

INCH		METRIC	
Fractional	Decimal	mm	
	.00394	.1	
	.00787	.2	
	.01181	.3	
1/64	.015625	.3969	
	.01575	.4	
	.01969	.5	
	.02362	.6	
	.02756	.7	
1/32	.03125	.7938	
	.0315	.8	
	.03543	.9	
	.03937	1.00	
	.046875	1.1906	
1/16	.0625	1.5875	
	.078125	1.9844	
	.07874	2.00	
	.09375	2.3813	
	.109375	2.7781	
	.11811	3.00	
	.125	3.175	
	.140625	3.5719	
	.15625	3.9688	
	.15748	4.00	
	.171875	4.3656	
	.1875	4.7625	
	.19685	5.00	
	.203125	5.1594	
	.21875	5.5563	
	.234375	5.9531	
	.23622	6.00	
	.2500	6.35	
	.265625	6.7469	
	.27559	7.00	
	.28125	7.1438	
	.296875	7.5406	
	.3125	7.9375	
	.31496	8.00	
	.328125	8.3344	
	.34375	8.7313	
	.35433	9.00	
	.359375	9.1281	
	.375	9.525	
	.390625	9.9219	
	.3937	10.00	
	.40625	10.3188	
	.421875	10.7156	
	.43307	11.00	
	.4375	11.1125	
	.453125	11.5094	

INCH		METRIC	
Fractional	Decimal	mm	
	.46875	11.9063	
	.47244	12.00	
	.484374	12.3031	
	.5000	12.70	
	.51181	13.00	
	.515625	13.0969	
	.53125	13.4938	
	.546875	13.8907	
	.55118	14.00	
	.5625	14.2875	
	.578125	14.6844	
	.59055	15.00	
	.59375	15.0813	
	.609375	15.4782	
	.625	15.875	
	.62992	16.00	
	.640625	16.2719	
	.65625	16.6688	
	.66929	17.00	
	.671875	17.0657	
	.6875	17.4625	
	.703125	17.8594	
	.70866	18.00	
	.71875	18.2563	
	.734375	18.6532	
	.74803	19.00	
	.7500	19.05	
	.765625	19.4469	
	.78125	19.8438	
	.7874	20.00	
	.796875	20.2407	
	.8125	20.6375	
	.82677	21.00	
	.828125	21.0344	
	.84375	21.4313	
	.859375	21.8282	
	.86614	22.00	
	.875	22.225	
	.890625	22.6219	
	.90551	23.00	
	.90625	23.0188	
	.921875	23.4157	
	.9375	23.8125	
	.94488	24.00	
	.953125	24.2094	
	.96875	24.6063	
	.98425	25.00	
	.984375	25.0032	
	1.0000	25.4001	

