

WROUGHT METALS - DIMENSIONS AND TOLERANCES

GM6160M

1 SCOPE. This standard provides a method of selecting rational or practical metric sizes and tolerances of wrought metals when considering common engineering shapes such as sheet, strip, bands and various bar shapes. It is beyond the scope of this standard to include all speciality items, but only those shapes or forms commonly used in the Corporation. The purpose of listing standard metric sizes and tolerances is to provide a basis for engineering departments to select sizes on a uniform basis that will help control inventory, result in economies, and be readily available to low volume (tonnage) sources such as, tool rooms, maintenance departments, pilot builds, and outside sources.

2 WROUGHT METAL TYPES. At the present time the recommendations in this standard cover only certain wrought forms described above for carbon, high strength low alloy and alloy steels. Tolerances for available forms of high strength low alloy steel are the same as carbon steel, except as noted and are found in applicable carbon steel tolerance tables.

2.1 Other standards that cover sizes and/or tolerances are found elsewhere in the GM Engineering Materials and Processes publication as follows:

Copper Brazes Double Wall Steel	
Tubing.....	GM123M and GM6099M
Electric Resistance Welded Tubing	
(small sizes).....	GM124M
Welded and Seamless Steel Pipe	GM136M
Sink or Mandrel Drawn Butt Welded	
Tubing	GM402M
Aluminum and Aluminum Alloys	Section F
Copper and Copper Alloys	Section F
Spring Wires	Section G

2.2 Other sources for this type of information include the American Iron and Steel Institute, Aluminum Association, American Society for Testing and Materials, Copper Development Association and the Society of Automotive Engineers.

2.3 The following ASTM Standards are one source for soft converted sizes and tolerances not included in this document:

A6 Structural steel plates, shapes, sheet piling and bars.
A480 Stainless steel plate, sheet and strip.
A511 Seamless stainless steel tubing.
A512 Cold drawn butt weld carbon steel tubing.
A513 Electric resistance welded carbon and alloy steel tubing.
A519 Seamless carbon and alloy steel tubing.
A554 Welded stainless steel tubing.
A787 Electric resistance welded metallic coated carbon steel tubing.

3 SELECTION PROCEDURE. This standard includes a series of sizes for the various wrought shapes described above, which will aid in the standardization and availability of

these products. These sizes were developed from national and international metric standards, metric country practices, and anticipated corporate needs. When selecting a size for design purposes, survey these size series thoroughly and attempt to specify a size from these lists. Some of the size series tables list figures in bold type, which signifies the preferred size of ANSI national standards. The regular type is the second preference while those in parentheses are third preference sizes. It is anticipated that the preferred sizes will be more readily available from supply centers. Some designs are such that none of the listed sizes are applicable. It is then permissible to employ nonrecommended sizes, however, all other alternates should be investigated and available determined before selecting nonrecommended sizes.

3.1 SIZE SELECTIONS. Size selections are listed in the following tables. These listings do not imply that these materials are available in all sizes or produced by specific manufacturing processes. The number of decimals shown in the size tables have no significance. The accuracy or number of significant figures is determined by design parameters, applicable tolerances, and standard drafting practice.

Table	Description
1	Thickness of sheet, strip, bands, plate and flat bars
2	Diameter of round wire and bar
3	Distance across flats of square bars
4	Distance across flats of hexagon bars
5	Width of flat products
6	Outside diameter of tubing
7	Wall thickness of tubing
8	Length

3.1.1 The above preferred size tables are applicable to all common wrought metal forms including aluminum, copper and steel.

4 TOLERANCES. The amount and direction of tolerances vary with the type of product. In general all sheet steel tolerances should be applied in a total plus direction. Sometimes all plus tolerances are applied to products that usually are designated plus and minus. For these products, subtract the minus tolerance from the nominal size, then specify as minimum. Thickness and width tolerances for flat rolled products and diameter, distance across flats, and thickness/width combinations of bar tolerances are tabulated. Some tolerance tables include more than one product and size availability may differ for each. Also the tables may not reflect a minimum or maximum dimension. In all cases tolerances only apply to the size range for which a particular product is available. Length, flatness, special edges, camber, circles etc are not tabulated since these parameters are not generally required for design. Refer to the applicable specification referenced in the Tables and Section 2 for these other tolerances.

