Selecting a Preferred Size

The idea for developing metric standards worldwide comes from a preferred numbering system. Its first known application was in the 1870's by Charles Renard, a French army captain who reduced the different diameters of rope for military balloons from 425 to 17.

Nominal metric sizes are identical where the metric systems have been in use for several years. These reflect preferred sizes for components such as threaded fasteners, steel plates, sheets, and bars used throughout the world. The accompanying table shows how the general system works.

For example, if a designer was choosing a hydraulic cylinder, bolt, or plate thickness, the sizes in the First-choice column would be preferred. Second- and Third-choice columns are self-explanatory. The table extends to smaller and larger sizes.* For instance, 60 mm sizes would be a preferred choice as would 2.5 mm devices.

The three columns to the far right are the originating Renard numbers. In the First- choice column, each succeeding number is 1.6 times the previous, with some rounding. These three columns provide the basis for the values on the left side of the table. The inch values show close corresponding English units.

The form of the first table carries through to other tables in the standard. The number series shown are recommended to reduce the number of standard sizes for items such as screw threads, steel plates, steel sheets, round steel bars, lifting capacities, and hydraulic cylinder diameters.

Preferred Sizes (mm)			Customary Sizes			Preferred Numbers		
First Choice	Second Choice	Third Choice	mm	inch Fractions	inch Decimals	First Choice	Second Choice	Third Choice
4			3.97	5/32	0.156	4		
		4.5	4.37	11/64	0.172			4.5
	5		4.76	3/16	0.188		5	
		5.5	5.56	7/32	0.219			5.6
6			6.35	1/4	0.25	6.3		
		7	7.14	9/32	0.281			7.1
	8		7.94	5/16	0.313		8	
		9	8.73	11/32	0.344			9
10			9.53	3/8	0.375	10		
		11	11.11	7/16	0.438			11.2
	12		12.7	1/2	0.5		12.5	
		14	14.29	9/16	0.563			14
16			15.88	5/8	0.625	16		
		18	17.46	11/16	0.688			18
	20		19.05	3/4	0.75		20	
		22	22.23	7/8	0.875			22.4
25			25.4	1	—	25		
		28	28.58	1-1/8	1.125			28
	30		30.16	1-3/16	1.188		31.5	
		35	34.93	1-3/8	1.375			35.5
40			39.69	1-9/16	1.563	40		

*The values in the first three columns of the table may be extended to cover smaller or larger sizes by multiplying or dividing sizes by 10.

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Preferred Tolerances in Metric

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	h11				
	59360.1		h9	h7	h6	
France	NF A47-411	h11	h9			h10
U.K.	BS 4500	h11	h9	h7	h6	
Italy	UNI 468, 469	h11	h9			
	UNI 5953			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.

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Miscellaneous Conversion Factors

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 X 10^{-4} kgf/mm^2 1 $lbf/inch^2$ = 6.8947 X 10^{-3} N/mm^2 (MPa) 1 kgf/cm^2 = 14.2233 $lbf/inch^2$ 1 kgf/cm^2 = 9.80665 X 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 X 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 = 60000 N • m/min 1 kW = 44220 lbf • ft/min 1 kW = 1.34 hp 1 hp = 75 kgf • m/s 1 hp = 44741 N • m/min 1 hp = 33000 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	Metre Per Second Square m/sec^2	1 ft/sec^2 = 0.3048 m/sec^2

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Inch & Metric Equivalents

Fractional and Decimal

INCH Fractional	INCH Decimal	METRIC 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
3/64	.046875	1.1906
1/16	.0625	1.5875
5/64	.078125	1.9844
	.07874	2.00
3/32	.09375	2.3813
7/64	.109375	2.7781
	.11811	3.00
1/8	.125	3.175
9/64	.140625	3.5719
5/32	.15625	3.9688
	.15748	4.00
11/64	.171875	4.3656
3/16	.1875	4.7625
	.19685	5.00
13/64	.203125	5.1594
7/32	.21875	5.5563
15/64	.234375	5.9531
	.23622	6.00
1/4	.2500	6.35
17/64	.265625	6.7469
	.27559	7.00
9/32	.28125	7.1438
19/64	.296875	7.5406
5/16	.3125	7.9375
	.31496	8.00
21/64	.328125	8.3344
11/32	.34375	8.7313
	.35433	9.00
23/64	.359375	9.1281
3/8	.375	9.525
25/64	.390625	9.9219
	.3937	10.00
13/32	.40625	10.3188
27/64	.421875	10.7156
	.43307	11.00
7/16	.4375	11.1125
29/64	.453125	11.5094

INCH Fractional	INCH Decimal	METRIC mm
15/32	.46875	11.9063
	.47244	12.00
31/64	.484374	12.3031
1/2	.5000	12.70
	.51181	13.00
33/64	.515625	13.0969
17/32	.53125	13.4938
35/64	.546875	13.8907
	.55118	14.00
9/16	.5625	14.2875
37/64	.578125	14.6844
	.59055	15.00
19/32	.59375	15.0813
39/64	.609375	15.4782
5/8	.625	15.875
	.62992	16.00
41/64	.640625	16.2719
21/32	.65625	16.6688
	.66929	17.00
43/64	.671875	17.0657
11/16	.6875	17.4625
45/64	.703125	17.8594
	.70866	18.00
23/32	.71875	18.2563
47/64	.734375	18.6532
	.74803	19.00
3/4	.7500	19.05
49/64	.765625	19.4469
25/32	.78125	19.8438
	.7874	20.00
51/64	.796875	20.2407
13/16	.8125	20.6375
	.82677	21.00
53/64	.828125	21.0344
27/32	.84375	21.4313
55/64	.859375	21.8282
	.86614	22.00
7/8	.875	22.225
57/64	.890625	22.6219
	.90551	23.00
29/32	.90625	23.0188
59/64	.921875	23.4157
15/16	.9375	23.8125
	.94488	24.00
61/64	.953125	24.2094
31/32	.96875	24.6063
	.98425	25.00
63/64	.984375	25.0032
1	1.0000	25.4000

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