Appendix

SI unit conversion table

●SI-Prefixes

	SI-Prefixes			SI-Prefixes			SI-Prefixes	
	Prefix	Symbol		Prefix	Symbol		Prefix	Symbol
10^{18}	exa	E	10^{2}	hecto	h	10^{-9}	nano	n
10^{15}	peta	P	10^{1}	deca	da	10^{-12}	pico	p
10^{12}	tera	T	10^{-1}	deci	d	10^{-15}	femto	f
10^{9}	giga	G	10^{-2}	centi	c	10^{-18}	atto	a
10^{6}	mega	M	10^{-3}	milli	m			
10^{3}	kilo	k	10^{-6}	micro	μ			

●Force, Weight

N $kg \cdot m/s^2$	dyn $g \cdot cm/s^2$	kgf	lbf
1	10^{5}	0.101972	0.224809
10^{-5}	1	1.01972×10^{-6}	0.224809×10^{-6}
9.80665	9.80665×10^{5}	1	2.20462
4.44822	4.44822×10^{5}	0.453592	1

Note) Highlighted cells show SI unit.

●mass

kg	g	lb	t	oz
1	10^{3}	2.20462	10^{-3}	35.274
10^{-3}	1	2.20462×10^{-3}	10^{-6}	0.035274
0.453592	453.592	1	0.453592×10^{-3}	16
1000	10^{6}	2204.62	1	3.5274×10^{4}
0.0283495	28.3495	0.06250	2.83495×10^{-5}	1

Note) Highlighted cells show SI unit.

●Stress

Pa N/m^2	MPa N/mm^2	kgf/mm^2	kgf/cm^2
1	1×10^{-6}	1.01972×10^{-7}	1.01972×10^{-5}
1×10^{6}	1	1.01972×10^{-1}	1.01972×10
9.80665×10^{6}	9.80665	1	1×10^{2}
9.80665×10^{4}	9.80665×10^{-2}	1×10^{-2}	1

Note) Highlighted cells show SI unit.

●Pressure

Pa N/m^2	MPa N/mm^2	bar	kgf/cm^2	atm	mmH_2O	mmHg Torr
1	1×10^{-6}	1×10^{-5}	1.01972×10^{-5}	9.86923×10^{-6}	1.01972×10^{-1}	7.50062×10^{-3}
1×10^{3}	1×10^{-3}	1×10^{-2}	1.01972×10^{-2}	9.86923×10^{-3}	1.01972×10^{2}	7.50062
1×10^{6}	1	1×10	1.01972×10	9.86923	1.01972×10^{5}	7.50062×10^{3}
1×10^{5}	1×10^{-1}	1	1.01972	9.86923×10^{-1}	1.01972×10^{4}	7.50062×10^{2}
9.80665×10^{4}	9.80665×10^{-2}	9.80665×10^{-1}	1	9.67841×10^{-1}	1×10^{4}	7.35559×10^{2}
1.01325×10^{5}	1.01325×10^{-1}	1.01325	1.03323	1	1.03323×10^{4}	7.60000×10^{2}
9.80665	9.80665×10^{-6}	9.80665×10^{-5}	1×10^{-4}	9.67841×10^{-5}	1	7.35559×10^{-2}
1.33322×10^{2}	1.33322×10^{-4}	1.33322×10^{-3}	1.35951×10^{-3}	1.31579×10^{-3}	1.35951×10	1

Note) Highlighted cells show SI unit.

●Kinematic Viscosity

m^2/s	cSt mm^2/s	St cm^2/s
1	1×10^{6}	1×10^{4}
1×10^{-6}	1	1×10^{-2}
1×10^{-4}	1×10^{2}	1

Note) Highlighted cells show SI unit.

●Velocity

m/s	m/min	km/h	ft/s	ft/min	mile/h
1	60	3.6	3.28084	196.850	2.23693
0.0166667	1	0.06	0.0546807	3.2808	0.0372823
0.277778	16.667	1	0.911344	54.6807	0.621371
0.30480	18.288	1.09728	1	60	0.681818
5.0800×10^{-3}	0.30480	0.018288	0.0166667	1	0.0113636
0.447041	26.8224	1.60934	1.46667	88	1

