

# Tolerances In Metric

## World Standards for Round Cold-Finished Steel Bars\*

Country	National Standard	ISO Product Tolerance				Other ISO Shaft Tolerances
		h11	h9	h7	h6	
Global	ISO 1829	h11	h9	h7	h6	h5, h8 (2nd choice)
USA	ANSI B4.2	h11	h9	h7	h6	
Japan	JIS G3 123	h11	h9	h7	h6	h13,h12,h10,h8
Germany	DIN 668 59360.1	h11	h9	h7	h6	
France	NF A47-411	h11	h9	h7	h6	h10
U.K.	BS 4500	h11	h9	h7	h6	
Italy	UNI 468, 469,UNI 5953	h11	h9	h7	h6	
Australia	AS1654	h11	h9	h7	h6	

ISO 1829, ANSI B4.2, BS 4500 and AS 1654 are preferred tolerance standards.

## Fits for Shafts and Holes\*

Hole Basis	Shaft Basis	Description
H11/c11	C11/h11	Loose running fits are for wide commercial tolerances or allowances on external members
H9/d9	D9/h9	Free running fits are good for large temperatures variations, high running speeds, or heavy journal pressure, but not where accuracy is essential
H8/f7	F8/h7	Close running fits are for running on accurate machines and for accurate locations at moderate speeds
H7/g6	G7/h6	Sliding fits are not intended to run freely, but to move and turn freely and locate accurately
H7/h6	H7/h6	Location clearance provides snug fits for location stationary parts, but can be freely assembled and disassembled
H7/k6	K7/h6	Location transition fits are for accurate locations a compromise between clearance and interference
H7/n6	N7/h6	Location transition fits are more accurate locations where greater interference is permissible
H7/p6	P7/h6	Location interference fits are for parts requiring rigidity and alignment with prime accuracy of location but without special bore-pressure requirements
H7/s6	S7/h6	Medium drive fits are ordinary for steel parts of shrink fits on light sections. These provide the tightest tolerances with cast iron
H7/u6	U7/h6	Force fits are suitable for parts which can be highly stressed or for shrink fits where the heavy pressing forces required are impractical

\*Reprinted from Kverneland, K.O., " How ISO Standards Cut Manufacturing Costs", *Machine Design* pp 126-130, Nov. 5, 1998. <http://www.kok.com>

# Conversion tables

## Millimeters to Inches

mm.	in.
0.01	0.0004
0.02	0.0008
0.03	0.0012
0.04	0.0016
0.05	0.0020
0.06	0.0024
0.07	0.0028
0.08	0.0031
0.09	0.0035

mm.	in.
0.10	0.0039
0.20	0.0079
0.30	0.0118
0.40	0.0157
0.50	0.0197
0.60	0.0236
0.70	0.0276
0.80	0.0315
0.90	0.0354

mm.	in.
1	0.039
2	0.079
3	0.118
4	0.157
5	0.197
6	0.236
7	0.276
8	0.315
9	0.354

mm.	in.
10	0.394
20	0.787
30	1.181
40	1.575
50	1.968
60	2.362
70	2.756
80	3.150
90	3.543

## Metric Tolerances (1/1000) in Millimeters

mm.	H6	H7	m6	k6	h9	g6	d9
from 1 up to 3	0 +6	0 +10	+8 +2	+6 +0	0 -25	-2 -8	-20 -45
from 3 up to 6	0 +8	0 +12	+12 +4	+9 +1	0 -30	-4 -12	-30 -60
from 6 up to 10	0 +9	0 +15	+15 +6	+10 +1	0 -36	-5 -14	-40 -76
from 10 up to 18	0 +11	0 +18	+18 +7	+12 +1	0 -43	-6 -17	-50 -93
from 18 up to 30	0 +13	0 +21	+21 +8	+15 +2	0 -52	-7 -20	-65 -117

