

# 15. Appendix

Table 1: Boundary dimensions of radial bearings (Tapered roller bearings not included)-1

Single row radial ball bearings		67						68		78						69		79						160		60		70							
Double row radial ball bearings																																			
Cylindrical roller bearings								N28		N38		NN48						N19		N29		NN39		NN49				N10		N20		NN30		NN40	
Needle roller bearings																																			
Spherical roller bearings																						239		249						230		240			
Number	Dimension	Diameter series 7				Diameter series 8								Diameter series 9								Diameter series 0													
		Dimension series				Dimension series								Dimension series								Dimension series													
		17	27	37	17~37	08	18	28	38	48	58	68	08	18~68	09	19	29	39	49	59	69	09	19~39	49~69	00	10	20	30	40	50	60	00	10~60		
Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min	Nominal diameter of bearing D	Nominal width B	Chamfer dimension r s min			
1	0.6	2	0.8	—	—	0.05	2.5	—	1	—	1.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
1	1	2.5	1	—	—	0.05	3	—	1	—	1.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
1	1.5	3	1	—	—	0.05	4	—	1.2	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
2	2	4	1.2	—	—	0.05	5	—	1.5	—	2.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
2	2.5	5	1.5	—	—	0.08	6	—	1.8	—	2.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
3	3	6	2	—	—	0.08	7	—	2	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
4	4	7	2	—	—	0.08	9	—	2.5	—	3.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
5	5	8	2	—	—	0.08	11	—	3	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
6	6	10	2.5	—	—	0.1	13	—	3.5	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
7	7	11	2.5	—	—	0.1	14	—	3.5	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
8	8	12	2.5	—	—	0.1	16	—	4	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
9	9	14	3	—	—	0.1	17	—	4	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
00	10	15	3	—	—	0.1	19	—	5	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
01	12	18	4	—	—	0.2	21	—	5	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
02	15	21	4	—	—	0.2	24	—	5	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
03	17	23	4	—	—	0.2	26	—	5	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
04	20	27	4	—	—	0.2	32	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
/22	22	—	—	—	—	—	34	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
05	25	32	4	—	—	0.2	37	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
/28	28	—	—	—	—	—	40	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
06	30	37	4	—	—	0.2	42	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
/32	32	—	—	—	—	—	44	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
07	35	44	5	—	—	0.3	47	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
08	40	—	—	—	—	—	52	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
09	45	—	—	—	—	—	58	—	4	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
10	50	—	—	—	—	—	65	—	5	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
11	55	—	—	—	—	—	72	—	7	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
12	60	—	—	—	—	—	78	—	7	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
13	65	—	—	—	—	—	85	—	7	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
14	70	—	—	—	—	—	90	—	8	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
15	75	—	—	—	—	—	95	—	8	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
16	80	—	—	—	—	—	100	—	8	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
17	85	—	—	—	—	—	110	—	9	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
18	90	—	—	—	—	—	115	—	9	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
19	95	—	—	—	—	—	120	—	9	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
20	100	—	—	—	—	—	125	—	9	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
21	105	—	—	—	—	—	130	—	9	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
22	110	—	—	—	—	—	140	—	10	—	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
24	120	—	—	—	—	—	150	—	10	—	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
26	130	—	—	—	—	—	165	—	11	—	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
28	140	—	—	—	—	—	175	—	11	—	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
30	150	—	—	—	—	—	190	—	13	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
32	160	—	—	—	—	—	200	—	13	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
34	170	—	—	—	—	—	215	—	14	—	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
36	180	—	—	—	—	—	225	—	14	—	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
38	190	—	—	—	—	—	240	—	16	—	24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
40	200	—	—	—	—	—	250	—	16	—	24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
44	220	—	—	—	—	—	270	—	16	—	24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
48	240	—	—	—	—	—	300	—	19	—	28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
52	260	—	—	—	—	—	320																												



**Table 2: Comparison of SI, CGS and gravity units-1**

Unit system	Length <i>L</i>	Mass <i>M</i>	Time <i>T</i>	Acceleration	Force	Stress	Pressure	Energy
SI	m	kg	s	m/s <sup>2</sup>	N	Pa	Pa	J
CGS system	cm	g	s	Gal	dyn	dyn/cm <sup>2</sup>	dyn/cm <sup>2</sup>	erg
Gravitation system	m	kgf · s <sup>2</sup> /m	s	m/s <sup>2</sup>	kgf	kgf/m <sup>2</sup>	kgf/m <sup>2</sup>	kgf · m

**Table 3: SI-customary unit conversion table-1**

Quantity	Unit designation	Symbol	Conversion rate to SI	SI unit designation	Symbol
Angle	Degree	°	$\pi/180$	Radian	rad
	Minute	'	$\pi/10\ 800$		
	Second	" (sec)	$\pi/648\ 000$		
Length	Meter	m	1	Meter	m
	Micron	$\mu$	$10^{-6}$		
	Angstrom	Å	$10^{-10}$		
Area	Square meter	m <sup>2</sup>	1	Square meter	m <sup>2</sup>
	Are	a	$10^2$		
	Hectare	ha	$10^4$		
Volume	Cubic meter	m <sup>3</sup>	1	Cubic meter	m <sup>3</sup>
	Liter	R.L	$10^{-3}$		
Mass	Kilogram	kg	1	Kilogram	kg
	Ton	t	$10^3$		
	Kilogram force / square second per meter	kgf · s <sup>2</sup> /m	9.806 65		
Time	Second	s	1	Second	s
	Minute	min	60		
	Hour	h	3 600		
	Day	d	86 400		
Speed	Meters per second	m/s	1	Meters per second	m/s
	Knot	kn	1 852/3 600		
Frequency and vibration	Cycle	s <sup>-1</sup> (pps)	1	Hertz	Hz
Revolutions (rotational speed)	Revolutions per minute (rpm)	rpm [min <sup>-1</sup> ]	1/60	Per second	s <sup>-1</sup>
Angular speed	Radians per second	rad/s	1	Radians per second	rad/s
Acceleration	Meters per square second	m/s <sup>2</sup>	1	Meters per second square	m/s <sup>2</sup>
	G	G	9.806 65		
Force	Kilogram force	kgf	9.806 65	Newton	N
	Ton force	tf	9 806.65		
	Dyne	dyn	$10^{-5}$		
Force moment	Kilogram force / meter	kgf · m	9.806 65	Newton meter	N · m
Inertia moment	Kilogram force / meter / square second	kgf · m · s <sup>2</sup>	9.806 65	Kilogram / square meter	kg · m <sup>2</sup>
Stress	Kilogram force per square meter	kgf/m <sup>2</sup>	9.806 65	Pascal or newton per square meter	Pa or N/m <sup>2</sup>
Pressure	Kilogram force per square meter	kgf/m <sup>2</sup>	9.806 65	Pascal	Pa
	Meter water column	mH <sub>2</sub> O	9 806.65		
	Meter of mercury	mHg	101 325/0.76		
	Torr	Torr	101 325/760		
	Atmosphere	atm	101 325		
	Bar	bar	$10^5$		
Energy	Erg	erg	$10^{-7}$	Joule	J
	IT calorie	cal <sub>IT</sub>	4.186 8		
	Kilogram force / meter	kgf · m	9.806 65		
	Kilowatt hour	kW · h	$3.600 \times 10^6$		
	Metric horsepower per hour	PS · h	$2.647\ 79 \times 10^6$		
Power rate and power	Watt	W	1	Watt	W
	Metric horsepower	PS	735.5		
	Kilogram force / meter per second	kgf · m/s	9.806 65		

