

Metric Equivalents and Conversions

Equivalents: Inch, fraction, decimal, millimeter

INCHES	MILLIMETERS	INCHES	MILLIMETERS
1	25.4	34	863.6
2	50.8	35	889.0
3	76.2	36	914.4
4	101.6	37	939.8
5	127.0	38	965.2
6	152.4	39	990.6
7	177.8	40	1016.0
8	203.2	41	1041.4
9	228.6	42	1066.8
10	254.0	43	1092.2
11	279.4	44	1117.6
12	304.8	45	1143.0
13	330.2	46	1168.4
14	355.6	47	1193.8
15	381.0	48	1219.2
16	406.4	49	1244.6
17	431.8	50	1270.0
18	457.2	51	1295.4
19	482.6	52	1320.8
20	508.0	53	1346.2
21	533.4	54	1371.6
22	558.8	55	1397.0
23	584.2	56	1422.4
24	609.6	57	1447.8
25	635.0	58	1473.2
26	660.4	59	1498.6
27	685.8	60	1524.0
28	711.2	61	1549.4
29	736.6	62	1574.8
30	762.0	63	1600.2
31	787.4	64	1625.6
32	812.8	65	1651.0
33	838.2	66	1676.4

INCHES		MILLIMETERS	INCHES		MILLIMETERS
1/64	0.015625	0.396875	33/64	0.515625	13.096875
1/32	0.031250	0.793750	17/32	0.531250	13.493750
3/64	0.046875	1.190625	35/64	0.546875	13.890625
1/16	0.062500	1.587500	9/16	0.562500	14.287500
5/64	0.078125	1.984375	37/64	0.578125	14.684375
3/32	0.093750	2.381250	19/32	0.593750	15.081250
7/64	0.109375	2.778125	39/64	0.609375	15.478125
1/8	0.125000	3.175000	5/8	0.625000	15.875000
9/64	0.140625	3.571875	41/64	0.640625	16.271875
5/32	0.156250	3.968750	21/32	0.656250	16.668750
11/64	0.171875	4.365625	43/64	0.671875	17.065625
3/16	0.187500	4.762500	11/16	0.687500	17.462500
13/64	0.203125	5.159375	45/64	0.703125	17.859375
7/32	0.218750	5.556250	23/32	0.718750	18.256250
15/64	0.234375	5.953125	47/64	0.734375	18.653125
1/4	0.250000	6.350000	3/4	0.750000	19.050000
17/64	0.265625	6.746875	49/64	0.765625	19.446875
9/32	0.281250	7.143750	25/32	0.781250	19.843750
19/64	0.296875	7.540625	51/64	0.796875	20.240625
5/16	0.312500	7.937500	13/16	0.812500	20.637500
21/64	0.328125	8.334375	53/64	0.828125	21.034375
11/32	0.343750	8.731250	27/32	0.843750	21.431250
23/64	0.359375	9.128125	55/64	0.859375	21.828125
3/8	0.375000	9.525000	7/8	0.875000	22.225000
25/64	0.390625	9.921875	57/64	0.890625	22.621875
13/32	0.406250	10.318750	29/32	0.906250	23.018750
27/64	0.421875	10.715625	59/64	0.921875	23.415625
7/16	0.437500	11.112500	15/16	0.937500	23.812500
29/64	0.453125	11.509375	61/64	0.953125	24.209375
15/32	0.468750	11.906250	31/32	0.968750	24.606250
31/64	0.484375	12.303125	63/64	0.984375	25.003125
1/2	0.500000	12.700000	1	1.000000	25.400000

Equivalents: Decimal, millimeter

INCHES	MILLIMETERS	INCHES	MILLIMETERS	INCHES	MILLIMETERS
0.001	0.0254	0.01	0.254	0.1	2.54
0.002	0.0508	0.02	0.508	0.2	5.08
0.003	0.0762	0.03	0.762	0.3	7.62
0.004	0.1016	0.04	1.016	0.4	10.16
0.005	0.1270	0.05	1.270	0.5	12.70
0.006	0.1524	0.06	1.524	0.6	15.24
0.007	0.1778	0.07	1.778	0.7	17.78
0.008	0.2032	0.08	2.032	0.8	20.32
0.009	0.2286	0.09	2.286	0.9	22.86