●Length

m	cm	mm	μm	nm	Å	in	ft
1	100	1000	10^{6}	10^{9}	10^{10}	39.3701	3.28084
0.01	1	10	10^{4}	10^{7}	10^{8}	0.393701	0.0328084
0.001	0.1	1	10^{3}	10^{6}	10^{7}	0.0393701	3.28084×10^{-3}
10^{-6}	10^{-4}	10^{-3}	1	10^{3}	10^{4}	39.3701×10^{-6}	3.28084×10^{-6}
10^{-9}	10^{-7}	10^{-6}	10^{-3}	1	10	39.3701×10^{-9}	3.28084×10^{-9}
10^{-10}	10^{-8}	10^{-7}	10^{-4}	0.1	1	39.3701×10^{-10}	3.28084×10^{-10}
0.0254	2.54	25.4	25.4×10^{3}	25.4×10^{6}	25.4×10^{7}	1	0.0833333
0.3048	30.48	304.8	304.8×10^{3}	304.8×10^{6}	304.8×10^{7}	12	1

Conversion Table for Hardness

Rockwell hardness C-scale	Vickers hardness	Brinell hardness		Rockwell hardness		Shore hardness
		Standard Ball	Tungsten Carbide Ball	A-Scale Load;600N barle Pressure Piece	B-Scale Load;1000N 1/16-in dia.Ball	
HRC	Hv	HB	HB	HRA	HRB	Hs
68	940	—	—	85.6	—	97
67	900	—	—	85.0	—	95
66	865	—	—	84.5	—	92
65	832	—	739	83.9	—	91
64	800	—	722	83.4	—	88
63	772	—	705	82.8	—	87
62	746	—	688	82.3	—	85
61	720	—	670	81.8	—	83
60	697	—	654	81.2	—	81
59	674	—	634	80.7	—	80
58	653	—	615	80.1	—	78
57	633	—	595	79.6	—	76
56	613	—	577	79.0	—	75
55	595	—	560	78.5	—	74
54	577	—	543	78.0	—	72
53	560	—	525	77.4	—	71
52	544	500	512	76.8	—	69
51	528	487	496	76.3	—	68
50	513	475	481	75.9	—	67
49	498	464	469	75.2	—	66
48	484	451	455	74.7	—	64
47	471	442	443	74.1	—	63
46	458	432	432	73.6	—	62
45	446	421	421	73.1	—	60
44	434	409	409	72.5	—	58
43	423	400	400	72.0	—	57
42	412	390	390	71.5	—	56
41	402	381	381	70.9	—	55
40	392	371	371	70.4	—	54
39	382	362	362	69.9	—	52
38	372	353	353	69.4	—	51
37	363	344	344	68.9	—	50
36	354	336	336	68.4	(109.0)	49
35	345	327	327	67.9	(108.5)	48
34	336	319	319	67.4	(108.0)	47
33	327	311	311	66.8	(107.5)	46
32	318	301	301	66.3	(107.0)	44
31	310	294	294	65.8	(106.0)	43
30	302	286	286	65.3	(105.5)	42
29	294	279	279	64.7	(104.5)	41
28	286	271	271	64.3	(104.0)	41
27	279	264	264	63.8	(103.0)	40
26	272	258	258	63.3	(102.5)	38
25	266	253	253	62.8	(101.5)	38
24	260	247	247	62.4	(101.0)	37
23	254	243	243	62.0	100.0	36
22	248	237	237	61.5	99.0	35
21	243	231	231	61.0	98.5	35
20	238	226	226	60.5	97.8	34
(18)	230	219	219	—	96.7	33
(16)	222	212	212	—	95.5	32
(14)	213	203	203	—	93.9	31
(12)	204	194	194	—	92.3	29
(10)	196	187	187	—	90.7	28
(8)	188	179	179	—	89.5	27
(6)	180	171	171	—	87.1	26
(4)	173	165	165	—	85.5	25
(2)	166	158	158	—	83.5	24
(0)	160	152	152	—	81.7	24