**Table 2: Comparison of SI, CGS and gravity units-2**

Unit system \ Quantity	Power rate	Temperature	Viscosity	Dynamic viscosity	Magnetic flux	Flux density	Magnetic field strength
SI	W	K	Pa · s	m <sup>2</sup> /s	Wb	T	A/m
CGS system	erg/s	°C	P	St	Mx	Gs	Oe
Gravitation system	kgf · m/s	°C	kgf · s/m <sup>2</sup>	m <sup>2</sup> /s	—	—	—

**Table 3: SI-customary unit conversion table-2**

Quantity	Unit designation	Symbol	Conversion rate to SI	SI unit designation	Symbol
Viscosity	Poise	P	10 <sup>-1</sup>	Pascal second	Pa · s
	Centipoise	cP	10 <sup>-3</sup>		
	Kilogram force / square second per meter	kgf · s/m <sup>2</sup>	9.806 65		
Dynamic viscosity	Stokes	St	10 <sup>-4</sup>	Square meter per second	m <sup>2</sup> /s
	Centistokes	cSt	10 <sup>-6</sup>		
Temperature	Degree	°C	+273.15	Kelvin	K
Radioactive Dosage	Curie	Ci	3.7 × 10 <sup>10</sup>	Becquerel	Bq
	Roentgen	R	2.58 × 10 <sup>-4</sup>	Coulombs per kilogram	C/kg
Absorption dosage	Rad	rad	10 <sup>-2</sup>	Gray	Gy
Dosage equivalent	Rem	rem	10 <sup>-2</sup>	Sievert	Sv
Magnetic flux	Maxwell	Mx	10 <sup>-8</sup>	Weber	Wb
Flux density	Gamma	γ	10 <sup>-9</sup>	Tesla	T
	Gauss	Gs	10 <sup>-4</sup>		
Magnetic field strength	Oersted	Oe	10 <sup>3</sup> /4 π	Amperes per meter	A/m
Quantity of electricity	Coulomb	C	1	Coulomb	C
Potential difference	Volt	V	1	Volt	V
Electric resistance	Ohm	Ω	1	Ohm	Ω
Current	Ampere	A	1	Ampere	A

**Table 4: Tenth power multiples of SI unit**

Multiples of unit	Prefix		Multiples of unit	Prefix	
	Name	Symbol		Name	Symbol
10 <sup>18</sup>	Exa	E	10 <sup>-1</sup>	Deci	d
10 <sup>15</sup>	Peta	P	10 <sup>-2</sup>	Centi	c
10 <sup>12</sup>	Tera	T	10 <sup>-3</sup>	Mili	m
10 <sup>9</sup>	Giga	G	10 <sup>-6</sup>	Micro	μ
10 <sup>6</sup>	Mega	M	10 <sup>-9</sup>	Nano	n
10 <sup>3</sup>	Kilo	k	10 <sup>-12</sup>	Pico	p
10 <sup>2</sup>	Hecto	h	10 <sup>-15</sup>	Femto	f
10	Deca	da	10 <sup>-18</sup>	Ato	a

Table 5: Dimensional tolerance for shafts

Diameter division mm		a13		c12		d6		e6		e13		f5		f6		g5		g6	
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
3	6	-270	-450	-70	-190	-30	-38	-20	-28	-20	-200	-10	-15	-10	-18	-4	-9	-4	-12
6	10	-280	-500	-80	-230	-40	-49	-25	-34	-25	-245	-13	-19	-13	-22	-5	-11	-5	-14
10	18	-290	-560	-95	-275	-50	-61	-32	-43	-32	-302	-16	-24	-16	-27	-6	-14	-6	-17
18	30	-300	-630	-110	-320	-65	-78	-40	-53	-40	-370	-20	-29	-20	-33	-7	-16	-7	-20
30	40	-310	-700	-120	-370	-80	-96	-50	-66	-50	-440	-25	-36	-25	-41	-9	-20	-9	-25
40	50	-320	-710	-130	-380														
50	65	-340	-800	-140	-440	-100	-119	-60	-79	-60	-520	-30	-43	-30	-49	-10	-23	-10	-29
65	80	-360	-820	-150	-450														
80	100	-380	-920	-170	-520	-120	-142	-72	-94	-72	-612	-36	-51	-36	-58	-12	-27	-12	-34
100	120	-410	-950	-180	-530														
120	140	-460	-1 090	-200	-600	-145	-170	-85	-110	-85	-715	-43	-61	-43	-68	-14	-32	-14	-39
140	160	-520	-1 150	-210	-610														
160	180	-580	-1 210	-230	-630														
180	200	-660	-1 380	-240	-700														
200	225	-740	-1 460	-260	-720	-170	-199	-100	-129	-100	-820	-50	-70	-50	-79	-15	-35	-15	-44
225	250	-820	-1 540	-280	-740														
250	280	-920	-1 730	-300	-820	-190	-222	-110	-142	-110	-920	-56	-79	-56	-88	-17	-40	-17	-49
280	315	-1 050	-1 860	-330	-850														
315	355	-1 200	-2 090	-360	-930	-210	-246	-125	-161	-125	-1 015	-62	-87	-62	-98	-18	-43	-18	-54
355	400	-1 350	-2 240	-400	-970														
400	450	-1 500	-2 470	-440	-1 070	-230	-270	-135	-175	-135	-1 105	-68	-95	-68	-108	-20	-47	-20	-60
450	500	-1 650	-2 620	-480	-1 110														
500	560	-	-	-	-	-260	-304	-145	-189	-	-	-	-	-76	-120	-	-	-22	-66
560	630	-	-	-	-														
630	710	-	-	-	-	-290	-340	-160	-210	-	-	-	-	-80	-130	-	-	-24	-74
710	800	-	-	-	-														
800	900	-	-	-	-	-320	-376	-170	-226	-	-	-	-	-86	-142	-	-	-26	-82
900	1 000	-	-	-	-														
1 000	1 120	-	-	-	-	-350	-416	-195	-261	-	-	-	-	-98	-164	-	-	-28	-94
1 120	1 250	-	-	-	-														
1 250	1 400	-	-	-	-	-390	-468	-220	-298	-	-	-	-	-110	-188	-	-	-30	-108
1 400	1 600	-	-	-	-														