Measurement conversions

MULTIPLY BY	FROM	TO	MULTIPLY BY
	← TO	← FROM	
0.03937	inch	millimeter	25.4
0.0016	inch ²	millimeter ²	645.16
0.061	inch ³	centimeter ³	16.3871
0.2642	gallon (U.S.)	liter	3.7854
0.03527	oz. (avdp.)	gram	28.3495
2.2044	pound	kilogram	0.4536
62.43	lbs/ft ³	g/cm ³	0.0160
0.145	psi	kPa	6.8948
14.2247	psi	kg/cm ²	0.0703
1.8°C + 32	°F	°C	(°F-32)/1.8

Tables for Determining Metric Tolerances

Table 6: Tolerances for Inside Dimensions (Holes)

Table 6 details tolerances for inside dimensions (holes) based relative to the tolerance symbol. Upper and lower values are provided as either positive or negative (or zero) values relative to the nominal size chosen. Pick the range in which the desired nominal value falls, and then either add or subtract the tolerances to find the upper and lower tolerance range for the desired nominal size.

UNITS IN mm		TOLERANCES FOR INSIDE DIMENSIONS (HOLES) (UNITS IN 0.001mm)																				
OVER	TO	A11	B8	B11	C11	D9	D10	D11	E8	E9	F6	F7	F8	G6	G7	H5	H6	H7	H8	H9	H10	
NOMINAL SIZE RANGE	0	1	—	—	—	+120	+45	+60	+80	+28	+39	+12	+16	+20	+8	+12	+4	+6	+10	+14	+25	+40
	1	3	+330 +270	+154 +140	+200 +140	+60	+20	+20	+20	+14	+14	+6	+6	+6	+2	+2	0	0	0	0	0	0
	3	6	+345 +270	+158 +140	+215 +140	+145 +70	+60 +30	+78 +30	+105 +30	+38 +20	+50 +20	+18 +10	+22 +10	+28 +10	+12 +4	+16 +4	+5 0	+8 0	+12 0	+18 0	+30 0	+48 0
	6	10	+370 +280	+172 +150	+240 +150	+170 +80	+76 +40	+98 +40	+130 +40	+47 +25	+61 +25	+22 +13	+28 +13	+35 +13	+14 +5	+20 +5	+6 0	+9 0	+15 0	+22 0	+36 0	+58 0
	10	14	+400 +290	+177 +150	+260 +150	+205 +95	+93 +50	+120 +50	+160 +50	+59 +32	+75 +32	+27 +16	+34 +16	+43 +16	+17 +6	+24 +6	+8 0	+11 0	+18 0	+27 0	+43 0	+70 0
	14	18																				
	18	24	+430 +300	+193 +160	+290 +160	+240 +110	+117 +65	+149 +65	+195 +65	+73 +40	+92 +40	+33 +20	+41 +20	+53 +20	+20 +7	+28 +7	+9 0	+13 0	+21 0	+33 0	+52 0	+84 0
	24	30																				