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4.1 INDEX, TOLERANCE TABLES.

	Table Numbers	
	Thickness Diameter of Across Flats	Width
A. Sheet and Strip, Carbon and HSLA Steel:		
1 Sheet, cold rolled, plus long terne and electroplated	9	13
2 Sheet, galvanized and aluminum/zinc alloy and aluminum coated	10	13
3 Sheet and bands, hot rolled	11/12	13/14
4 Strip, cold rolled	15	18/19/20
5 Strip, hot rolled	16/21	17
B. Sheet and Strip, alloy steel:		
1 Sheet, cold rolled	22	13
2 Sheet, hot rolled	23	14
3 Strip, cold rolled	24	18/19/20
4 Strip, hot rolled	25	27
C. Bars, Carbon and Alloy Steel:		
1 Cold drawn or turned and polished, carbon	28	28
2 Cold drawn or turned and polished, alloy	29	29
3 Cold drawn, ground and polished or turned, ground and polished, rounds	30	-
4 Hot rolled, hexagon and octagon	31	-
5 Hot rolled, round and square	32	-
6 Hot rolled, flat	33	23

5 PRECISION.

5.1 The various steel forms available are specified in millimeters (except coil lengths) to the following precision:

Forms	Precision
Thickness	
Sheet, Strip, Tin mill products	.XX
Plate, Bar flats	.X
Width	
Strip	.X
Sheet, Plate, Bar flats, Tin mill products	X.
Diameter or Cross Section	
Bar, Rod	.X
Wire	.XX
Fine wire	.XXX
Tubing	
Wall thickness	.XX
Inside or outside diameter	.XX
Length, all products (see NOTE)	X.

NOTE: Cut lengths specified in mm and coil lengths if specified meters.

5.1.1 The recommended width increments for sheet steel products are multiples of 25 mm for widths over 600 mm. Widths under 600 mm cut from wider sheets are specified to exact requirements.

5.2 The various aluminum forms available are specified in millimeters to the following precision:

Forms	Precision
Thickness	
Sheet, plate thru 50 mm	.XX
Plate over 50 mm	.XX*
Width	
Flat Sheet	X.
Slit coiled sheet	
Thru 50 mm	.XX
Over 50 thru 250 mm	.XX*
Over 250 mm	X.
Plate	X.
Diameter or Cross Section	
Wire, rod, bar, shapes and tube	.XX
Cut lengths	X.

*Multiples of 0.05 mm

6 COATINGS. Some wrought steel shapes are available with various coatings including galvanized, long terne, aluminum/zinc, aluminum, electrolytic zinc or tin, and paint. Table 34 is a list of coating thicknesses (except paint) available for steel forms. Customary unit coating weights are included for reference only. Metric coating thicknesses are not direct conversion and in some cases may vary with customary unit practice. Metric coating thicknesses for some products may require negotiation between the purchaser and supplier.

7 GENERAL TOLERANCE COVERSION.

7.1 Tolerances for the products listed in the tables that are part of this standard will be applicable for most designs, but due to the variance of tolerances for different products, it will be necessary in some cases, for those tolerances not listed, to convert present inch tolerances to equivalent metric units. However, converting these tolerances generally result in numbers that are either impractical to measure or more limiting than required. Table 35 lists recommended conversions from inches to millimeters. This table is only intended as a guide for

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tolerance conversions of wrought metal products and is not to be used for other purposes since the metric values shown are not exact or rounded per established procedures.

7.2 Conversion to metric linear units from customary units generally results in one less decimal place while maintaining similar accuracy. Therefore when converting from thousandths of an inch to mm, select an applicable metric dimension to two decimal places, for example, when converting 0.001 inch, use 0.03 mm rather than 0.025 mm. Where the table does not depict the exact inch size required for conversion, use the next higher or lower metric unit as applicable or use alternate metric dimensions so designated for fractions wherever possible as

shown in the table, but keep in mind that the significant figures for fractional numbers vary depending on application. In all cases it must be ascertained that the metric units employed are acceptable to the industry supplying the material.