Material Chemical Composition

Category	Std. No.	Designation	Chemical Composition %									
			C	Si	Mn	P	S	Ni	Cr	Mo	Al	others
Carbon Steels for machine structural use	JIS G 4051	S40C	0.37~0.43	0.15~0.35	0.60~0.90	≦0.030	≦0.035	≦0.20	≦0.20			Cu≦0.30 Ni+Cr≦0.35
		S45C	0.42~0.48	0.15~0.35	0.60~0.90	≦0.030	≦0.035	≦0.20	≦0.20			Cu≦0.30 Ni+Cr≦0.35
		S50C	0.47~0.53	0.15~0.35	0.60~0.90	≦0.030	≦0.035	≦0.20	≦0.20			Cu≦0.30 Ni+Cr≦0.35
		S53C	0.50~0.56	0.15~0.35	0.60~0.90	≦0.030	≦0.035	≦0.20	≦0.20			Cu≦0.30 Ni+Cr≦0.35
		S55C	0.52~0.58	0.15~0.35	0.60~0.90	≦0.030	≦0.035	≦0.20	≦0.20			Cu≦0.30 Ni+Cr≦0.35
Structural Steels with specified hardenability bands	JIS G 4052	SCM415H	0.12~0.18	0.15~0.35	0.55~0.95	≦0.030	≦0.030	≦0.25	0.85~1.25	0.15~0.30		
		SCM420H	0.17~0.23	0.15~0.35	0.55~0.95	≦0.030	≦0.030	≦0.25	0.85~1.25	0.15~0.30		
		SCM435H	0.32~0.39	0.15~0.35	0.55~0.95	≦0.030	≦0.030	≦0.25	0.85~1.25	0.15~0.35		
		SCM440H	0.37~0.44	0.15~0.35	0.55~0.95	≦0.030	≦0.030	≦0.25	0.85~1.25	0.15~0.35		
		SCM445H	0.42~0.49	0.15~0.35	0.55~0.95	≦0.030	≦0.030	≦0.25	0.85~1.25	0.15~0.35		
Chrome - molybdenum Steel	JIS G 4105	SCM415	0.13~0.18	0.15~0.35	0.60~0.85	≦0.030	≦0.030	≦0.25	0.90~1.20	0.15~0.30		Cu≦0.30
		SCM418	0.16~0.21	0.15~0.35	0.60~0.85	≦0.030	≦0.030	≦0.25	0.90~1.20	0.15~0.30		Cu≦0.30
		SCM420	0.18~0.23	0.15~0.35	0.60~0.85	≦0.030	≦0.030	≦0.25	0.90~1.20	0.15~0.30		Cu≦0.30
		SCM430	0.28~0.33	0.15~0.35	0.60~0.85	≦0.030	≦0.030	≦0.25	0.90~1.20	0.15~0.30		Cu≦0.30
		SCM435	0.35~0.38	0.15~0.35	0.60~0.85	≦0.030	≦0.030	≦0.25	0.90~1.20	0.15~0.30		Cu≦0.30
		SCM440	0.38~0.43	0.15~0.35	0.60~0.85	≦0.030	≦0.030	≦0.25	0.90~1.20	0.15~0.30		Cu≦0.30
		SCM445	0.43~0.48	0.15~0.35	0.60~0.85	≦0.030	≦0.030	≦0.25	0.90~1.20	0.15~0.30		Cu≦0.30

Category	Std. No.	Designation	Chemical Composition %								
			C	Si	Mn	P	S	Ni	Cr	Mo	others
Stainless Steels	JIS G 4303 ~ JIS G 4305	SUS303	≦0.15	≦1.00	≦2.00	≦0.20	≧0.15	8.00~10.00	17.00~19.00	≦0.60	
		SUS304	≦0.08	≦1.00	≦2.00	≦0.045	≦0.030	8.00~10.50	18.00~20.00		
		SUS316	≦0.08	≦1.00	≦2.00	≦0.045	≦0.030	10.00~14.00	16.00~18.00	2.00~3.00	
		SUS317	≦0.08	≦1.00	≦2.00	≦0.045	≦0.030	11.00~15.00	18.00~20.00	3.00~4.00	
		SUS440A	0.60~0.75	≦1.00	≦1.00	≦0.040	≦0.040		16.00~18.00	≦0.75	
		SUS440B	0.75~0.95	≦1.00	≦1.00	≦0.040	≦0.030		16.00~18.00	≦0.75	
		SUS440C	0.95~1.20	≦1.00	≦1.00	≦0.040	≦0.030		16.00~18.00	≦0.75	
		SUS630	≦0.07	≦1.00	≦1.00	≦0.040	≦0.030	3.00~5.00	15.50~17.50		
		SUS631	≦0.09	≦1.00	≦1.00	≦0.040	≦0.030	6.5~7.75	16.00~18.00		