Diameter division mm		j5		js5		j6		js6		j7		k4		k5		k6		m5	
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
3	6	+3	-2	+2.5	-2.5	+6	-2	+4	-4	+8	-4	+5	+1	+6	+1	+9	+1	+9	+4
6	10	+4	-2	+3	-3	+7	-2	+4.5	-4.5	+10	-5	+5	+1	+7	+1	+10	+1	+12	+6
10	18	+5	-3	+4	-4	+8	-3	+5.5	-5.5	+12	-6	+6	+1	+9	+1	+12	+1	+15	+7
18	30	+5	-4	+4.5	-4.5	+9	-4	+6.5	-6.5	+13	-8	+8	+2	+11	+2	+15	+2	+17	+8
30	40																		
40	50	+6	-5	+5.5	-5.5	+11	-5	+8	-8	+15	-10	+9	+2	+13	+2	+18	+2	+20	+9
50	65																		
65	80	+6	-7	+6.5	-6.5	+12	-7	+9.5	-9.5	+18	-12	+10	+2	+15	+2	+21	+2	+24	+11
80	100																		
100	120	+6	-9	+7.5	-7.5	+13	-9	+11	-11	+20	-15	+13	+3	+18	+3	+25	+3	+28	+13
120	140																		
140	160	+7	-11	+9	-9	+14	-11	+12.5	-12.5	+22	-18	+15	+3	+21	+3	+28	+3	+33	+15
160	180																		
180	200																		
200	225	+7	-13	+10	-10	+16	-13	+14.5	-14.5	+25	-21	+18	+4	+24	+4	+33	+4	+37	+17
225	250																		
250	280	+7	-16	+11.5	-11.5	+16	-16	+16	-16	+26	-26	+20	+4	+27	+4	+36	+4	+43	+20
280	315																		
315	355	+7	-18	+12.5	-12.5	+18	-18	+18	-18	+29	-28	+22	+4	+29	+4	+40	+4	+46	+21
355	400																		
400	450	+7	-20	+13.5	-13.5	+20	-20	+20	-20	+31	-32	+25	+5	+32	+5	+45	+5	+50	+23
450	500																		
500	560	-	-	-	-	-	-	+22	-22	-	-	-	-	-	-	+44	0	-	-
560	630	-	-	-	-	-	-												
630	710	-	-	-	-	-	-	+25	-25	-	-	-	-	-	-	+50	0	-	-
710	800	-	-	-	-	-	-												
800	900	-	-	-	-	-	-	+28	-28	-	-	-	-	-	-	+56	0	-	-
900	1 000	-	-	-	-	-	-												
1 000	1 120	-	-	-	-	-	-	+33	-33	-	-	-	-	-	-	+66	0	-	-
1 120	1 250	-	-	-	-	-	-												
1 250	1 400	-	-	-	-	-	-	+39	-39	-	-	-	-	-	-	+78	0	-	-
1 400	1 600	-	-	-	-	-	-												

Unit  $\mu\text{m}$

h4		h5		h6		h7		h8		h9		h10		h11		h13		js4		Diameter division mm	
high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	over	incl.
0	-4	0	-5	0	-8	0	-12	0	-18	0	-30	0	-48	0	-75	0	-180	+2	-2	3	6
0	-4	0	-6	0	-9	0	-15	0	-22	0	-36	0	-58	0	-90	0	-220	+2	-2	6	10
0	-5	0	-8	0	-11	0	-18	0	-27	0	-43	0	-70	0	-110	0	-270	+2.5	-2.5	10	18
0	-6	0	-9	0	-13	0	-21	0	-33	0	-52	0	-84	0	-130	0	-330	+3	-3	18	30
0	-7	0	-11	0	-16	0	-25	0	-39	0	-62	0	-100	0	-160	0	-390	+3.5	-3.5	30	40
																				40	50
0	-8	0	-13	0	-19	0	-30	0	-46	0	-74	0	-120	0	-190	0	-460	+4	-4	50	65
																				65	80
0	-10	0	-15	0	-22	0	-35	0	-54	0	-87	0	-140	0	-220	0	-540	+5	-5	80	100
																				100	120
0	-12	0	-18	0	-25	0	-40	0	-63	0	-100	0	-160	0	-250	0	-630	+6	-6	120	140
																				140	160
																				160	180
0	-14	0	-20	0	-29	0	-46	0	-72	0	-115	0	-185	0	-290	0	-720	+7	-7	180	200
																				200	225
																				225	250
0	-16	0	-23	0	-32	0	-52	0	-81	0	-130	0	-210	0	-320	0	-810	+8	-8	250	280
																				280	315
0	-18	0	-25	0	-36	0	-57	0	-89	0	-140	0	-230	0	-360	0	-890	+9	-9	315	355
																				355	400
0	-20	0	-27	0	-40	0	-63	0	-97	0	-155	0	-250	0	-400	0	-970	+10	-10	400	450
																				450	500
-	-	-	-	0	-44	0	-70	0	-110	0	-175	0	-280	0	-440	0	-	-	-	500	560
																				560	630
-	-	-	-	0	-50	0	-80	0	-125	0	-200	0	-320	0	-500	0	-	-	-	630	710
																				710	800
-	-	-	-	0	-56	0	-90	0	-140	0	-230	0	-360	0	-560	0	-	-	-	800	900
																				900	1 000
-	-	-	-	0	-66	0	-105	0	-165	0	-260	0	-420	0	-660	0	-	-	-	1 000	1 120
																				1 120	1 250
-	-	-	-	0	-78	0	-125	0	-195	0	-310	0	-500	0	-780	0	-	-	-	1 250	1 400
																				1 400	1 600

