



Designation: B 107/B 107M – 94

Standard Specification for Magnesium-Alloy Extruded Bars, Rods, Shapes, Tubes, and Wire¹

This standard is issued under the fixed designation B 107/B 107M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope *

1.1 This specification covers magnesium-alloy extruded bars, rods, shapes, tubes, and wire of the composition given in Table 1.

1.2 The values stated in either inch-pound or SI units are to be regarded separately as standards. The SI units are shown in brackets or in separate tables or columns. The values stated in each system are not exact equivalents; therefore, each system must be used independent of the other. Combining values from the two systems may result in nonconformance with the specification.

1.3 Unless the order specifies the “M” specification designation, the material shall be furnished to the inch-pound units.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of order acceptance form a part of this specification to the extent referenced herein.

2.2 ASTM Standards:

B 275 Practice For Codification of Certain Nonferrous Metals and Alloys, Cast and Wrought²

B 296 Practice for Temper Designations of Magnesium Alloys, Cast and Wrought²

B 557 Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products²

B 557M Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)²

B 660 Practices for Packaging/Packing of Aluminum and Magnesium Products²

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications³

E 35 Test Methods for Chemical Analysis of Magnesium and Magnesium Alloys⁴

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys For Determination of Chemical Composition⁴

E 527 Practice for Numbering Metals and Alloys (UNS)⁵

2.3 *Federal Standards:*⁶

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

Fed. Std. No. 184 Identification Marking of Aluminum, Magnesium and Titanium

2.4 *Military Standard:*⁶

MIL-STD-129 Marking for Shipment and Storage (Military Agencies)

3. Terminology

3.1 Definitions:

3.1.1 *extruded bar*—an extruded solid section, long in relation to its cross-sectional dimensions, having a symmetrical cross section that is square or rectangular with sharp or rounded corners or edges, or is a regular hexagon or octagon, and whose width or greatest distance between faces is 0.375 in. [10 mm] or greater.

3.1.2 *extruded rod*—a solid extruded product 0.375 in. [10 mm] or greater in diameter that is long in relation to cross section.

3.1.3 *extruded shape*—a hollow or solid extruded section, long in relation to its cross-sectional dimensions, whose cross section is other than that of wire, rod, bar, or tube.

3.1.4 *extruded tube*—an extruded hollow section, long in relation to its cross-sectional dimensions, which is symmetrical and is round, square, rectangular, hexagonal, octagonal or elliptical with sharp or rounded corners, and has a uniform wall thickness except as affected by corner radii.

3.1.5 *extruded wire*—an extruded solid sectional long in relation to its cross-sectional dimensions, having a symmetrical cross section that is square or rectangular with sharp or rounded corners or edges, or is round, hexagonal or octagonal, and whose diameter, width or greatest distance between parallel faces is less than 0.375 in. [through 10 mm].

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *producer*—the primary manufacturer of the material.

3.2.2 *supplier*—includes only the category of jobbers and distributors as distinct from producers.

4. Ordering Information

4.1 Orders for material to this specification shall include the

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² *Annual Book of ASTM Standards*, Vol 02.02.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ *Annual Book of ASTM Standards*, Vol 03.05.

⁵ *Annual Book of ASTM Standards*, Vol 01.01.

⁶ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094. Attn: NPODS.

*A Summary of Changes section appears at the end of this standard.

TABLE 1 Chemical Requirements^A

NOTE 1—Analysis shall regularly be made only for the elements specifically mentioned in this table. If, however, the presence of other elements is suspected or indicated in the course of routine analysis to be in amounts greater than the specified limits, further analysis shall be made to determine that the total of these other elements is not in excess of the limits specified in the last column of the table.

NOTE 2—The following applies to all specified limits in this table: For purposes of acceptance and rejection, an observed value or a calculated value obtained from analysis should be rounded-off to the nearest unit in the last right-hand place of figures used in expressing the specified limit.