Category	Std. No.	Designation	Chemical Composition %									
			C	Si	Mn	P	S	Pb	Cr	Mo	W	others
Alloy Tool Steels	JIS G 4404	SKS 2	1.00~1.10	≦0.35	≦0.80	≦0.030	≦0.030		0.50~1.00		1.00~1.50	
		SKS 3	0.90~1.00	≦0.35	0.90~1.20	≦0.030	≦0.030		0.50~1.00		0.50~1.00	
		SKS 4	0.45~0.55	≦0.35	≦0.50	≦0.030	≦0.030		0.50~1.00		0.50~1.00	
High Carbon Chromium Bearing Steels	JIS G 4805	SUJ 1	0.95~1.10	0.15~0.35	≦0.50	≦0.025	≦0.025		0.90~1.20	≦0.08		
		SUJ 2	0.95~1.10	0.15~0.35	≦0.50	≦0.025	≦0.025		1.30~1.60	≦0.08		
		SUJ 3	0.95~1.10	0.40~0.70	0.90~1.15	≦0.025	≦0.025		0.90~1.20	≦0.08		
		SUJ 4	0.95~1.10	0.15~0.35	≦0.50	≦0.025	≦0.025		1.30~1.60	0.10~0.25		

Category	Std. No.	Designation	Chemical Composition %							
			Cu	Pb	Fe	Sn	Zn	Mn	Ni	others
Copper alloy	JIS H 3270	C5191B				5.5~7.0				P;0.03~0.35 Cu+Sn+P≧99.5
	JIS H 3260	C3604W	57.0~61.0	1.8~3.7	≦0.50		Remains			Fe+Sn≦1.2

Category	Std. No.	Designation	Chemical Composition %									
			Cu	Zn	Al	Mn	Ni	Pb	Sn	Fe	Si	others
Copper alloy	JIS H 5111	BC6	82.0 ~87.0	4.0~6.0	≦0.01		≦1.0	4.0~6.0	4.0~6.0	≦0.3	≦0.01	

Comparison with other country's standard for material

Japan Industrial Standard;JIS			ISO	USA	UK	Germany	France
Category	Std. No.	Designation					
Carbon Steels for Machine structural use	JIS G 4051	S40C	C40/C40E4/C40M2	AISI 1040	EN-C40,C40E,C40R		
		S45C	C45/C45E4/C45M2	AISI 1045	EN-C45,C45E,C45R		
		S50C	C50/C50E4/C50M2	AISI 1049	EN-C50,C50E,C50R		
		S53C	—	AISI 1053	—	—	—
		S55C	C55/C55E4/C55M2	AISI 1055	EN-C55,C55E,C55R		
Structural Steels with specified hardenability bands	JIS G 4052	SCM415H	—	—	—	—	—
		SCM420H	—	—	708H20	—	—
		SCM435H	34CrMo4/34CrMoS4	AISI 4137H	—	—	—
		SCM440H	42CrMo4/42CrMoS4	AISI 4140H	EN-42CrMo4/42CrMoS4		
		SCM445H	—	AISI 4147H	—	—	—
Chrome - molybdenum Steel	JIS G 4105	SCM415	—	—	—	—	—
		SCM418	18CrMo4/18CrMoS4	—	—	—	—
		SCM420	—	—	708M20	—	—
		SCM430	—	AISI 4130	—	—	—
		SCM435	34CrMo4/34CrMoS4	AISI 4137	—	—	—
		SCM440	42CrMo4/42CrMoS4	AISI 4140	EN-42CrMo4/42CrMoS4		
		SCM445	—	AISI 4147	—	—	—