8 GENERAL. The data presented includes only products that have been hard converted to SI units from customary units by national standards organizations. Other products will be added when metricated if a need exists.

9 GENERAL INFORMATION. This standard first published October 1973; revised January 1977. Revised September 1983.

TABLE 1 - RECOMMENDED THICKNESSES - STEEL SHEET, STRIP, BANDS, FLAT BARS AND PLATE¹

mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
0.05	0.25	0.7	(1.3)	(2.4)	4.0	8	25	60	160
0.06	0.28	(0.75)	1.4	2.5	4.2	9	28	70	180
0.08	0.30	0.8	(1.5)	(2.6)	4.5	10	30	80	200
0.10	0.35	(0.85)	1.6	2.8	4.8	11	32	90	250
0.12	0.40	0.9	(1.7)	3.0	5	12	35	100	300
0.14	0.45	(0.95)	1.8	3.2	5.5	14	38	110	
0.16	0.50	1.0	(1.9)	(3.4)	6	16	40	120	
0.18	0.55	(1.05)	2.0	3.5	(6.5)	18	45	130	
0.20	0.60	1.1	(2.1)	(3.6)	7	20	50	140	
0.22	0.65	1.2	2.2	3.8	(7.5)	22	55	150	

¹Bold face values first preference, regular type second preference and if applicable, third preference is shown in parentheses. All preferred sizes listed are based on ANSI B32.3-1977 and ANSI B32.4M-1980.

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TABLE 2 - RECOMMENDED SIZES - ROUND BARS AND WIRE¹

mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
0.020	0.080	0.35	(1.3)	3.5	(8.5)	20	40	(95)	250
0.022	0.090	0.40	1.4	(3.8)	9	21	42	100	280
0.025	0.100	0.45	1.6	4.0	(9.5)	22	45	110	300
0.028	0.110	0.50	1.8	(4.2)	10	23	48	120	320
0.030	0.12	0.55	2.0	4.5	11	24	50	130	
0.035	0.14	0.60	(2.1)	(4.8)	12	25	55	140	
0.040	0.16	0.65	2.2	5.0	13	26	60	150	
0.045	0.18	0.70	(2.4)	5.5	14	28	65	160	
0.050	0.20	0.8	2.5	6	15	30	70	170	
0.055	0.22	0.9	(2.6)	6.5	16	32	75	180	
0.060	0.25	1.0	2.8	7	17	35	80	190	
0.065	0.28	1.1	3.0	(7.5)	18	(36)	(85)	200	
0.070	0.30	1.2	(3.2)	8	19	38	90	220	

¹Bold face values first preference, regular type second preference and if applicable, third preference is shown in parentheses. All preferred sizes listed are based on ANSI B32.3-1977 and ANSI B32.4M-1980.

TABLE 3 - RECOMMENDED DISTANCE ACROSS FLATS - SQUARE BARS¹

mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
3.0	8	16	25	40	55	80	110	160	220
4.0	10	18	30	45	60	90	120	180	250
5.0	12	20	35	50	70	100	140	200	300
6.0	14	22							

¹Bold face values first preference, regular type second preference and if applicable, third preference is shown in parentheses. All preferred sizes listed are based on ANSI B32.3-1977 and ANSI B32.4M-1980.

TABLE 4 - RECOMMENDED DISTANCE ACROSS FLATS - HEXAGON AND OCTAGON BARS¹

mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
3.0	6.0	12	16	21	30	41	60	90	120
4.0	7.0	13	17	22	32	46	70	100	135
5.0	8.0	14	18	24	34	50	80	110	150
5.5	10	15	19	27	36	55			

¹Bold face values first preference, regular type second preference and if applicable, third preference is shown in parentheses. All preferred sizes listed are based on ANSI B32.3-1977 and ANSI B32.4M-1980.