Quantity	Conventional		SI Unit	Conversion Factors
	Inch Unit	Metric Unit		
Length	Inch inch	Meter m	Metre m	1 inch = 25.4 mm 1 mm = 0.03937 inch 1 m = 3.2808 ft 1 ft = 0.3048 m
Area	Square Inch inch ²	Square Centimeter cm ²	Square Metre m ²	1 inch ² = 6.4516 cm ² 1 cm ² = 0.155 inch ² 1 m ² = 10.764 ft ² 1 ft ² = 0.092903 m ²
Mass	Pound Mass lb	Kilogram Mass kg	Kilogram Mass kg	1 lb = 0.45359237 kg 1 kg = 2.2046 lb
Force	Pound Force lbf	Kilogram Force kgf	Newton N	1 lbf = 0.45359237 kgf 1 lbf = 4.44822 N 1 kgf = 2.2046 lbf 1 kgf = 9.80665 N 1 N = 0.1019716 kgf 1 N = 0.224809 lbf
Stress Pressure	Pounds Per Square Inch lbf/inch ²	Kilogram Per Square Centimeter kgf/cm ²	Pascal N/m ² (Pa)	1 MPa (megapascal) = 10 ⁶ N/m ² = N/mm ² 1 kPa (kilopascal) = 10 ³ N/m ² 1 lbf/inch ² = 0.070307 kgf/cm ² 1 lbf/inch ² = 7.0307 • 10 ⁻⁴ kgf/mm ² 1 lbf/inch ² = 6.8947 • 10 ⁻³ N/mm ² (MPa) 1 kgf/cm ² = 14.2233 lbf/inch ² 1 kgf/cm ² = 9.80665 • 10 ⁻² N/mm ² (MPa)
Torque Work	Inch • Pounds lbf • inch	Kilogram- Meters kgf • m	Newton- Metres N • m	1 lbf • inch = 1.1521 kgf • cm 1 kgf • cm = 0.8679 lbf • inch 1 lbf • inch = 0.1129848 N • m 1 kgf • m = 9.80665 N • m 1 kgf • cm = 9.80665 • 10 ⁻² N • m 1 N • m = 8.85 lbf • inch 1 N • m = 10.19716 kgf • cm
Power	lbf • ft/min	kgf • m/s	N • m/s	1 kW = 1000 N • m/s 1 kW = 60,000 N • m/min 1 kW = 44,220 lbf • ft/min 1 kW = 1.34 hp 1 hp = 75 kgf • m/s 1 hp = 44,741 N • m/min 1 hp = 33,000 lbf • ft/min 1 hp = 0.7457 kW
Velocity	Feet Per Second ft/sec	Meters Per Second m/sec	Metres Per Second m/s	1 ft/sec = 0.3048 m/sec 1 inch/sec = 2.54 cm/sec 1 ft/min = 0.00508 m/sec 1 mile/hr = 0.44704 m/sec 1 km/hr = 0.27777 m/sec 1 mile/hr = 1.609344 km/hr
Acceleration	Feet Per Second Square ft/sec ²	Meter Per Second Square m/sec ²	Metre Per Second Square m/sec ²	1 ft/sec ² = 0.3048 m/sec ²

A FEW WORLD STANDARDS FOR ROUND COLD-FINISHED STEEL BARS*

Country	National Standard	ISO Product Tolerance				Other ISO Shaft Tolerance
Global	ISO 1829	h11	h9	h7	h6	h5, h8 (second 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			h10
U.K.	BS 4500	h11	h9	h7	h6	
Italy	UNI 468, 469 UNI 5953	h11	h9	h7		
Australia	AS 1654	h11	h9	h7	h6	

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

PREFERRED 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 temperature 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 locating 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 for 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 for ordinary steel parts or shrink fits on light sections. these provide the tightest usable fit 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, November 5, 1998.