	30	40	+470 +310	+209 +170	+330 +170	+280 +120	+142 +80	+180 +80	+240 +80	+89 +50	+112 +50	+41 +25	+50 +25	+64 +25	+25 +9	+34 +9	+11 0	+16 0	+25 0	+39 0	+62 0	+100 0
	40	50	+480 +320	+219 +180	+340 +180	+290 +130																
	50	65	+530 +340	+236 +190	+380 +190	+330 +140	+174 +100	+220 +100	+290 +100	+106 +60	+134 +60	+49 +30	+60 +30	+76 +30	+29 +10	+40 +10	+13 0	+19 0	+30 0	+46 0	+74 0	+120 0
	65	80	+550 +360	+246 +200	+390 +200	+340 +150																
	80	100	+600 +380	+274 +220	+440 +220	+390 +170	+207 +120	+260 +120	+340 +120	+126 +72	+159 +72	+58 +36	+71 +36	+90 +36	+34 +12	+47 +12	+15 0	+22 0	+35 0	+54 0	+87 0	+140 0
	100	120	+630 +410	+294 +240	+460 +240	+400 +180																
	120	140	+710 +460	+323 +260	+510 +260	+450 +200																
	140	160	+770 +520	+343 +280	+530 +280	+460 +210	+245 +145	+305 +145	+395 +145	+148 +85	+185 +85	+68 +43	+83 +43	+106 +43	+39 +14	+54 +14	+18 0	+25 0	+40 0	+63 0	+100 0	+160 0
	160	180	+830 +580	+373 +310	+560 +310	+480 +230																
	180	200	+950 +660	+412 +340	+630 +340	+530 +240																
	200	225	+1030 +740	+452 +380	+670 +380	+550 +260	+285 +170	+355 +170	+460 +170	+172 +100	+215 +100	+79 +50	+96 +50	+122 +50	+44 +15	+61 +15	+20 0	+29 0	+46 0	+72 0	+115 0	+185 0
	225	250	+1110 +820	+492 +420	+710 +420	+570 +280																
250	280	+1240 +920	+561 +480	+800 +480	+620 +300	+320 +190	+400 +190	+510 +190	+191 +110	+240 +110	+88 +56	+108 +56	+137 +56	+49 +17	+69 +17	+23 0	+32 0	+52 0	+81 0	+130 0	+210 0	
280	315	+1370 +1050	+621 +540	+860 +540	+650 +330																	
315	355	+1560 +1200	+689 +600	+960 +600	+720 +360	+350 +210	+440 +210	+570 +210	+214 +125	+265 +125	+98 +62	+119 +62	+151 +62	+54 +18	+75 +18	+25 0	+36 0	+57 0	+89 0	+140 0	+230 0	
355	400	+1710 +1350	+769 +680	+1040 +680	+760 +400																	
400	450	+1900 +1500	+857 +760	+1160 +760	+840 +440	+385 +230	+480 +230	+630 +230	+232 +135	+290 +135	+108 +68	+131 +68	+165 +68	+60 +20	+83 +20	+27 0	+40 0	+63 0	+97 0	+155 0	+250 0	
450	500	+2050 +1650	+937 +840	+1240 +840	+880 +480																	