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TABLE 5 - RECOMMENDED WIDTH - FLAT PRODUCTS^{1, 2}

mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
10	30	50	80	120	160	250	500	1200	3000
12	35	55	90	130	180	280	600	1500	3500
16	40	60	100	140	200	300	800	2000	4000
20	45	70	110	150	225	400	1000	2500	5000
25									

¹Bold face values first preference, regular type second preference and if applicable, third preference is shown in parentheses. All preferred sizes listed are based on ANSI B32.3-1977 and ANSI B32.4M-1980.

²See also 5.1 for corporate practice of specifying widths of steel sheets.

TABLE 6 - RECOMMENDED OUTSIDE DIAMETERS - ROUND TUBING¹

mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1.0	4	14	25	38	55	80	110	160	220
1.2	5	15	28	40	60	85	120	170	250
1.6	6	16	30	42	65	90	130	180	280
2.0	8	18	32	45	70	95	140	190	300
2.5	10	20	35	50	75	100	150	200	320
3	12	22							

¹All sizes listed are based on ANSI B32.5-1977.

TABLE 7 - RECOMMENDED WALL THICKNESS - ROUND TUBING¹

mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
0.05	0.20	0.70	1.4	2.5	5.0	9	16	28	40
0.06	0.25	0.80	1.5	2.8	5.5	10	18	30	42
0.08	0.30	0.9	1.6	3.0	6	11	20	32	45
0.10	0.40	1.0	1.8	3.5	7	12	22	35	50
0.12	0.50	1.1	2.0	4.0	8	14	25	38	60
0.16	0.60	1.2	2.2	4.5					

¹All sizes listed are based on ANSI B32.5-1977.

TABLE 8 - RECOMMENDED LENGTHS FOR ALL PRODUCTS

mm	mm	mm	mm	mm	mm	mm	mm
1000 ¹	2500	3500	4000	5000	8000	12 000	16 000
2000	3000	3700 ²	4500	6000	10 000	14 000	18 000

¹Not applicable to flat products.

²Bar products only.

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TABLE 9 - THICKNESS TOLERANCES¹ COLD ROLLED CARBON AND HSLA STEEL SHEET AND LONG TERNE, ELECTROLYTIC TIN AND ELECTROLYTIC ZINC COLD ROLLED CARBON STEEL SHEET

Specified Width, mm		Thickness Tolerance, Plus Only, mm for Specified Minimum Thickness ² , mm				
Over	Thru	Thru 0.4	Over 0.4 Thru 1.0	Over 1.0 thru 1.2	Over 1.2 Thru 2.5	Over 2.5 Thru 4.0
50	1800	0.10 ³	0.15	0.20	0.25	0.30 ⁴
1800	2000	-	0.15	0.20	0.30	0.35
2000	-	-	0.30	0.30	0.35	0.40

¹References: Long Terme, ASTM A308; Electrolytic Zinc, ASTM A591; Electrolytic Tin, ASTM A599; Uncoated Steel, ASTM A568M.

²0.50 mm minimum thickness for high strength low alloy steel.

³The tolerance for electrolytic zinc below 0.4 mm is plus 0.08 mm for widths to 1500 mm.

⁴Not applicable to widths under 300 mm.

TABLE 10 - THICKNESS TOLERANCES¹ GALVANIZED, ALUMINIZED AND ALUMINUM/ZINC ALLOY COLD ROLLED CARBON STEEL SHEET

Specified Width, mm		Thickness Tolerance, Plus Only, mm For Specified Minimum Thickness, mm					
Over	Thru	Thru 0.4	Over 0.4 Thru 1.0	Over 1.0 Thru 1.5	Over 1.5 Thru 2.0	Over 2.0 Thru 2.5	Over 2.5 Thru 5.0
-	1500	0.15	0.20	0.25	0.30	0.40	0.45
1500	-	-	0.20	0.25	0.30	0.45	0.45

¹References: Galvanized, ASTM A525M; Aluminized, ASTM A463; Aluminum/Zinc, ASTM A792.