Expressed in thousandths of a millimeter

RUNNING & SLIDING FITS		d, e — LOOSE CLEARANCE					f — AVERAGE RUNNING			
LOCATIONAL FITS		g — LOCATIONAL CLEARANCE					h — LOCATIONAL TRANSITION			
FORCE FITS		k — LIGHT DRIVE					p, s — MEDIUM DRIVE			
DIA.	$\frac{V}{\Delta}$ $\frac{V}{\Delta}$ $\frac{V}{\Delta}$	NOMINAL SIZE RANGE IN INCHES & MILLIMETERS								
		.039 to .118 in.	.118 to .236 in.	.236 to .394 in.	.394 to .709 in.	.709 to 1.181 in.	1.181 to 1.969 in.	1.969 to 3.150 in.	3.150 to 4.724 in.	4.724 to 7.087 in.
		1 to 3mm	3 to 6mm	6 to 10mm	10 to 18mm	18 to 30mm	30 to 50mm	50 to 80mm	80 to 120mm	120 to 180mm
FITS		VALUES (From / To) IN THOUSANDTHS OF A mm								
Hole	H6	+6	+8	+9	+11	+13	+16	+19	+22	+25
		0	0	0	0	0	0	0	0	0
Shaft	g5	-2	-4	-5	-6	-7	-9	-10	-12	-14
		-6	-9	-11	-14	-16	-20	-23	-27	-32
	h5	0	0	0	0	0	0	0	0	0
		-4	-5	-6	-8	-9	-11	-13	-15	-18
	k5	+4	+6	+7	+9	+11	+13	+15	+18	+21
p5	0	+1	+1	+1	+2	+2	+2	+3	+3	
Hole	H7	+10	+12	+15	+18	+22	+26	+32	+37	+43
		0	0	0	0	0	0	0	0	0
Shaft	f6	-6	-10	-13	-16	-20	-25	-30	-36	-43
		-12	-18	-22	-27	-33	-41	-49	-58	-68
	g6	-2	-4	-5	-6	-7	-9	-10	-12	-14
		-8	-12	-14	-17	-20	-25	-29	-34	-39
	h6	0	0	0	0	0	0	0	0	0
k6	-6	-8	-9	-11	-13	-16	-19	-22	-25	
Hole	H8	+6	+9	+10	+12	+15	+18	+21	+25	+28
		0	+1	+1	+1	+2	+2	+2	+3	+3
Shaft	p6	+12	+20	+24	+29	+35	+42	+51	+59	+68
		+6	+12	+15	+18	+22	+26	+32	+37	+43
Hole	H8	+14	+18	+22	+27	+33	+39	+46	+54	+63
		0	0	0	0	0	0	0	0	0
Shaft	e8	-14	-20	-25	-32	-40	-50	-60	-72	-85
		-28	-38	-47	-59	-73	-89	-106	-126	-148
	f8	-6	-10	-13	-16	-20	-25	-30	-36	-43
		-20	-28	-35	-43	-53	-64	-76	-90	-106
Hole	H9	0	0	0	0	0	0	0	0	0
		-14	-18	-22	-27	-33	-39	-46	-54	-63
Shaft	s8	+29	+37	+45	+55	+68	+82	+99	+125	+155
		+15	+19	+23	+28	+35	+43	+53	+71	+92
Hole	H9	+25	+30	+36	+43	+52	+62	+74	+87	+100
		0	0	0	0	0	0	0	0	0
Shaft	e9	-14	-20	-25	-32	-40	-50	-60	-72	-85
		-39	-50	-61	-75	-92	-112	-134	-159	-185
Hole	H11	0	0	0	0	0	0	0	0	0
		+60	+75	+90	+110	+130	+160	+190	+220	+250
Shaft	d11	-20	-30	-40	-50	-65	-80	-100	-120	-145
		-80	-105	-130	-160	-195	-240	-290	-340	-395
Hole	h11	0	0	0	0	0	0	0	0	0
		-60	-75	-90	-110	-130	-160	-190	-220	-250