Unit  $\mu\text{m}$

m6		n5		n6		p5		p6		r6		r7		Basic tolerance				Diameter division mm	
high	low	high	low	high	low	high	low	high	low	high	low	high	low	IT2	IT3	IT5	IT7	over	incl.
+12	+4	+13	+8	+16	+8	+17	+12	+20	+12	+23	+15	+27	+15	1.5	2.5	5	12	3	6
+15	+6	+16	+10	+19	+10	+21	+15	+24	+15	+28	+19	+34	+19	1.5	2.5	6	15	6	10
+18	+7	+20	+12	+23	+12	+26	+18	+29	+18	+34	+23	+41	+23	2	3	8	18	10	18
+21	+8	+24	+15	+28	+15	+31	+22	+35	+22	+41	+28	+49	+28	2.5	4	9	21	18	30
+25	+9	+28	+17	+33	+17	+37	+26	+42	+26	+50	+34	+59	+34	2.5	4	11	25	30	40
																		40	50
+30	+11	+33	+20	+39	+20	+45	+32	+51	+32	+60	+41	+71	+41	3	5	13	30	50	65
																		65	80
+35	+13	+38	+23	+45	+23	+52	+37	+59	+37	+73	+51	+86	+51	4	6	15	35	80	100
																		100	120
+40	+15	+45	+27	+52	+27	+61	+43	+68	+43	+88	+63	+103	+63	5	8	18	40	120	140
																		140	160
																		160	180
+46	+17	+51	+31	+60	+31	+70	+50	+79	+50	+106	+77	+123	+77	7	10	20	46	180	200
																		200	225
																		225	250
+52	+20	+57	+34	+66	+34	+79	+56	+88	+56	+126	+94	+146	+94	8	12	23	52	250	280
																		280	315
+57	+21	+62	+37	+73	+37	+87	+62	+98	+62	+144	+108	+165	+108	9	13	25	57	315	355
																		355	400
+63	+23	+67	+40	+80	+40	+95	+68	+108	+68	+166	+126	+189	+126	10	15	27	63	400	450
																		450	500
+70	+26	-	-	+88	+44	-	-	+122	+78	+194	+150	+220	+150	-	-	-	70	500	560
																		560	630
+80	+30	-	-	+100	+50	-	-	+138	+88	+225	+175	+255	+175	-	-	-	80	630	710
																		710	800
+90	+34	-	-	+112	+56	-	-	+156	+100	+235	+185	+265	+185	-	-	-	90	800	900
																		900	1 000
+106	+40	-	-	+132	+66	-	-	+186	+120	+266	+210	+300	+210	-	-	-	105	1 000	1 120
																		1 120	1 250
+126	+48	-	-	+156	+78	-	-	+218	+140	+316	+250	+355	+250	-	-	-	125	1 250	1 400
																		1 400	1 600

Table 6: Dimensional tolerance for housing bore

Diameter division mm		E7		E10		E11		E12		F6		F7		F8		G6		G7		H6	
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
3	6	+32	+20	+68	+20	+95	+20	+140	+20	+18	+10	+22	+10	+28	+10	+12	+4	+16	+4	+8	0
6	10	+40	+25	+83	+25	+115	+25	+175	+25	+22	+13	+28	+13	+35	+13	+14	+5	+20	+5	+9	0
10	18	+50	+32	+102	+32	+142	+32	+212	+32	+27	+16	+34	+16	+43	+16	+17	+6	+24	+6	+11	0
18	30	+61	+40	+124	+40	+170	+40	+250	+40	+33	+20	+41	+20	+53	+20	+20	+7	+28	+7	+13	0
30	40	+75	+50	+150	+50	+210	+50	+300	+50	+41	+25	+50	+25	+64	+25	+25	+9	+34	+9	+16	0
40	50																				
50	65	+90	+60	+180	+60	+250	+60	+360	+60	+49	+30	+60	+30	+76	+30	+29	+10	+40	+10	+19	0
65	80																				
80	100	+107	+72	+212	+72	+292	+72	+422	+72	+58	+36	+71	+36	+90	+36	+34	+12	+47	+12	+22	0
100	120																				
120	140	+125	+85	+245	+85	+335	+85	+485	+85	+68	+43	+83	+43	+106	+43	+39	+14	+54	+14	+25	0
140	160																				
160	180																				
180	200	+146	+100	+285	+100	+390	+100	+560	+100	+79	+50	+96	+50	+122	+50	+44	+15	+61	+15	+29	0
200	225																				
225	250																				
250	280	+162	+110	+320	+110	+430	+110	+630	+110	+88	+56	+108	+56	+137	+56	+49	+17	+69	+17	+32	0
280	315																				
315	355	+182	+125	+355	+125	+485	+125	+695	+125	+98	+62	+119	+62	+151	+62	+54	+18	+75	+18	+36	0
355	400																				
400	450	+198	+135	+385	+135	+535	+135	+765	+135	+108	+68	+131	+68	+165	+68	+60	+20	+83	+20	+40	0
450	500																				
500	560	+215	+145	-	-	-	-	-	-	+120	+76	+146	+76	+186	+76	+66	+22	+92	+22	+44	0
560	630																				
630	710	+240	+160	-	-	-	-	-	-	+130	+80	+160	+80	+205	+80	+74	+24	+104	+24	+50	0
710	800																				
800	900	+260	+170	-	-	-	-	-	-	+142	+86	+176	+86	+226	+86	+82	+26	+116	+26	+56	0
900	1000																				
1000	1120	+300	+195	-	-	-	-	-	-	+164	+98	+203	+98	+263	+98	+94	+28	+133	+28	+66	0
1120	1250																				
1250	1400	+345	+220	-	-	-	-	-	-	+188	+110	+235	+110	+305	+110	+108	+30	+155	+30	+78	0
1400	1600																				
1600	1800	+390	+240	-	-	-	-	-	-	+212	+120	+270	+120	+350	+120	+124	+32	+182	+32	+92	0
1800	2000																				