Alloy ^B		Composition, %										
UNS No.	ASTM No.	Magnesium	Aluminum	Manganese	Zinc	Zirconium, min	Silicon	Copper	Nickel	Iron	Calcium	Other ^C Impurities
M11311	AZ31B	remainder	2.5–3.5	0.20–1.0	0.6–1.4	...	0.10	0.05	0.005	0.005	0.04	0.30
M11312	AZ31C	remainder	2.4–3.6	0.15–1.0 ^D	0.50–1.5	...	0.10	0.10	0.03	...	...	0.30
M11610	AZ61A	remainder	5.8–7.2	0.15–0.5	0.40–1.5	...	0.10	0.05	0.005	0.005	...	0.30
M11800	AZ80A	remainder	7.8–9.2	0.12–0.5	0.20–0.8	...	0.10	0.05	0.005	0.005	...	0.30
M15100	M1A	remainder	...	1.2–2.0	...	...	0.10	0.05	0.01	...	0.30	0.30
M16400	ZK40A	remainder	...	...	3.5–4.5	0.45	...	...	...	...	...	0.30
M16600	ZK60A	remainder	...	...	4.8–6.2	0.45	...	...	...	...	...	0.30

^A Limits are in weight percent maximum unless shown as a range or otherwise stated.

^B These alloy designations were established in accordance with Practice B 275 (see also Practice E 527).

^C Includes listed elements for which no specific limit is shown.

^D Manganese minimum limit need not be met if iron is 0.005 %, or less.

following information:

- 4.1.1 This specification number,
- 4.1.2 Quantity in pieces or pounds [kilograms],
- 4.1.3 Alloy (Section 6),
- 4.1.4 Temper (Section 7),
- 4.1.5 Nominal cross-sectional dimensions as follows:
 - 4.1.5.1 For rod and round wire—diameter,
 - 4.1.5.2 For square corner bars and wire—depth and width,
 - 4.1.5.3 For sharp cornered hexagonal or octagonal bars and wire—distance across flats,
 - 4.1.5.4 For round tube—outside or inside diameter and wall thickness,
 - 4.1.5.5 For square or sharp cornered other than round tube—distance across flats and wall thickness,
 - 4.1.5.6 For round cornered bars and wire; shapes; tube other than round, square, rectangular, hexagonal or octagonal with sharp corners—drawing required,
- 4.1.6 Length,
- 4.1.7 Surface finish (see 9.2),
- 4.1.8 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (Section 10),
- 4.1.9 Whether certification is required (Section 12),
- 4.1.10 Whether marking for identification is required (Section 13 and Practices B 660), and
- 4.1.11 Whether special packaging is required for shipment (Section 14).

5. Quality Assurance

5.1 *Responsibility for Inspection*— Unless otherwise specified in the contract or purchase order, the producer or supplier is responsible for the performance of all inspection and test requirements specified herein. Except as otherwise specified in the contract or order, the producer or supplier may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections

are deemed necessary to assure that material conforms to prescribed requirements.

6. Chemical Composition

6.1 *Limits*—The bars, rods, shapes, tubes, or wire shall conform to the chemical requirements in Table 1.

6.2 *Number of Samples*—The number of samples taken for determination of chemical composition shall be as follows:

6.2.1 When samples are taken at the time the ingots are poured, at least one sample shall be taken for each group of ingots poured simultaneously from the same source of molten metal.

6.2.2 Unless compliance is established by 6.2.1, sampling of the finished product shall be in accordance with Practice E 55. One sample shall be taken for each 4000 lb (2000 kg) or less of material comprising the lot, except that not more than one analysis shall be required per piece.


6.3 *Methods of Chemical Analysis*—Any suitable method of chemical analysis may be used. In case of dispute, the analysis shall be made by methods given in Test Methods E 35 or any other standard methods of analysis approved by ASTM unless some other method is agreed upon.

7. Tensile Requirements

7.1 *Limits*—The bars, rods, shapes, tubes, and wire shall conform to the tensile properties requirements in Table 2 unless other agreement is made between producer or supplier and purchaser. Properties for sizes and tempers not shown in Table 2 shall be as agreed by producer or supplier and purchaser.

7.2 *Number of Specimens*—From material having nominal weight of less than 1 lb/linear ft [through 1.7 kg/linear m], one tension test sample shall be taken for each 1000 lb [500 kg] or fraction thereof in the shipment. For material having a nominal weight of 1 lb/linear ft [over 1.7 kg/linear m] or more, one tension test shall be taken for each 1000 ft [300 m] or fraction thereof in the shipment. Other procedures for selecting samples may be employed if agreed upon by the seller and the purchaser.

7.3 Geometry of test specimens and the location in the

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product from which they are taken shall be as specified in Test Methods B 557 and B 557M.

7.4 *Test Methods*—The tension tests shall be made in accordance with Test Methods B 557 and B 557M.