Expressed in inches

RUNNING & SLIDING FITS		d, e — LOOSE CLEARANCE					f — AVERAGE RUNNING			
LOCATIONAL FITS		g — LOCATIONAL CLEARANCE					h — LOCATIONAL TRANSITION			
FORCE FITS		k — LIGHT DRIVE					p, s — MEDIUM DRIVE			
DIA.	FITS	NOMINAL SIZE RANGE IN INCHES & MILLIMETERS								
		$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$.039 to .118 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$.118 to .236 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$.236 to .394 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$.394 to .709 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$.709 to 1.181 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$ 1.181 to 1.969 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$ 1.969 to 3.150 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$ 3.150 to 4.724 in.	$\begin{matrix} \text{V} \\ \text{V} \\ \text{V} \end{matrix}$ 4.724 to 7.087 in.
		1 to 3mm	3 to 6mm	6 to 10mm	10 to 18mm	18 to 30mm	30 to 50mm	50 to 80mm	80 to 120mm	120 to 180mm
VALUES (From / To) IN INCHES										
Hole	H6	+0.0024 .00000	+0.0031 .00000	+0.0035 .00000	+0.0043 .00000	+0.0051 .00000	+0.0063 .00000	+0.0075 .00000	+0.0087 .00000	+0.0098 .00000
Shaft	g5	-.00008 -.00024	-.00016 -.00035	-.00020 -.00043	-.00024 -.00055	-.00028 -.00063	-.00035 -.00079	-.00039 -.00091	-.00047 -.00106	-.00055 -.00126
	h5	.00000 -.00016	.00000 -.00020	.00000 -.00024	.00000 -.00031	.00000 -.00035	.00000 -.00043	.00000 -.00051	.00000 -.00059	.00000 -.00071
	k5	+0.0016 .00000	+0.0024 .00004	+0.0028 .00008	+0.0035 .00008	+0.0043 .00008	+0.0051 .00008	+0.0059 .00012	+0.0071 .00012	+0.0083 .00016
	p5	+0.0039 +.00024	+0.0067 +.00047	+0.0083 +.00059	+0.0102 +.00071	+0.0122 +.00087	+0.0146 +.00102	+0.0177 +.00126	+0.0205 +.00146	+0.0240 +.00169
Hole	H7	+0.0039 .00000	+0.0047 .00000	+0.0059 .00000	+0.0071 .00000	+0.0083 .00000	+0.0098 .00000	+0.0118 .00000	+0.0138 .00000	+0.0157 .00000
Shaft	f6	-.00024 -.00047	-.00039 -.00071	-.00051 -.00087	-.00063 -.00106	-.00079 -.00130	-.00098 -.00161	-.00118 -.00193	-.00142 -.00228	-.00169 -.00268
	g6	-.00008 -.00031	-.00016 -.00047	-.00020 -.00055	-.00024 -.00067	-.00028 -.00079	-.00035 -.00098	-.00039 -.00114	-.00047 -.00134	-.00055 -.00154
	h6	.00000 -.00028	.00000 -.00031	.00000 -.00035	.00000 -.00043	.00000 -.00051	.00000 -.00063	.00000 -.00075	.00000 -.00087	.00000 -.00098
	k6	+0.0024 +.00000	+0.0035 +.00004	+0.0039 +.00004	+0.0047 +.00004	+0.0059 +.00008	+0.0071 +.00008	+0.0083 +.00008	+0.0098 +.00012	+0.0110 +.00012
	p6	+0.0047 +.00024	+0.0079 +.00047	+0.0094 +.00059	+0.0114 +.00071	+0.0138 +.00087	+0.0165 +.00102	+0.0201 +.00126	+0.0232 +.00146	+0.0268 +.00169
Hole	H8	+0.0055 .00000	+0.0071 .00000	+0.0087 .00000	+0.0106 .00000	+0.0130 .00000	+0.0154 .00000	+0.0181 .00000	+0.0213 .00000	+0.0248 .00000
Shaft	e8	-.00055 -.00110	-.00079 -.00150	-.00098 -.00185	-.00126 -.00232	-.00157 -.00287	-.00197 -.00350	-.00236 -.00417	-.00283 -.00496	-.00335 -.00583
	f8	-.00024 -.00079	-.00039 -.00110	-.00051 -.00138	-.00063 -.00169	-.00079 -.00209	-.00098 -.00252	-.00118 -.00299	-.00142 -.00354	-.00169 -.00417
	h8	.00000 -.00055	.00000 -.00071	.00000 -.00087	.00000 -.00106	.00000 -.00130	.00000 -.00154	.00000 -.00181	.00000 -.00213	.00000 -.00248
	s8	+0.0014 +.00059	+0.00146 +.00075	+0.00177 +.00091	+0.00217 +.00110	+0.00268 +.00138	+0.00323 +.00169	+0.00390 +.00209	+0.0492 +.00280	+0.0610 +.00362
Hole	H9	+0.0098 .00000	+0.0118 .00000	+0.0142 .00000	+0.0169 .00000	+0.0205 .00000	+0.0244 .00000	+0.0291 .00000	+0.0343 .00000	+0.0394 .00000
Shaft	e9	-.00055 -.00154	-.00079 -.00197	-.00098 -.00240	-.00126 -.00295	-.00157 -.00362	-.00197 -.00441	-.00236 -.00528	-.00283 -.00626	-.00335 -.00728
	h9	.00000 -.00098	.00000 -.00118	.00000 -.00142	.00000 -.00169	.00000 -.00205	.00000 -.00244	.00000 -.00291	.00000 -.00343	.00000 -.00394
Hole	H11	+0.00236 .00000	+0.00295 .00000	+0.00354 .00000	+0.00433 .00000	+0.00512 .00000	+0.00630 .00000	+0.00748 .00000	+0.00866 .00000	+0.00984 .00000
Shaft	d11	-.00079 -.00315	-.00118 -.00413	-.00157 -.00512	-.00197 -.00630	-.00256 -.00768	-.00315 -.00945	-.00394 -.01142	-.00472 -.01339	-.00571 -.01555
	h11	.00000 -.00236	.00000 -.00295	.00000 -.00354	.00000 -.00433	.00000 -.00512	.00000 -.00630	.00000 -.00748	.00000 -.00866	.00000 -.00984