## Metric Tolerances (1/1000) in Inches

mm.	H6	H7	m6	k6	h9	g6	d9
from .039 up to .118	0 +.2362	0 +.3937	+.3150 +.0787	+.2362 +0	0 -.9843	-.0787 -.3150	-.7874 -1.7717
from .118 up to .236	0 +.3150	0 +.4724	+.4724 +.1575	+.3543 +.0394	0 -1.181	-.1575 -.4724	-1.1811 -2.3622
from .236 up to .394	0 +.3543	0 +.5905	+.5905 +.2362	+.3937 +.0394	0 -1.4173	-.1968 -.5512	-1.5748 -2.9921
from .394 up to .709	0 +.4331	0 +.7087	+.7087 +.2756	+.4724 +.0394	0 -1.6929	-.2362 -.6693	-1.9685 -3.6614
from .709 up to 1.181	0 +.5118	0 +.8268	+.8268 +.3150	+.5905 +.0787	0 -2.0472	-.2756 -.7874	-2.5591 -4.6063

## Equivalence Tables

Wnr.	C%	Si%	Mn%	P <sub>≤</sub> %	S <sub>≤</sub> %	Cr%	Other	AISI/SAE
1.2510	0.90-1.05	0.15-0.35	1.00-1.20	0.035	0.035	0.50-0.70	W% 0.50-0.70 V% 0.05-0.015	01
1.2344	0.37-0.43	0.90-1.20	0.30-.050	0.030	0.030	4.80-5.50	V% 0.90-1.10 Mo% 1.20-1.50	H13 Improved
1.2312	0.35-0.45	0.30-0.50	1.40-1.60	0.030	0.05-0.10	1.80-2.00	Mo% 0.15-0.25	P20 Modified
1.7242	0.13-0.20	0.15-0.35	0.50-0.80	0.035	0.035	0.90-1.20	Ni% ≤0.40 Mo% 0.20-0.30	DIN16CrMo4
1.8159	0.47-0.55	≤0.40	0.70-1.10	0.035	0.035	0.90-1.20	V% 0.10-0.20	6145 6150
1.0503	0.42-0.50	≤0.40	0.50-0.80	0.045	0.045	≤0.40	Ni% ≤0.40 Mo% ≤0.10	1043 / 1045
1.7264	0.18-0.23	0.15-0.35	0.90-1.20	0.035	0.035	1.10-1.40	Mo% 0.20-0.30	DIN20 CrMo5
1.8550	0.30-0.37	≤0.40	0.40-0.70	0.025	0.030	1.50-1.80	Al% 0.80-1.20 Ni% 0.85-1.15 Mo% 0.15-0.25	Premium Hotwork Steel
1.2101	0.58-0.66	0.90-1.20	0.90-1.20	0.030	0.030	0.40-0.70		Spring Steel
1.3505	0.90-1.05	0.15-0.35	0.25-0.45	0.030	0.025	1.35-1.65	Cu ≤0.30 Ni% ≤0.30	SAE-E52100
1.0308	≤0.17	≤0.35	≤0.40	0.050	0.050		N%0.007	St-35
1.4301	≤0.07	≤1.00	≤2.00	0.045	0.030	17.0-19.5	N% 0.11 Ni% 8.00-10.5	AISI 304
1.4034	0.43-0.50	≤1.00	≤1.00	0.040	0.030	12.5-14.5		AISI 420
2.4669	≤0.08	≤0.50	≤0.50	0.015	0.010	14.0-17.0	Ni% ≤70(+Co) Nb% 0.70-1.20 Ti% 2.25-2.75 Al% 0.40-1.00 Cu% ≤0.50 Fe% 5.00-9.00	AISI 688

Category	From	Multiply by	To
Pressure	BARS ( /cm <sup>2</sup> )	14.50377	psi (pounds/in <sup>2</sup> )
Temperature	° Celsius	1.8+32	° Farenheit
Force	Newtons	0.224808	Pounds
Weight	Kg.	2.205	Pounds