Tables for Determining Metric Tolerances

Table 6: Tolerances for Inside Dimensions (Holes) – continued

UNITS IN mm		TOLERANCES FOR INSIDE DIMENSIONS (HOLES) (UNITS IN 0.001mm)																			
OVER	TO	H11	H12	H13	J6	J7	J8	K6	K7	K8	M6	M7	M8	N6	N7	N8	R7	JS6	JS7	JS8	JS9
0	1	+60	+100	+140	+2	+4	+6	0	0	0	-2	-2	-2	-4	-4	-4	-10	+3	+5	+7	+12.5
	3	0	0	0	-4	-6	-8	-6	-10	-14	-8	-12	-16	-10	-14	-18	-20	-3	-5	-7	-12.5
3	6	+75	+120	+180	+5	+6	+10	+2	+3	+5	-1	0	+2	-5	-4	-2	-11	+4	+6	+9	+15
		0	0	0	-3	-6	-8	-6	-9	-13	-9	-12	-16	-13	-16	-20	-23	-4	-6	-9	-15
6	10	+90	+150	+220	+5	+8	+12	+2	+5	+6	-3	0	+1	-7	-4	-3	-13	+4.5	+7.5	+11	+18
		0	0	0	-4	-7	-10	-7	-10	-16	-12	-15	-21	-16	-19	-25	-28	-4.5	-7.5	-11	-18
10	14	+110	+180	+270	+6	+10	+15	+2	+6	+8	-4	0	+2	-9	-5	-3	-16	+5.5	+9	+13.5	+21.5
	18	0	0	0	-5	-8	-12	-9	-12	-19	-15	-18	-25	-20	-23	-30	-34	-5.5	-9	-13.5	-21.5
18	24	+130	+210	+330	+8	+12	+20	+2	+6	+10	-4	0	+4	-11	-7	-3	-20	+6.5	+10.5	+16.5	+26
	30	0	0	0	-5	-9	-13	-11	-15	-23	-17	-21	-29	-24	-28	-36	-41	-6.5	-10.5	-16.5	-26
30	40	+160	+250	+390	+10	+14	+24	+3	+7	+12	-4	0	+5	-12	-8	-3	-25	+8	+12.5	+19.5	+31
	50	0	0	0	-6	-11	-15	-13	-18	-27	-20	-25	-34	-28	-33	-42	-50	-8	-12.5	-19.5	-31
50	65	+190	+300	+460	+13	+18	+28	+4	+9	+14	-5	0	+5	-14	-9	-4	-30	+9.5	+15	+23	+37
	80	0	0	0	-6	-12	-18	-15	-21	-32	-24	-30	-41	-33	-39	-50	-62	-9.5	-15	-23	-37
80	100	+220	+350	+540	+16	+22	+34	+4	+10	+16	-6	0	+6	-16	-10	-4	-38	+11	+17.5	+27	+43.5
	120	0	0	0	-6	-13	-20	-18	-25	-38	-28	-35	-48	-38	-45	-58	-76	-11	-17.5	-27	-43.5
120	140																-48				
																		-88			
140	160	+250	+400	+630	+18	+26	+41	+4	+12	+20	-8	0	+8	-20	-12	-4	-50	+12.5	+20	+31.5	+50
	180	0	0	0	-7	-14	-22	-21	-28	-43	-33	-40	-55	-45	-52	-67	-90	-12.5	-20	-31.5	-50
180	200																-53				
																		-93			
200	225	+290	+460	+720	+22	+30	+47	+5	+13	+22	-8	0	+9	-22	-14	-5	-60	+14.5	+23	+36	+57.5
	250	0	0	0	-7	-16	-25	-24	-33	-50	-37	-46	-63	-51	-60	-77	-109	-14.5	-23	-36	-57.5
250	280	+320	+520	+810	+25	+36	+55	+5	+16	+25	-9	0	+9	-25	-14	-5	-74	+16	+26	+40.5	+65
	315	0	0	0	-7	-16	-26	-27	-36	-56	-41	-52	-72	-57	-66	-86	-126	-16	-26	-40.5	-65
315	355	+360	+570	+890	+29	+39	+60	+7	+17	+28	-10	0	+11	-26	-16	-5	-87	+18	+28.5	+44.5	+70
	400	0	0	0	-7	-18	-29	-29	-40	-61	-46	-57	-78	-62	-73	-94	-144	-18	-28.5	-44.5	-70
400	450	+400	+630	+970	+33	+43	+66	+8	+18	+29	-10	0	+11	-27	-17	-6	-103	+20	+31.5	+48.5	+77.5
	500	0	0	0	-7	-20	-31	-32	-45	-68	-50	-63	-86	-67	-80	-103	-166	-20	-31.5	-48.5	-77.5

Tables for Determining Metric Tolerances

Table 7: Tolerances for Outside Dimensions (Shafts)

Table 7 details tolerances for outside dimensions (shafts) based relative to the tolerance symbol. Upper and lower values are provided as either positive or negative (or zero) values relative to the nominal size chosen. Pick the range in which the desired nominal value falls, and then either add or subtract the tolerances to find the upper and lower tolerance range for the desired nominal size.