Japan Industrial Standard;JIS			ISO	USA	UK	Germany	France
Category	Std. No.	Designation					
Stainless Steels	JIS G 4303 ~ JIS G 4305	SUS303	TR15510(1997)-13	ASTM-S 30300	303 S 31	X10CrNiS 189	Z8 CNF 18.09
		SUS304	TR15510(1997)-6	ASTM-S 30400	304 S 31	X5CrNi 1810	Z7CN 18.09
		SUS316	TR15510(1997)-26	ASTM-S 31600	316 S 31	X5CrNiMo17122	Z7CND 17.11-02
		SUS317	—	ASTM-S 31700	317 S 16	—	—
		SUS440A	—	ASTM-S 44002	EN-1.4109		
		SUS440B	—	ASTM-S 44003	—	—	—
		SUS440C	—	ASTM-S 44004	EN-1.4125		Z100CD17
		SUS630	TR15510(1997)-58	ASTM-S 17400	—	—	Z7CNU 17.04
		SUS631	TR15510(1997)-59	ASTM-S 17700	—	X7CrNiAl 177	Z9CNA 17.07
Alloy Tool Steels	JIS G 4404	SKS 2	105WCr1	—	—	105WCr6	105WCr5
		SKS 3	—	—	—	—	—
		SKS 4	—	—	—	—	—
High Carbon Chromium Bearing Steels	JIS G 4805	SUJ 1	—	ASTM 51100	—	—	—
		SUJ 2	100Cr6	ASTM 52100	—	100Cr6	100Cr6
		SUJ 3	100CrMnSi4-4	ASTM A 485 Grade1	—	—	—
Copper alloy	JIS H 3270	C5191B	CuSn6	—	PB103	CuSn6	—
	JIS H 3260	C3604W	CuZn 39 PB 3	—	—	CuZn 39 PB 3	—
	JIS H 5111	BC6	—	ASTM-C 83600	LG2	CuSn 5 ZnPb	—

Appended table

Fits tolerances for frequent use　JIS B 0401

●Fit tolerances of normal holes

Unit: μm

Dimensional division		Fit tolerance grade for holes															
over	up to	D8	D9	D10	E7	E8	E9	F6	F7	F8	G6	G7	H6	H7	H8	H9	H10
—	3	+34 +20	+45 +20	+60 +20	+24 +14	+28 +14	+39 +14	+12 +6	+16 +6	+20 +6	+8 +2	+12 +2	+6 0	+10 0	+14 0	+25 0	+40 0
3	6	+48 +30	+60 +30	+78 +30	+32 +20	+38 +20	+50 +20	+18 +10	+22 +10	+28 +10	+12 +4	+16 +4	+8 0	+12 0	+18 0	+30 0	+48 0
6	10	+62 +40	+76 +40	+98 +40	+40 +25	+47 +25	+61 +25	+22 +13	+28 +13	+35 +13	+14 +5	+20 +5	+9 0	+15 0	+22 0	+36 0	+58 0
10	14	+77 +50	+93 +50	+120 +50	+50 +32	+59 +32	+75 +32	+27 +16	+34 +16	+43 +16	+17 +6	+24 +6	+11 0	+18 0	+27 0	+43 0	+70 0
14	18																
18	24	+98 +65	+117 +65	+149 +65	+61 +40	+73 +40	+92 +40	+33 +20	+41 +20	+53 +20	+20 +7	+28 +7	+13 0	+21 0	+33 0	+52 0	+84 0
24	30																
30	40	+119 +80	+142 +80	+180 +80	+75 +50	+89 +50	+112 +50	+41 +25	+50 +25	+64 +25	+25 +9	+34 +9	+16 0	+25 0	+39 0	+62 0	+100 0
40	50																
50	65	+146 +100	+174 +100	+220 +100	+90 +60	+106 +60	+134 +60	+49 +30	+60 +30	+76 +30	+29 +10	+40 +10	+19 0	+30 0	+46 0	+74 0	+120 0
65	80																
80	100	+174 +120	+207 +120	+260 +120	+107 +72	+126 +72	+159 +72	+58 +36	+71 +36	+90 +36	+34 +12	+47 +12	+22 0	+35 0	+54 0	+87 0	+140 0
100	120																