Unit μm

Diameter division mm		K6		K7		M6		M7		N6		N7		P6		P7		R6		R7	
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
3	6	+2	-6	+3	-9	-1	-9	0	-12	-5	-13	-4	-16	-9	-17	-8	-20	-12	-20	-11	-23
6	10	+2	-7	+5	-10	-3	-12	0	-15	-7	-16	-4	-19	-12	-21	-9	-24	-16	-25	-13	-28
10	18	+2	-9	+6	-12	-4	-15	0	-18	-9	-20	-5	-23	-15	-26	-11	-29	-20	-31	-16	-34
18	30	+2	-11	+6	-15	-4	-17	0	-21	-11	-24	-7	-28	-18	-31	-14	-35	-24	-37	-20	-41
30	40	+3	-13	+7	-18	-4	-20	0	-25	-12	-28	-8	-33	-21	-37	-17	-42	-29	-42	-25	-50
40	50																				
50	65	+4	-15	+9	-21	-5	-24	0	-30	-14	-33	-9	-39	-26	-45	-21	-51	-35	-54	-30	-60
65	80																				
80	100	+4	-18	+10	-25	-6	-28	0	-35	-16	-38	-10	-45	-30	-52	-24	-59	-44	-66	-38	-73
100	120																				
120	140	+4	-21	+12	-28	-8	-33	0	-40	-20	-45	-12	-52	-36	-61	-28	-68	-56	-81	-48	-88
140	160																				
160	180																				
180	200	+5	-24	+13	-33	-8	-37	0	-46	-22	-51	-14	-60	-41	-70	-33	-79	-71	-100	-63	-109
200	225																				
225	250																				
250	280	+5	-27	+16	-36	-9	-41	0	-52	-25	-57	-14	-66	-47	-79	-36	-88	-85	-117	-74	-126
280	315																				
315	355	+7	-29	+17	-40	-10	-46	0	-57	-26	-62	-16	-73	-51	-87	-41	-98	-97	-133	-87	-144
355	400																				
400	450	+8	-32	+18	-45	-10	-50	0	-63	-27	-67	-17	-80	-55	-95	-45	-108	-113	-153	-103	-166
450	500																				
500	560	0	-44	0	-70	-26	-70	-26	-96	-44	-88	-44	-114	-78	-122	-78	-148	-150	-194	-150	-220
560	630																				
630	710	0	-50	0	-80	-30	-80	-30	-100	-50	-100	-50	-130	-88	-138	-88	-168	-175	-225	-175	-225
710	800																				
800	900	0	-56	0	-90	-34	-90	-34	-124	-56	-112	-56	-146	-100	-156	-100	-190	-210	-266	-210	-300
900	1000																				
1000	1120	0	-66	0	-105	-40	-106	-40	-145	-66	-132	-66	-171	-120	-186	-120	-225	-250	-316	-250	-355
1120	1250																				
1250	1400	0	-78	0	-125	-48	-126	-48	-173	-78	-156	-78	-203	-140	-213	-140	-265	-300	-378	-300	-425
1400	1600																				
1600	1800	0	-92	0	-150	-58	-150	-58	-208	-92	-184	-92	-242	-170	-262	-170	-320	-370	-462	-370	-520
1800	2000																				

Unit  $\mu\text{m}$

H7	H8	H9	H10	H11	H13	J6	Js6		J7	Js7		K5	Diameter division mm	
							high	low		high	low		over	incl.
+ 12 0	+ 18 0	+ 30 0	+ 48 0	+ 75 0	+180 0	+ 5 -3	+ 4 - 4	+ 6 - 6	+ 6 - 6	+ 6 - 6	0 - 5	3	6	
+ 15 0	+ 22 0	+ 36 0	+ 58 0	+ 90 0	+220 0	+ 5 -4	+ 4.5 - 4.5	+ 8 - 7	+ 7.5 - 7.5	+ 1 - 5	+1 - 5	6	10	
+ 18 0	+ 27 0	+ 43 0	+ 70 0	+110 0	+270 0	+ 6 -5	+ 5.5 - 5.5	+10 - 8	+ 9 - 9	+2 - 6	+2 - 6	10	18	
+ 21 0	+ 33 0	+ 52 0	+ 84 0	+130 0	+330 0	+ 8 -5	+ 6.5 - 6.5	+12 - 9	+10.5 -10.5	+1 - 8	+1 - 8	18	30	
+ 25 0	+ 39 0	+ 62 0	+100 0	+160 0	+390 0	+10 -6	+ 8 - 8	+14 -11	+12.5 -12.5	+2 - 9	+2 - 9	30	40	
												40	50	
+ 30 0	+ 46 0	+ 74 0	+120 0	+190 0	+460 0	+13 -6	+ 9.5 - 9.5	+18 -12	+15 -15	+3 -10	+3 -10	50	65	
												65	80	
+ 35 0	+ 54 0	+ 87 0	+140 0	+220 0	+540 0	+16 -6	+11 -11	+22 -13	+17.5 -17.5	+2 -13	+2 -13	80	100	
												100	120	
+ 40 0	+ 63 0	+100 0	+160 0	+250 0	+630 0	+18 -7	+12.5 -12.5	+26 -14	+20 -20	+3 -15	+3 -15	120	140	
												140	160	
												160	180	
+ 46 0	+ 72 0	+115 0	+185 0	+290 0	+720 0	+22 -7	+14.5 -14.5	+30 -16	+23 -23	+2 -18	+2 -18	180	200	
												200	225	
												225	250	
+ 52 0	+ 81 0	+130 0	+210 0	+320 0	+810 0	+25 -7	+16 -16	+36 -16	+26 -26	+3 -20	+3 -20	250	280	
												280	315	
+ 57 0	+ 89 0	+140 0	+230 0	+360 0	+890 0	+29 -7	+18 -18	+39 -18	+28.5 -28.5	+3 -22	+3 -22	315	355	
												355	400	
+ 63 0	+ 97 0	+155 0	+250 0	+400 0	+970 0	+33 -7	+20 -20	+43 -20	+31.5 -31.5	+2 -25	+2 -25	400	450	
												450	500	
+ 70 0	+110 0	+175 0	+280 0	+440 0	- 0	- -	+22 -22	- -	+35 -35	- -	- -	500	560	
												560	630	
+ 80 0	+125 0	+200 0	+320 0	+500 0	- 0	- -	+25 -25	- -	+40 -40	- -	- -	630	710	
												710	800	
+ 90 0	+140 0	+230 0	+360 0	+560 0	- 0	- -	+28 -28	- -	+45 -45	- -	- -	800	900	
												900	1 000	
+105 0	+165 0	+260 0	+420 0	+660 0	- 0	- -	+33 -33	- -	+52.5 -52.5	- -	- -	1 000	1 120	
												1 120	1 250	
+125 0	+195 0	+310 0	+500 0	+780 0	- 0	- -	+39 -39	- -	+62.5 -62.5	- -	- -	1 250	1 400	
												1 400	1 600	
+150 0	+230 0	+370 0	+600 0	+920 0	- 0	- -	+46 -46	- -	+75 -75	- -	- -	1 600	1 800	
												1 800	2 000	