7.5 *Retests*—If any tension specimen fails to conform to the requirements prescribed in Table 2, two additional specimens shall be selected and tested from other bars, rods, shapes, tubes,

or wire in the lot. If either of these specimens fails to conform to the applicable requirements, the material may be rejected. If, however, the failure of the specimens to conform to the requirements is the result of an inadequate thermal treatment, the material may be reheat treated and resampled in accordance with 7.2.

TABLE 2 Tensile Requirements

NOTE—For purposes of determining conformance with this specification, each value for tensile strength and yield strength shall be rounded to the nearest 100 psi and each value for elongation shall be rounded to the nearest 0.5 %, both in accordance with the rounding method of Practice E 29.

Alloy ^A		Temper ^A	Form	Specified Diameter or Thickness	Over-Through	Specified Cross-Sectional Area,	Tensile Strength,		Yield Strength (0.2 % offset),		Elongation in 2 in. [50 mm] or 4 × Dia., min, % ^{B,C}
UNS No.	ASTM No.			in. ^{D,E}	[mm]	in. ² or OD of Tube, in.	ksi	[MPa]	ksi	[MPa]	
M11311	AZ31B	F	bars, rods, shapes, and wire	0.249 and under	[...-6.30]	all	35.0	[240]	21.0	[145]	7
				0.250-1.499	[6.30-40.00]	all	35.0	[240]	22.0	[150]	7
				1.500-2.499	[40.00-60.00]	all	34.0	[235]	22.0	[150]	7
				2.500-4.999	[60.00-130.00]	all	32.0	[220]	20.0	[140]	7
			hollow shapes	all	all	32.0	[220]	16.0	[110]	8	
			tubes	0.028-0.250	[0.70-6.30]	6.000 [150.00] and under	32.0	[220]	20.0	[140]	8
				0.250-0.750	[6.30-20.00]		32.0	[220]	16.0	[110]	4
M11610	AZ61A	F	bars, rods, shapes, and wire	0.249 and under	[...-6.30]	all	38.0	[260]	21.0	[145]	8
				0.250-2.499	[6.30-60.00]	all	40.0	[275]	24.0	[165]	9
				2.500-4.999	[60.00-130.00]	all	40.0	[275]	22.0	[150]	7
				hollow shapes	all	all	36.0	[250]	16.0	[110]	7
			tubes	0.028-0.750	[0.70-20.00]	6.000 [150.00] and under	36.0	[250]	16.0	[110]	7
M11800	AZ80A	F	bars, rods, shapes, and wire	0.249 and under	[...-6.30]	all	43.0	[295]	28.0	[195]	9
				0.250-1.499	[6.30-40.00]	all	43.0	[295]	28.0	[195]	8
				1.500-2.499	[40.00-60.00]	all	43.0	[295]	28.0	[195]	6
				2.500-4.999	[60.00-130.00]	all	42.0	[290]	27.0	[185]	4
M11800	AZ80A	T5	bars, rods, shapes, and wire	0.249 and under	[...-6.30]	all	47.0	[325]	30.0	[205]	4
				0.250-2.499	[6.30-60.00]	all	48.0	[330]	33.0	[230]	4
				2.500-4.999	[60.00-130.00]	all	45.0	[310]	30.0	[205]	2
M15100	M1A	F	bars, rods, shapes, and wire	0.249 and under	[...-6.30]	all	30.0	[205]	^F	[13]	2
				0.250-1.499	[6.30-40.00]	all	32.0	[220]	^F	[13]	3
				1.500-2.499	[40.00-60.00]	all	32.0	[220]	^F	[13]	2
				2.500-4.999	[60.00-130.00]	all	29.0	[200]	^F	[13]	2
			hollow shapes	all	all	28.0	[195]	^F	[13]	2	
			tubes	0.028-0.750	[0.70-20.00]	6.000 [150.00] and under	28.0	[195]	^F	[13]	2
M16400	ZK40A	T5	bars, rods, shapes, and wire	all		4.999 [3200] and under	40.0	[275]	37.0	[255]	4.0
			hollow shapes	all	all	40.0	[275]	37.0	[255]	4.0	
			tubes	0.062-0.500	[1.60-12.50]	3.000 [80.00] and under	40.0	[275]	36.0	[255]	4.0
M16600	ZK60A	F	bars, rods, shapes, and wire	all		4.999 [3200] and under	43.0	[295]	31.0	[215]	5