UNITS IN mm		TOLERANCES FOR OUTSIDE DIMENSIONS (SHAFTS) (UNITS IN 0.001mm)																				
OVER	TO	a11	b8	b11	c11	d9	d10	d11	e7	e8	e9	f6	f7	f8	f9	g5	g6	g7	h4	h5	h6	h7
0	1	—	—	—	—	-60	-20	-20	-20	-14	-14	-14	-6	-6	-6	-2	-2	-2	0	0	0	0
1	3	-270 -330	-140 -154	-140 -200	-120	-45	-60	-80	-24	-28	-39	-12	-16	-20	-31	-6	-8	-12	-3	-4	-6	-10
3	6	-270 -345	-140 -158	-140 -215	-70 -145	-30 -60	-30 -78	-30 -105	-20 -32	-20 -38	-20 -50	-10 -18	-10 -22	-10 -28	-10 -40	-4 -9	-4 -12	-4 -16	0 -4	0 -5	0 -8	0 -12
6	10	-280 -370	-150 -172	-150 -240	-80 -170	-40 -76	-40 -98	-40 -130	-25 -40	-25 -47	-25 -61	-13 -22	-13 -28	-13 -35	-13 -49	-5 -11	-5 -14	-5 -20	0 -4	0 -6	0 -9	0 -15
10	14	-290 -400	-150 -177	-150 -260	-95 -205	-50 -93	-50 -120	-50 -160	-32 -50	-32 -59	-32 -75	-16 -27	-16 -34	-16 -43	-16 -59	-6 -14	-6 -17	-6 -24	0 -5	0 -8	0 -11	0 -18
18	24	-300 -430	-160 -193	-160 -290	-110 -240	-65 -117	-65 -149	-65 -195	-40 -61	-40 -73	-40 -92	-20 -33	-20 -41	-20 -53	-20 -72	-7 -16	-7 -20	-7 -28	0 -6	0 -9	0 -13	0 -21
30	40	-310 -470	-170 -209	-170 -330	-120 -280	-80	-80	-80	-50	-50	-50	-25	-25	-25	-25	-9	-9	-9	0	0	0	0
40	50	-320 -480	-180 -219	-180 -340	-130 -290	-142	-180	-240	-75	-89	-112	-41	-50	-64	-87	-20	-25	-34	-7	-11	-16	-25
50	65	-340 -530	-190 -236	-190 -380	-140 -330	-100	-100	-100	-60	-60	-60	-30	-30	-30	-30	-10	-10	-10	0	0	0	0
65	80	-360 -550	-200 -246	-200 -390	-150 -340	-174	-220	-290	-90	-106	-134	-49	-60	-76	-104	-23	-29	-40	-8	-13	-19	-30
80	100	-380 -600	-220 -274	-220 -440	-170 -390	-120	-120	-120	-72	-72	-72	-36	-36	-36	-36	-12	-12	-12	0	0	0	0
100	120	-410 -630	-240 -294	-240 -460	-180 -400	-207	-260	-340	-107	-126	-159	-58	-71	-90	-123	-27	-34	-47	-10	-15	-22	-35
120	140	-460 -710	-260 -323	-260 -510	-200 -450																	
140	160	-520 -770	-280 -343	-280 -530	-210 -460	-145	-145	-145	-85	-85	-85	-43	-43	-43	-43	-14	-14	-14	0	0	0	0
160	180	-580 -830	-310 -373	-310 -560	-230 -480																	
180	200	-660 -950	-340 -412	-340 -630	-240 -530																	
200	225	-740 -1030	-380 -452	-380 -670	-260 -550	-170	-170	-170	-100	-100	-100	-50	-50	-50	-50	-15	-15	-15	0	0	0	0
225	250	-820 -1110	-420 -492	-420 -710	-280 -570																	
250	280	-920 -1240	-480 -561	-480 -800	-300 -620	-190	-190	-190	-110	-110	-110	-56	-56	-56	-56	-17	-17	-17	0	0	0	0
280	315	-1050 -1370	-540 -621	-540 -860	-330 -650	-320	-400	-510	-162	-191	-240	-88	-108	-137	-186	-40	-49	-69	-16	-23	-32	-52
315	355	-1200 -1560	-600 -689	-600 -960	-360 -720	-210	-210	-210	-125	-125	-125	-62	-62	-62	-62	-18	-18	-18	0	0	0	0
355	400	-1350 -1710	-680 -769	-680 -1040	-400 -760	-350	-440	-570	-182	-214	-265	-98	-119	-151	-202	-43	-54	-75	-18	-25	-36	-57
400	450	-1500 -1900	-760 -857	-760 -1160	-440 -840	-230	-230	-230	-135	-135	-135	-68	-68	-68	-68	-20	-20	-20	0	0	0	0
450	500	-1650 -2050	-840 -937	-840 -1240	-480 -880	-385	-480	-630	-198	-232	-290	-108	-131	-165	-223	-47	-60	-83	-20	-27	-40	-63