Table 7: Basic tolerance

Unit  $\mu\text{m}$

Diameter division mm		IT basic tolerance class									
over	incl.	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10
—	3	0.8	1.2	2	3	4	6	10	14	25	40
3	6	1	1.5	2.5	4	5	8	12	18	30	48
6	10	1	1.5	2.5	4	6	9	15	22	36	58
10	18	1.2	2	3	5	8	11	18	27	43	70
18	30	1.5	2.5	4	6	9	13	21	33	52	84
30	50	1.5	2.5	4	7	11	16	25	39	62	100
50	80	2	3	5	8	13	19	30	46	74	120
80	120	2.5	4	6	10	15	22	35	54	87	140
120	180	3.5	5	8	12	18	25	40	63	100	160
180	250	4.5	7	10	14	20	29	46	72	115	185
250	315	6	8	12	16	23	32	52	81	130	210
315	400	7	9	13	18	25	36	57	89	140	230
400	500	8	10	15	20	27	40	63	97	155	250
500	630	9	11	16	22	30	44	70	110	175	280
630	800	10	13	18	25	35	50	80	125	200	320
800	1 000	11	15	21	29	40	56	90	140	230	360
1 000	1 250	13	18	24	34	46	66	105	165	260	420
1 250	1 600	15	21	29	40	54	78	125	195	310	500
1 600	2 000	18	25	35	48	65	92	150	230	370	600
2 000	2 500	22	30	41	57	77	110	175	280	440	700
2 500	3 150	26	36	50	69	93	135	210	330	540	860

Table 8: Viscosity conversion table

Kinematic viscosity mm <sup>2</sup> /s	Saybolt SUS (second)	Redwood R <sup>n</sup> (second)	Engler E (degree)
2.7	35	32.2	1.18
4.3	40	36.2	1.32
5.9	45	40.6	1.46
7.4	50	44.9	1.60
8.9	55	49.1	1.75
10.4	60	53.5	1.88
11.8	65	57.9	2.02
13.1	70	62.3	2.15
14.5	75	67.6	2.31
15.8	80	71.0	2.42
17.0	85	75.1	2.55
18.2	90	79.6	2.68
19.4	95	84.2	2.81
20.6	100	88.4	2.95
23.0	110	97.1	3.21
25.0	120	105.9	3.49
27.5	130	114.8	3.77
29.8	140	123.6	4.04
32.1	150	132.4	4.32
34.3	160	141.1	4.59
36.5	170	150.0	4.88
38.8	180	158.8	5.15
41.0	190	167.5	5.44
43.2	200	176.4	5.72
47.5	220	194.0	6.28
51.9	240	212	6.85
56.5	260	229	7.38
60.5	280	247	7.95
64.9	300	265	8.51
70.3	325	287	9.24
75.8	350	309	9.95
81.2	375	331	10.7
86.8	400	353	11.4
92.0	425	375	12.1
97.4	450	397	12.8

Kinematic viscosity mm <sup>2</sup> /s	Saybolt SUS (second)	Redwood R <sup>n</sup> (second)	Engler E (degree)
103	475	419	13.5
108	500	441	14.2
119	550	485	15.6
130	600	529	17.0
141	650	573	18.5
152	700	617	19.9
163	750	661	21.3
173	800	705	22.7
184	850	749	24.2
195	900	793	25.6
206	950	837	27.0
217	1 000	882	28.4
260	1 200	1 058	34.1
302	1 400	1 234	39.8
347	1 600	1 411	45.5
390	1 800	1 587	51
433	2 000	1 763	57
542	2 500	2 204	71
650	3 000	2 646	85
758	3 500	3 087	99
867	4 000	3 526	114
974	4 500	3 967	128
1 082	5 000	4 408	142
1 150	5 500	4 849	156
1 300	6 000	5 290	170
1 400	6 500	5 730	185
1 510	7 000	6 171	199
1 630	7 500	6 612	213
1 740	8 000	7 053	227
1 850	8 500	7 494	242
1 960	9 000	7 934	256
2 070	9 500	8 375	270
2 200	10 000	8 816	284

