercut 	PC QC	PC: Add undercut(s) on P dimension area. QC: Add undercut(s) on Q dimension area. <Ordering Code> PC <Application Notes> Applicable to M=6 or More Ⓧ Not applicable to D=Q and D=P

MSC, NSC, JSC

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	

PC, QC

• For Coarse Threads

P(=M) Q(=N)	PC QC	F-B (T-S)
6	4.4	2
8	6.0	3
10	7.7	
12	9.4	4
16	13.0	
20	16.4	5
24	19.6	

• When combined with Fine Thread Alterations

PMC, MMC QMC, NMC	PC QC	F-B (T-S)
6	4.8	2.0
8	6.4	
10	8.4	
12	10.4	
15	13.4	
17	15.4	
20	18.4	

PMS, MMS QMS, NMS	PC QC	F-B (T-S)
10	8.0	3.0
12	9.7	
14	11.7	
18	15.7	