●Fit tolerances of normal shafts

Unit: μm

Dimensional division		Fit tolerance grade for shafts															
over	up to	d8	d9	e7	e8	e9	f6	f7	f8	g5	g6	g7	h5	h6	h7	h8	h9
—	3	-20 -34	-20 -45	-14 -24	-14 -28	-14 -39	-6 -12	-6 -16	-6 -20	-2 -6	-2 -8	-2 -12	0 -4	0 -6	0 -10	0 -14	0 -25
3	6	-30 -48	-30 -60	-20 -32	-20 -38	-20 -50	-10 -18	-10 -22	-10 -28	-4 -9	-4 -12	-4 -16	0 -5	0 -8	0 -12	0 -18	0 -30
6	10	-40 -62	-40 -76	-25 -40	-25 -47	-25 -61	-13 -22	-13 -28	-13 -35	-5 -11	-5 -14	-5 -20	0 -6	0 -9	0 -15	0 -22	0 -36
10	14	-50 -77	-50 -93	-32 -50	-32 -59	-32 -75	-16 -27	-16 -34	-16 -43	-6 -14	-6 -17	-6 -24	0 -8	0 -11	0 -18	0 -27	0 -43
14	18																
18	24	-65 -98	-65 -117	-40 -61	-40 -73	-40 -92	-20 -33	-20 -41	-20 -53	-7 -16	-7 -20	-7 -28	0 -9	0 -13	0 -21	0 -33	0 -52
24	30																
30	40	-80 -119	-80 -142	-50 -75	-50 -89	-50 -112	-25 -41	-25 -50	-25 -64	-9 -20	-9 -25	-9 -34	0 -11	0 -16	0 -25	0 -39	0 -62
40	50																
50	65	-100 -146	-100 -174	-60 -90	-60 -106	-60 -134	-30 -49	-30 -60	-30 -76	-10 -23	-10 -29	-10 -40	0 -13	0 -19	0 -30	0 -46	0 -74
65	80																
80	100	-120 -174	-120 -207	-72 -107	-72 -126	-72 -159	-36 -58	-36 -71	-36 -90	-12 -27	-12 -34	-12 -47	0 -15	0 -22	0 -35	0 -54	0 -87
100	120																

Unit: μm

Dimensional division		Fit tolerance grade for holes															
over	up to	JS6	JS7	K6	K7	M6	M7	N6	N7	N8	N9	P6	P7	P8	P9	R7	S7
—	3	±3	±5	0 -6	0 -10	-2 -8	-2 -12	-4 -10	-4 -14	-4 -18	-4 -29	-6 -12	-6 -16	-6 -20	-6 -31	-10 -20	-14 -24
3	6	±4	±6	+2 -6	+3 -9	-1 -9	0 -12	-5 -13	-4 -16	-2 -20	0 -30	-9 -17	-8 -20	-12 -30	-12 -42	-11 -23	-15 -27
6	10	±4.5	±7.5	+2 -7	+5 -10	-3 -12	0 -15	-7 -16	-4 -19	-3 -25	0 -36	-12 -21	-9 -24	-15 -37	-15 -51	-13 -28	-17 -32
10	14	±5.5	±9	+2 -9	+6 -12	-4 -15	0 -18	-9 -20	-5 -23	-3 -30	0 -43	-15 -26	-11 -29	-18 -45	-18 -61	-16 -34	-21 -39
14	18																
18	24	±6.5	±10.5	+2 -11	+6 -15	-4 -17	0 -21	-11 -24	-7 -28	-3 -36	0 -52	-18 -31	-14 -35	-22 -55	-22 -74	-20 -41	-27 -48
24	30																
30	40	±8	±12.5	+3 -13	+7 -18	-4 -20	0 -25	-12 -28	-8 -33	-3 -42	0 -62	-21 -37	-17 -42	-26 -65	-26 -88	-25 -50	-34 -59
40	50																
50	65	±9.5	±15	+4 -15	+9 -21	-5 -24	0 -30	-14 -33	-9 -39	-4 -50	0 -74	-26 -45	-21 -51	-32 -78	-32 -106	-30 -60	-42 -72
65	80															-32 -62	-48 -78
80	100	±11	±17.5	+4 -18	+10 -25	-6 -28	0 -35	-16 -38	-10 -45	-4 -58	0 -87	-30 -52	-24 -59	-37 -91	-37 -124	-38 -73	-58 -93
100	120															-41 -76	-66 -101