**Table 9: Kgf to N conversion table**

kgf		N	kgf		N	kgf		N
0.1020	<b>1</b>	9.8066	3.4670	<b>34</b>	333.43	6.8321	<b>67</b>	657.04
0.2039	<b>2</b>	19.613	3.5690	<b>35</b>	343.23	6.9341	<b>68</b>	666.85
0.3059	<b>3</b>	29.420	3.6710	<b>36</b>	353.04	7.0361	<b>69</b>	676.66
0.4079	<b>4</b>	39.227	3.7730	<b>37</b>	362.85	7.1380	<b>70</b>	686.46
0.5099	<b>5</b>	49.033	3.8749	<b>38</b>	372.65	7.2400	<b>71</b>	696.27
0.6118	<b>6</b>	58.840	3.9769	<b>39</b>	382.46	7.3420	<b>72</b>	706.08
0.7138	<b>7</b>	68.646	4.0789	<b>40</b>	392.27	7.4440	<b>73</b>	715.88
0.8158	<b>8</b>	78.453	4.1808	<b>41</b>	402.07	7.5459	<b>74</b>	725.69
0.9177	<b>9</b>	88.260	4.2828	<b>42</b>	411.88	7.6479	<b>75</b>	735.50
1.0197	<b>10</b>	98.066	4.3848	<b>43</b>	421.68	7.7499	<b>76</b>	745.30
1.1217	<b>11</b>	107.87	4.4868	<b>44</b>	431.49	7.8518	<b>77</b>	755.11
1.2237	<b>12</b>	117.68	4.5887	<b>45</b>	441.30	7.9538	<b>78</b>	764.92
1.3256	<b>13</b>	127.49	4.6907	<b>46</b>	451.10	8.0558	<b>79</b>	774.72
1.4276	<b>14</b>	137.29	4.7927	<b>47</b>	460.91	8.1578	<b>80</b>	784.53
1.5296	<b>15</b>	147.10	4.8946	<b>48</b>	470.72	8.2597	<b>81</b>	794.34
1.6316	<b>16</b>	156.91	4.9966	<b>49</b>	480.52	8.3617	<b>82</b>	804.14
1.7335	<b>17</b>	166.71	5.0986	<b>50</b>	490.33	8.4637	<b>83</b>	813.95
1.8355	<b>18</b>	176.52	5.2006	<b>51</b>	500.14	8.5656	<b>84</b>	823.76
1.9375	<b>19</b>	186.33	5.3025	<b>52</b>	509.94	8.6676	<b>85</b>	833.56
2.0394	<b>20</b>	196.13	5.4045	<b>53</b>	519.75	8.7696	<b>86</b>	843.37
2.1414	<b>21</b>	205.94	5.5065	<b>54</b>	529.56	8.8716	<b>87</b>	853.18
2.2434	<b>22</b>	215.75	5.6085	<b>55</b>	539.36	8.9735	<b>88</b>	862.98
2.3454	<b>23</b>	225.55	5.7104	<b>56</b>	549.17	9.0755	<b>89</b>	872.79
2.4473	<b>24</b>	235.36	5.8124	<b>57</b>	558.98	9.1775	<b>90</b>	882.60
2.5493	<b>25</b>	245.17	5.9144	<b>58</b>	568.78	9.2794	<b>91</b>	892.40
2.6513	<b>26</b>	254.97	6.0163	<b>59</b>	578.59	9.3814	<b>92</b>	902.21
2.7532	<b>27</b>	264.78	6.1183	<b>60</b>	588.40	9.4834	<b>93</b>	912.02
2.8552	<b>28</b>	274.59	6.2203	<b>61</b>	598.20	9.5854	<b>94</b>	921.82
2.9572	<b>29</b>	284.39	6.3223	<b>62</b>	608.01	9.6873	<b>95</b>	931.63
3.0592	<b>30</b>	294.20	6.4242	<b>63</b>	617.82	9.7893	<b>96</b>	941.44
3.1611	<b>31</b>	304.01	6.5262	<b>64</b>	627.62	9.8913	<b>97</b>	951.24
3.2631	<b>32</b>	313.81	6.6282	<b>65</b>	637.43	9.9932	<b>98</b>	961.05
3.3651	<b>33</b>	323.62	6.7302	<b>66</b>	647.24	10.0952	<b>99</b>	970.86

(How to read the table) If for example you want to convert 10 kgf to N, find "10" in the middle column of the first set of columns on the right. Look in the N column directly to the right of "10," and you will see that 10 kgf equals 98.066 N. Oppositely, to convert 10 N to kgf, look in the kgf column to the right of "10" and you will see that 10 N equals 1.0197 kgf.