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TABLE 2 *Continued*

Alloy ^A		Temper ^A	Form	Specified Diameter or Thickness	Over-Through	Specified Cross-Sectional Area, in. ² or OD of Tube, in.	Tensile Strength, min		Yield Strength (0.2 % offset), min		Elongation in 2 in. [50 mm] or 4 × Dia., min, % ^{B,C}		
UNS No.	ASTM No.			in. ^{D,E}	[mm]		ksi	[MPa]	ksi	[MPa]			
						5.000–39.999 [3201–26 000]	43.0	[295]	31.0	[215]	4		
			hollow shapes	all		all	40.0	[275]	28.0	[195]	5		
			tubes	0.028–0.750	[0.70–20.00]	3.000 [80.00] and under	40.0	[275]	28.0	[195]	5		
M16600	ZK60A	T5	bars, rods, shapes, and wire	all		4.999 [3200] and under	45.0	[310]	36.0	[250]	4		
								5.000–24.999 [3201–16 000]	45.0	[295]	31.0	[215]	6
								25.000–39.999 [16 001–26 000]	43.0				6
			hollow shapes	all		all	46.0	[315]	38.0	[260]	4		
			tubes	0.028–0.250	[0.70–6.30]	3.000 [80.00] and under	46.0	[315]	38.0	[260]	4		
				0.094–1.188	[2.50–30.00]	3.001 [80.00]–8.500 [215]	44.0	[305]	33.0	[230]	4		

^A See Practice B 296.

^B Elongation of full-section and machined sheet-type specimens is measured in 2 in. [50 mm] of machined round specimens, in 4 × specimen dia. [5 × dia. in metric].

^C For material of such dimensions that a standard test specimen cannot be obtained, for wire less than 0.125 in. diameter [3.2 mm diameter], or for material thinner than 0.062 in. [1.60 mm] the test for elongation is not required.

^D Intermediate dimensions shall be rounded off to the third decimal place in accordance with Practice E 29.

^E Wall thickness of tubes.

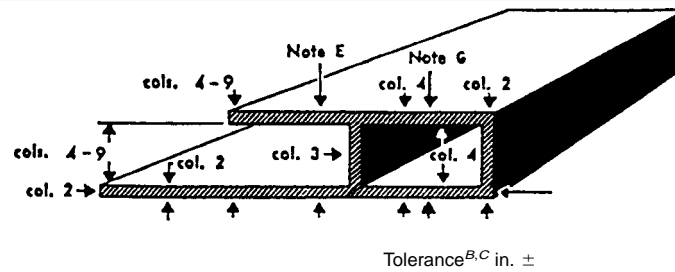
^F Not required.

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TABLE 3 Cross-Sectional Tolerances for Bars, Rods, Shapes, and Wire^A