Unit: μm

Dimensional division		Fit tolerance grade for shafts													
over	up to	js5	js6	js7	k5	k6	k7	m5	m6	n6	p6	r6	s6	t6	u6	x6
—	3	±2	±3	±5	+4 0	+6 0	+10 0	+6 +2	+8 +2	+10 +4	+12 +6	+16 +10	+20 +14	—	+24 +18	+26 +20
3	6	±2.5	±4	±6	+6 +1	+9 +1	+13 +1	+9 +4	+12 +4	+16 +8	+20 +12	+23 +15	+27 +19	—	+31 +23	+36 +28
6	10	±3	±4.5	±7.5	+7 +1	+10 +1	+16 +1	+12 +6	+15 +6	+19 +10	+24 +15	+28 +19	+32 +23	—	+37 +28	+43 +34
10	14	±4	±5.5	±9	+9 +1	+12 +1	+19 +1	+15 +7	+18 +7	+23 +12	+29 +18	+34 +23	+39 +28	—	+44 +33	+51 +40
14	18													—		+56 +45
18	24	±4.5	±6.5	±10.5	+11 +2	+15 +2	+23 +2	+17 +8	+21 +8	+28 +15	+35 +22	+41 +28	+48 +35	—	+54 +41	+67 +54
24	30													+54 +41	+61 +48	+77 +64
30	40	±5.5	±8	±12.5	+13 +2	+18 +2	+27 +2	+20 +9	+25 +9	+33 +17	+42 +26	+50 +34	+59 +43	+64 +48	+76 +60	—
40	50													+70 +54	+86 +70	—
50	65	±6.5	±9.5	±15	+15 +2	+21 +2	+32 +2	+24 +11	+30 +11	+39 +20	+51 +32	+60 +41	+72 +53	+85 +66	+106 +87	—
65	80											+62 +43	+78 +59	+94 +75	+121 +102	—
80	100	±7.5	±11	±17.5	+18 +3	+25 +3	+38 +3	+28 +13	+35 +13	+45 +23	+59 +37	+73 +51	+93 +71	+113 +91	+146 +124	—
100	120											+76 +54	+101 +79	+126 +104	+166 +144	—

General tolerances

●General tolerances for linear dimensions　JIS B 0405

Unit：mm

Tolerance grade		Dimensional division					
Symbol	Remark	0.5 or over up to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1000
f	Fine	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3
m	Medium	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8
c	Coarse	±0.2	±0.3	±0.5	±0.8	±1.2	±2
v	Very coarse	—	±0.5	±1	±1.5	±2.5	±4

●General tolerances for chamfer dimensions　JIS B 0405

Unit：mm

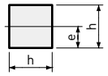
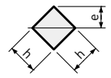
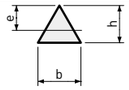
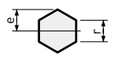
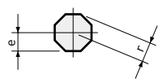
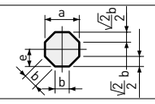
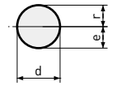
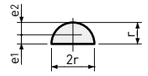
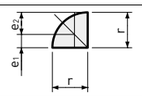
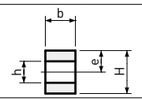
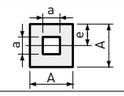
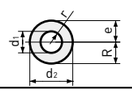
Tolerance grade		Dimensional division		
Symbol	Remark	0.5 or over up to 3	over 3 up to 6	over 6
f	Fine	±0.2	±0.5	±1
m	Medium	±0.2	±0.5	±1
c	Coarse	±0.4	±1	±2
v	Very coarse	±0.4	±1	±2

●General tolerances for angular dimensions　JIS B 0405

Tolerance grade		Length division of shorter side formed angle(mm)				
Symbol	Remark	up to 10	over 10 up to 50	over 50 up to 120	over 120 up to 400	over 400
f	Fine	±1°	±30′	±20′	±10′	±5′
m	Medium	±1°	±30′	±20′	±10′	±5′
c	Coarse	±1°30′	±1°	±30′	±15′	±10′
v	Very coarse	±3°	±2°	±1°	±30′	±20′