1kgf=9.80665N  
1N=0.101972kgf

Table 10: Inch-millimetre conversion table

inch		0"	1"	2"	3"	4"	5"	6"	7"	8"	9"
fraction	decimal										
1/64	0.015625	0.397	25.400	50.800	76.200	101.600	127.000	152.400	177.800	203.200	228.600
1/32	0.031250	0.794	25.797	51.197	76.597	101.997	127.397	152.797	178.197	203.597	229.000
3/64	0.046875	1.191	26.194	51.594	76.994	102.394	127.794	153.194	178.594	203.994	229.394
1/16	0.062500	1.588	26.591	51.991	77.391	102.791	128.191	153.591	178.991	204.391	229.791
5/64	0.078125	1.984	26.988	52.388	77.788	103.188	128.588	153.988	179.388	204.788	230.188
3/32	0.093750	2.381	27.384	52.784	78.184	103.584	128.984	154.384	179.784	205.184	230.584
7/64	0.109375	2.778	27.781	53.181	78.581	103.981	129.381	154.781	180.181	205.581	230.981
1/8	0.125000	3.175	28.178	53.578	78.978	104.378	129.778	155.178	180.578	205.978	231.378
9/64	0.140625	3.572	28.575	53.975	79.375	104.775	130.175	155.575	180.975	206.375	231.775
5/32	0.156250	3.969	28.972	54.372	79.772	105.172	130.572	155.972	181.372	206.772	232.172
11/64	0.171875	4.366	29.369	54.769	80.169	105.569	130.969	156.369	181.769	207.169	232.569
3/16	0.187500	4.762	29.766	55.166	80.566	105.966	131.366	156.766	182.166	207.566	232.966
13/64	0.203125	5.159	30.162	55.562	80.962	106.362	131.762	157.162	182.562	207.962	233.362
7/32	0.218750	5.556	30.559	55.959	81.359	106.759	132.159	157.559	182.959	208.359	233.759
15/64	0.234375	5.953	30.956	56.356	81.756	107.156	132.556	157.956	183.356	208.756	234.156
1/4	0.250000	6.350	31.353	56.753	82.153	107.553	132.953	158.353	183.753	209.153	234.553
17/64	0.265625	6.747	31.750	57.150	82.550	107.950	133.350	158.750	184.150	209.550	234.950
9/32	0.281250	7.144	31.547	57.547	82.947	108.347	133.747	159.147	184.547	209.947	235.347
19/64	0.296875	7.541	32.544	57.944	83.344	108.744	134.144	159.544	184.944	210.344	235.744
5/16	0.312500	7.938	32.941	58.341	83.741	109.141	134.541	159.941	185.341	210.741	236.141
21/64	0.328125	8.334	33.338	58.738	84.138	109.538	134.938	160.338	185.738	211.138	236.538
11/32	0.343750	8.731	33.734	59.134	84.534	109.934	135.334	160.734	186.134	211.534	236.934
23/64	0.359375	9.128	34.131	59.531	84.931	110.331	135.731	161.131	186.531	211.931	237.331
3/8	0.375000	9.525	34.528	59.928	85.328	110.728	136.128	161.528	186.928	212.328	237.728
25/64	0.390625	9.922	60.325	60.325	85.725	111.125	136.525	161.925	187.325	212.725	238.125
13/32	0.406250	10.319	60.722	60.722	86.122	111.522	136.922	162.322	187.722	213.122	238.522
27/64	0.421875	10.716	61.119	61.119	86.519	111.919	137.319	162.719	188.119	213.519	238.919
7/16	0.437500	11.112	61.516	61.516	86.916	112.316	137.716	163.116	188.516	213.916	239.316
29/64	0.453125	11.509	61.912	61.912	87.312	112.712	138.112	163.512	188.912	214.312	239.712
15/32	0.468750	11.906	62.309	62.309	87.709	113.109	138.509	163.909	189.309	214.709	240.109
31/64	0.484375	12.303	62.706	62.706	88.106	113.506	138.906	164.306	189.706	215.106	240.506
1/2	0.500000	12.700	63.103	63.103	88.503	113.903	139.303	164.703	190.103	215.503	240.903
33/64	0.515625	13.097	63.500	63.500	88.900	114.300	139.700	165.100	190.500	215.900	241.300
17/32	0.531250	13.494	63.897	63.897	89.297	114.697	140.097	165.497	190.897	216.297	241.697
35/64	0.546875	13.891	64.294	64.294	89.694	115.094	140.494	165.894	191.294	216.694	242.094
9/16	0.562500	14.288	64.691	64.691	90.091	115.491	140.891	166.291	191.691	217.091	242.491
37/64	0.578125	14.684	90.488	90.488	90.488	115.888	141.283	166.688	192.088	217.488	242.888
19/32	0.593750	15.081	90.884	90.884	90.884	116.284	141.684	167.084	192.484	217.884	243.284
39/64	0.609375	15.478	91.281	91.281	91.281	116.681	142.081	167.481	192.881	218.281	243.681
5/8	0.625000	15.875	91.678	91.678	91.678	117.078	142.478	167.878	193.278	218.678	244.078
41/64	0.640625	16.272	92.075	92.075	92.075	117.475	142.875	168.275	193.675	219.075	244.475
21/32	0.656250	16.669	92.472	92.472	92.472	117.872	143.272	168.672	194.072	219.472	244.872
43/64	0.671875	17.066	92.869	92.869	92.869	118.269	143.669	169.069	194.469	219.869	245.269
11/16	0.687500	17.462	93.266	93.266	93.266	118.666	144.066	169.466	194.866	220.266	245.666
45/64	0.703125	17.859	93.662	93.662	93.662	119.062	144.462	169.862	195.262	220.662	246.062
23/32	0.718750	18.256	94.059	94.059	94.059	119.459	144.859	170.259	195.659	221.056	246.459
47/64	0.734375	18.653	94.456	94.456	94.456	119.856	145.256	170.656	196.056	221.456	246.856
3/4	0.750000	19.050	94.853	94.853	94.853	120.253	145.653	171.053	196.453	221.853	247.253
49/64	0.765625	19.447	95.250	95.250	95.250	120.650	146.050	171.450	196.850	222.250	247.650
25/32	0.781250	19.844	95.647	95.647	95.647	121.047	146.447	171.847	197.247	222.647	248.047
51/64	0.796875	20.241	96.044	96.044	96.044	121.444	146.844	172.244	197.644	223.044	248.444
13/16	0.812500	20.638	96.441	96.441	96.441	121.841	147.241	172.641	198.041	223.441	248.841
53/64	0.828125	21.034	96.838	96.838	96.838	122.238	147.638	173.038	198.438	223.838	249.238
27/32	0.843750	21.431	97.234	97.234	97.234	122.634	148.034	173.434	198.834	224.234	249.634
55/64	0.859375	21.828	97.631	97.631	97.631	123.031	148.431	173.831	199.231	224.631	250.031
7/8	0.875000	22.225	98.028	98.028	98.028	123.428	148.828	174.228	199.628	225.028	250.428
57/64	0.890625	22.622	98.425	98.425	98.425	123.825	149.225	174.625	200.025	225.425	250.825
39/32	0.906250	23.019	98.822	98.822	98.822	124.222	149.622	175.022	200.422	225.822	251.222
59/64	0.921875	23.416	99.219	99.219	99.219	124.619	150.019	175.419	200.819	226.219	251.619
15/16	0.937500	23.812	99.616	99.616	99.616	125.016	150.416	175.816	201.216	226.616	252.016
61/64	0.953125	24.209	100.012	100.012	100.012	125.412	150.812	176.212	201.612	227.012	252.412
31/32	0.968750	24.606	100.409	100.409	100.409	125.809	151.209	176.609	202.009	227.409	252.809
63/64	0.984375	25.003	100.806	100.806	100.806	126.206	151.606	177.006	202.406	227.806	253.206
			101.203	101.203	101.203	126.603	152.003	177.403	202.803	228.203	253.603

Table 11: Hardness conversion table (reference)

Rockwell hardness C scale 1471.0N {150kgf}	Vicker's hardness	Brinell hardness		Rockwell hardness		Shore hardness
		Standard steel balls	Tungsten carbide steel balls	A scale 588.4N {60kgf}	B scale 980.7N {100kgf}	
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

Note 1: From hardness conversion table (SAE J417)

Table 12: Greek alphabet list

Upright	Italic		Reading
	Upper case	Lower case	
A	<i>A</i>	<i>α</i>	Alpha
B	<i>B</i>	<i>β</i>	Beta
Γ	<i>Γ</i>	<i>γ</i>	Gamma
Δ	<i>Δ</i>	<i>δ</i>	Delta
E	<i>E</i>	<i>ε</i>	Epsilon
Z	<i>Z</i>	<i>ζ</i>	Zeta
H	<i>H</i>	<i>η</i>	Eta
Θ	<i>Θ</i>	<i>θ</i>	Theta
I	<i>I</i>	<i>ι</i>	Iota
K	<i>K</i>	<i>κ</i>	Kappa
Λ	<i>Λ</i>	<i>λ</i>	Lambda
M	<i>M</i>	<i>μ</i>	Mu
N	<i>N</i>	<i>ν</i>	Nu
Ξ	<i>Ξ</i>	<i>ξ</i>	Xi
O	<i>O</i>	<i>ο</i>	Omicron
Π	<i>Π</i>	<i>π</i>	Pi
P	<i>P</i>	<i>ρ</i>	Rho
Σ	<i>Σ</i>	<i>σ</i>	Sigma
T	<i>T</i>	<i>τ</i>	Tau
Υ	<i>Υ</i>	<i>υ</i>	Upsilon
Φ	<i>Φ</i>	<i>φ</i>	Phi
X	<i>X</i>	<i>χ</i>	Chi
Ψ	<i>Ψ</i>	<i>ψ</i>	Psi
Ω	<i>Ω</i>	<i>ω</i>	Omega

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