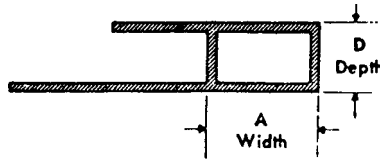


Specified Dimension, in.	Metal Dimensions				Space Dimensions			
	Allowable Deviation from Specified Dimension Where 75% or More of the Dimension is Metal ^D				Allowable Deviation from Specified Dimension Where More than 25% of the Dimension is Space ^{E,F}			
	All Except Those Covered By Column 3	Wall Thickness ^{G,H,I} Completely Enclosing Space 0.11 in. ² and Over (Eccentricity)	At Dimensioned Points 0.250–0.624 in. from Base of Leg	At Dimensioned Points 0.625–1.249 in. from Base of Leg	At Dimensioned Points 1.250–2.499 in. from Base of Leg	At Dimensioned Points 2.500–3.999 in. from Base of Leg	At Dimensioned Points 4.000–5.999 in. from Base of Leg	At Dimensioned Points 6.000–8.000 in. from Base of Leg
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
Circumscribing Circle Sizes Less than 10 in. in Dia								
0.124 and under	0.006	±10 % of specified dimension:	0.010	0.012	...	...	...	...
0.125–0.249	0.007	±0.060 max	0.012	0.014	0.016	...	...	...
0.250–0.499	0.008	0.010 min	0.014	0.016	0.018	0.020	...	...
0.500–0.749	0.009		0.016	0.018	0.020	0.022	...	...
0.750–0.999	0.010		0.018	0.020	0.022	0.025	0.30	...
1.000–1.499	0.012		0.021	0.023	0.026	0.030	0.035	...
1.500–1.999	0.014		0.024	0.026	0.031	0.036	0.042	0.050
2.000–3.999	0.024		0.034	0.038	0.048	0.057	0.068	0.080
4.000–5.999	0.034		0.044	0.050	0.064	0.078	0.094	0.110
6.000–7.999	0.044		0.054	0.062	0.082	0.099	0.120	0.140
8.000–9.999	0.054		0.064	0.074	0.100	0.120	0.145	0.170
Circumscribing Circle Sizes 10 in. in Dia and Over								
0.124 and under	0.014	±15 % of specified dimension:	0.018	0.020	...	...	...	...
0.125–0.249	0.015	±0.090 max	0.019	0.022	0.028	...	...	...
0.250–0.499	0.016	±0.015 min	0.020	0.024	0.030	0.050	...	...
0.500–0.749	0.017		0.022	0.027	0.040	0.060	...	...
0.750–0.999	0.018		0.023	0.030	0.050	0.070	0.090	...
1.000–1.499	0.019		0.024	0.034	0.060	0.080	0.100	...
1.500–1.999	0.024		0.034	0.044	0.070	0.090	0.110	0.170
2.000–3.999	0.034		0.044	0.054	0.080	0.100	0.120	0.180
4.000–5.999	0.044		0.054	0.064	0.090	0.110	0.130	0.190
6.000–7.999	0.054		0.064	0.074	0.100	0.120	0.140	0.200
8.000–9.999	0.064		0.074	0.084	0.110	0.130	0.150	0.210
10.000–11.999	0.074		0.084	0.094	0.120	0.140	0.160	0.220
12.000–13.999	0.084		0.094	0.104	0.130	0.150	0.170	0.230
14.000–15.999	0.094		0.104	0.114	0.140	0.160	0.180	0.240
16.000–17.999	0.104		0.114	0.124	0.150	0.170	0.190	0.250
18.000–19.999	0.114		0.124	0.134	0.160	0.180	0.200	0.260
20.000–21.999	0.124		0.134	0.144	0.170	0.190	0.210	0.270
22.000–23.999	0.134		0.144	0.154	0.180	0.200	0.220	0.280

^A These tolerances are applicable to the average shape. Wider tolerances may be required for some shapes and closer tolerances may be possible for others.
^B The tolerances applicable to a dimension composed of two or more component dimensions is the sum of the tolerances of the component dimensions if all of the component dimensions are indicated.
^C When a tolerance is specified other than as an equal bilateral tolerance, the value of the standard tolerance is that which would apply to the mean of the maximum dimensions permissible under the tolerance.
^D These tolerances do not apply to space dimensions such as dimensions X and Z of the example even when Y is 75 % or more of X. For the tolerance applicable to dimensions X, use Col. 4, 5, 6, 7, 8 or 9, dependent on distance A and the circumscribing circle diameter.
^E At points less than 0.250 in. from base of leg the tolerances in Column 2 are applicable.

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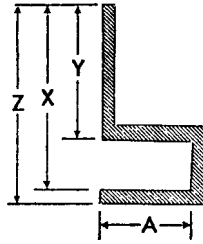
^F The following tolerances apply where the space is completely enclosed (hollow shapes): For the width (*A*) the tolerance is the value shown in Column 4 for the depth (*D*), the tolerance is the value shown in Column 4 for the width (*A*). In no case is the tolerance for either width or depth less than at the corners (Column 2, metal dimensions).



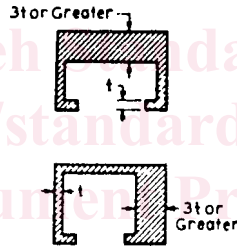
Example—Hollow shape having 1 by 3 in. rectangular outside dimensions and having a circumscribing circle diameter less than 10 in.: width tolerance is ± 0.024 in. and depth tolerance ± 0.034 in. (Tolerances at corners, Column 2, metal dimensions, are ± 0.024 in. for the width and ± 0.012 in. for the depth.)

^G Where dimensions specified are outside and inside, rather than wall thickness itself, the allowable deviation (eccentricity) given in Column 3 applies to mean wall thickness (mean wall thickness is the average of two wall thickness measurements taken at opposite sides of the void).

^H In the case of Class 1 Hollow Shapes the standard wall thickness tolerance for extruded round tube is applicable. (A Class 1 Hollow Shape is one whose void is round and 1 in. or more in diameter and whose weight is equally distributed on opposite sides of two or more equally spaced axes.)



^I Tolerance applicable to the wall thickness enclosing the void of hollow and semihollow shapes is subject to negotiation when the nominal thickness of one wall is three times or greater than that of the opposite wall.



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