Appended table

Area・Center of gravity・Moment of Inertia of area

Cross section	Sectional area A	Distance to center of gravity e	Moment of Inertia of area I	Section modulus Z=I/e
	bh	$\frac{h}{2}$	$\frac{bh^3}{12}$	$\frac{bh^2}{6}$
	h^2	$\frac{h}{2}$	$\frac{h^4}{12}$	$\frac{h^3}{6}$
	h^2	$\frac{h}{2}\sqrt{2}$	$\frac{h^4}{12}$	$0.1179h^3=\frac{\sqrt{2}}{12}h^3$
	$\frac{bh}{12}$	$\frac{2}{3}h$	$\frac{bh^3}{36}$	$\frac{bh^2}{24}$
	$\frac{3\sqrt{3}}{2}r^2$	$\sqrt{\frac{3}{4}}r$	$\frac{5\sqrt{3}}{16}r^4$	$\frac{5}{8}r^3$
		r		$\frac{5\sqrt{3}}{16}r^3$
	$2.828r^2$	$0.924r^2$	$\frac{1+2\sqrt{2}}{6}r^4$	$0.6906r^3$
	$0.8284a^2$	$b=\frac{a}{1+\sqrt{2}}$	$0.0547a^4$	$0.1095a^3$
	$\pi r^2=\frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64}=\frac{\pi r^4}{4}$	$\frac{\pi d^3}{32}=\frac{\pi r^3}{4}$
	πab	a	$\frac{\pi}{4}ba^3$	$\frac{\pi}{4}ba^2$
	$\frac{\pi}{2}r^2$	$e_1=0.4244r$ $e_2=0.5756r$	$\left(\frac{\pi}{8}-\frac{8}{9\pi}\right)r^4$	$z_1=0.2587r^3$ $z_2=0.1908r^3$
	$\frac{\pi}{4}r^2$	$e_1=0.4244r$ $e_2=0.5756r$	$0.055r^4$	$z_1=0.1296r^3$ $z_2=0.0956r^3$
	$b(H-h)$	$\frac{H}{2}$	$\frac{b}{12}(H^3-h^3)$	$\frac{b}{6H}(H^3-h^3)$
	A^2-a^2	$\frac{A}{2}$	$\frac{A^4-a^4}{12}$	$\frac{1}{6}\frac{A^4-a^4}{A}$
	$\frac{\pi}{4}(d_2^2-d_1^2)$	$\frac{d_2}{2}$	$\frac{\pi}{64}(d_2^4-d_1^4)$ $=\frac{\pi}{4}(R^4-r^4)$	$\frac{\pi}{32}\left(\frac{d_2^4-d_1^4}{d_2}\right)$ $=\frac{\pi}{4}\frac{R^4-r^4}{R}$

Appended table

Technical Data Sheet

As customer's request, KSS selects Ball Screws. For selection of Ball Screws, please let us know detail of usage condition as much as possible and it enables precise selection.
Prompt selection can be possible by using technical data sheet below.

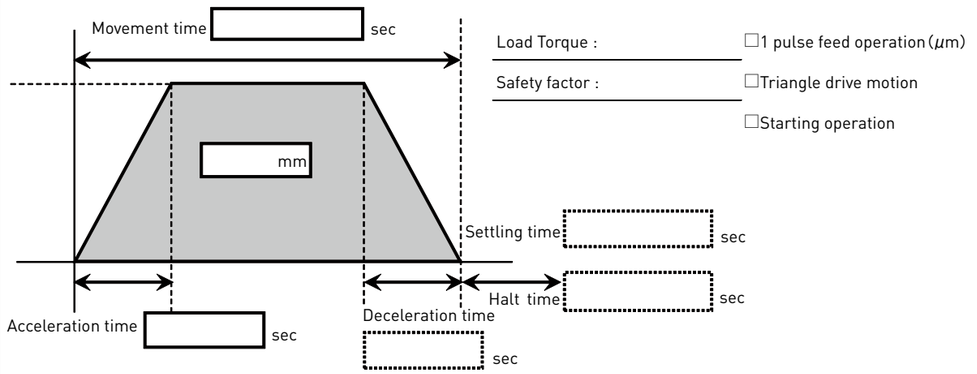
Technical data sheet

Date	/ /		Person in charge			
Company Name						
Telephone No.			E-mail address			
Industry Field	☐ Semiconductor ☐ LCD ☐ Measuring Equipment ☐ Stage ☐ Optical ☐ Food ☐ Medical ☐ Aero space ☐ Automobile ☐ Military affairs ☐ Others ( )					
Products	☐Ball Screw ☐ Lead Screw ☐ Resin Lead Screw ☐ Direct Motor Drive Ball Screw ☐Actuator ☐ Others( )					
Operating Condition	Machine Name		Shaft dia. (mm)		Lead (mm)	
	Application		Accuracy Grade		Axial play (μm)	
	Position	☐ Hor. ☐ Vert. ☐ ( ) deg	Travel (mm)		Lubrication	
	Operating Temp.	☐Room Temp. ☐Others( ) deg	Load (max/mean)		Speed (max/mean)	
	Remarks					
Reqd. accuracy	Absolute Positioning μm		Repeatability μm		Lost motion μm	

●Operating Pattern●

Crucial items

Optional Items



Load Torque :

Safety factor :

☐1 pulse feed operation (μm)

☐Triangle drive motion

☐Starting operation

Memorandum

Request items	☐Ball Screw life time ☐ Ball Screw Model selection ☐Motor Model selection ☐ Others ( )		
Calculated Ball Screw Life	(hours/days/years)	Recommended Ball Screw/Motor	
Resistered No.			

KSS CO.,LTD.

Appended table

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