Tables for Determining Metric Tolerances

Table 7: Tolerances for Outside Dimensions (Shafts) – continued

UNITS IN mm		TOLERANCES FOR OUTSIDE DIMENSIONS (SHAFTS) (UNITS IN 0.001mm)																			
OVER	TO	h8	h9	h10	h11	j5	j6	j7	k5	k6	k7	k8	m5	m6	m7	n5	n6	n7	r6	js6	js7
0	1	0	0	0	0	+2	+4	+6	+4	+6	+10	+14	+6	+8	+12	+8	+10	+14	+16	+3	+5
1	3	-14	-25	-40	-60	-2	-2	-4	0	0	0	0	+2	+2	+2	+4	+4	+4	+10	-3	-5
3	6	0	0	0	0	+3	+6	+8	+6	+9	+13	+18	+9	+12	+16	+13	+16	+20	+23	+4	+6
		-18	-30	-48	-75	-2	-2	-4	+1	+1	+1	0	+4	+4	+4	+8	+8	+8	+15	-4	-6
6	10	0	0	0	0	+4	+7	+10	+7	+10	+16	+22	+12	+15	+21	+16	+19	+25	+28	+4.5	+7.5
		-22	-36	-58	-90	-2	-2	-5	+1	+1	+1	0	+6	+6	+6	+10	+10	+10	+19	-4.5	-7.5
10	14	0	0	0	0	+5	+8	+12	+9	+12	+19	+27	+15	+18	+25	+20	+23	+30	+34	+5.5	+9
14	18	-27	-43	-70	-110	-3	-3	-6	+1	+1	+1	0	+7	+7	+7	+12	+12	+12	+23	-5.5	-9
18	24	0	0	0	0	+5	+9	+13	+11	+15	+23	+33	+17	+21	+29	+24	+28	+36	+41	+6.5	+10.5
24	30	-33	-52	-84	-130	-4	-4	-8	+2	+2	+2	0	+8	+8	+8	+15	+15	+15	+28	-6.5	-10.5
30	40	0	0	0	0	+6	+11	+15	+13	+18	+27	+39	+20	+25	+34	+28	+33	+42	+50	+8	+12.5
40	50	-39	-62	-100	-160	-5	-5	-10	+2	+2	+2	0	+9	+9	+9	+17	+17	+17	+34	-8	-12.5
50	65	0	0	0	0	+6	+12	+18	+15	+21	+32	+46	+24	+30	+41	+33	+39	+50	+60	+9.5	+15
		-46	-74	-120	-190	-7	-7	-12	+2	+2	+2	0	+11	+11	+11	+20	+20	+20	+41	-9.5	-15
65	80																		+62		
																			+43		
80	100	0	0	0	0	+6	+13	+20	+18	+25	+38	+54	+28	+35	+48	+38	+45	+58	+73	+11	+17.5
		-54	-87	-140	-220	-9	-9	-15	+3	+3	+3	0	+13	+13	+13	+23	+23	+23	+51	-11	-17.5
100	120																		+76		
																			+54		
120	140																		+88		
																			+63		
140	160	0	0	0	0	+7	+14	+22	+21	+28	+43	+63	+33	+40	+55	+45	+52	+67	+90	+12.5	+20
		-63	-100	-160	-250	-11	-11	-18	+3	+3	+3	0	+15	+15	+15	+27	+27	+27	+65	-12.5	-20
160	180																		+93		
																			+68		
180	200																		+106		
																			+77		
200	225	0	0	0	0	+7	+16	+25	+24	+33	+50	+72	+37	+46	+63	+51	+60	+77	+109	+14.5	+23
		-72	-115	-185	-290	-13	-13	-21	+4	+4	+4	0	+17	+17	+17	+31	+31	+31	+80	-14.5	-23
225	250																		+113		
																			+84		
250	280	0	0	0	0	+7	+16	+26	+27	+36	+56	+81	+43	+52	+72	+57	+66	+86	+126	+16	+26
		-81	-130	-210	-320	-16	-16	-26	+4	+4	+4	0	+20	+20	+20	+34	+34	+34	+94	-16	-26
280	315																		+130		
																			+98		
315	355	0	0	0	0	+7	+18	+29	+29	+40	+61	+89	+46	+57	+78	+62	+73	+94	+144	+18	+28.5
		-89	-140	-230	-360	-18	-18	-28	+4	+4	+4	0	+21	+21	+21	+37	+37	+37	+108	-18	-28.5
355	400																		+150		
																			+114		
400	450	0	0	0	0	+7	+20	+31	+32	+45	+68	+97	+50	+63	+86	+67	+80	+103	+166	+20	+31.5
		-97	-155	-250	-400	-20	-20	-32	+5	+5	+5	0	+23	+23	+23	+40	+40	+40	+126	-20	-31.5
450	500																		+172		
																			+132		

Technical Reference | Tables for Determining Metric Tolerances