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ASME B18.30.1M-2000

OPEN-END BLIND RIVETS WITH BREAK MANDRELS (METRIC SERIES)

AN AMERICAN NATIONAL STANDARD



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Date of Issuance: June 30, 2000

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FOREWORD

In 1994, ASME established the B18.30 subcommittee. This subcommittee was initially formed to develop U.S. standards for blind rivets. After the first meeting however, it was recommended that the subcommittee should develop standards for all blind fasteners.

The first endeavor by this subcommittee was to create U.S. standards for metric blind rivets, followed by U.S. standards for inch blind rivets. It was further recommended that the U.S. committee consider input based on the International Standards Organization (ISO) and the Industrial Fastener Institute (IFI). The latter organization was the first to establish well-documented, dimensional and mechanical properties for blind rivets. Therefore, much of the data in the IFI standards was used to prepare this standard.

ASME B18.30.1M-2000 was approved by the American National Standards Institute (ANSI) on February 29, 2000.

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Standardization of Bolts, Nuts, Rivets, Screws, Washers, and Similar Fasteners

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Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings which are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

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OPEN-END BLIND RIVETS WITH BREAK MANDRELS (METRIC SERIES)

1 INTRODUCTORY NOTES

1.1 Scope

This Standard establishes the dimensional, mechanical, and performance requirements of open-end blind rivets with break mandrels (metric series).

1.2 Dimensions

All dimensions in this Standard are in millimeters (mm), unless stated otherwise.

1.3 Options

Options, if specified, shall be at the discretion of the supplier, unless otherwise agreed upon by the supplier and purchaser.

1.4 Terminology

For definitions of terms relating to fasteners or component features thereof used in this Standard, refer to ASME B18.12.

1.5 Referenced Standards

Unless otherwise specified, the reference shall be to the most recent edition at the time of order placement.

ASME B18.12, Glossary of Terms for Mechanical Fasteners

ASME B18.18.1M, Inspection and Quality Assurance for General Purpose Fasteners

ASME B18.24.3, Part Identifying Number (PIN) Code System Standard for B18

ASME B18.30.2M, Mechanical Testing of Blind Rivets (under development)

Publisher: American Society of Mechanical Engineers (ASME International), Three Park Avenue, New York, NY 10016; ASME Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

ASTM A167, Standard Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A493, Standard Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

ASTM A580/A580M, Standard Specification for Stainless Steel Wire

ASTM A638/A638M, Standard Specification for Precipitation Hardening Iron Base Superalloy Bars, Forgings, and Forging Stock for High-Temperature Service

ASTM A853, Standard Specification for Steel Wire, Carbon, for General Use

ASTM B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip

ASTM B152M, Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar (Metric)

ASTM B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire

ASTM B211M, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric)

ASTM B221M, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM B316/B316M, Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods

Publisher: American Society for Testing and Materials (ASTM), 100 Bar Harbor Drive, West Conshohocken, PA 19428-2959

1.6 Comparison with ISO Standards

Blind rivet standards have not been issued by ISO.

2 GENERAL DATA

2.1 Description

Break mandrel blind rivets are pull mandrel type blind rivets where, during the setting operation, the mandrel is pulled into or against the rivet body and breaks at or near the junction of the mandrel shank and its upset end.

2.2 Styles

2.2.1 Protruding Head. A protruding head blind rivet has a rivet head that projects beyond the surface of the assembly after setting. The two styles of protruding heads included in this Standard are regular head, style 1; and large head, style 2 (see Table 1).

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2.2.2 Countersunk Head. A countersunk head blind rivet is one, which after setting, has a head that is essentially flush with the surface of the fastened component. The two styles included in this Standard are 100 deg countersunk head, style 3; and 120 deg countersunk head, style 4 (see Table 2).

3 RIVET DIMENSIONS

Protruding head break mandrel blind rivets style 1 and style 2 shall conform to the dimensions indicated in Table 1. Countersunk head style break mandrel blind rivets style 3 and style 4 shall conform to the dimensions indicated in Table 2.

4 FINISH

Rivets shall have a plain finish (unplated or uncoated) unless otherwise specified. Finishes and coatings for special requirements, such as military usage, should be specified through the appropriate ASTM standards with the agreement of the purchaser.

5 APPLICATION DATA

Recommendations on the selection and application of protruding or countersunk head break mandrel blind rivets are given in Tables 3 and 4 respectively.

5.1 Protruding Head Styles

Recommended drill size, hole size, grip range, and maximum rivet body length are given in Table 3.

5.2 Countersunk Head Styles

Recommended drill size, hole size, grip range, and maximum rivet body length are given in Table 4.

6 GRADES AND MATERIALS

The material combinations of break mandrel blind rivets are designated as grades, with each material combination of rivet body material and mandrel materials as given in Table 5. Grade 20 rivets are not subject to either shear or tensile testing.

7 MECHANICAL AND PERFORMANCE REQUIREMENTS

7.1 Shear Strength

Rivets, except Grade 20, shall have ultimate shear strengths not less than the minimum ultimate shear strengths specified for the applicable size and grade given in Table 6, when tested in accordance with ASME B18.30.2M (when issued).

7.2 Tensile Strength

Rivets, except Grade 20, shall have ultimate tensile strengths not less than the minimum ultimate tensile strengths specified for the applicable size and grade given in Table 6, when tested in accodance with ASME B18.30.2M (when issued).

7.3 Mandrel Break Load

While the rivet is being set, the axially applied load necessary to break the mandrel shall be within the limits specified for the applicable rivet size and grade in Table 7, when tested in accordance with ASME B18.30.2M (when issued).

8 DESIGNATION

Head Style Codes:

P1 = protruding head style 1

P2 = protruding head style 2

C3 = countersunk head style 3

C4 = countersunk head style 4

Head Style – Nominal Rivet Size × Max. Rivet Length, L – Material Grade

EXAMPLE: P1 – 4.8 × 17.8 – 11

This example shows a 4.8 mm diameter rivet with a protruding head of style 1 (Table 1), a maximum length of 17.8 mm (Table 3), and an aluminum alloy body with aluminum alloy mandrel (Table 5).

For a recommended part indentifying numbering system (PIN), see ASME B18.24.3.

9 WORKMANSHIP

Rivets shall be free of burrs, loose scale, seams, notches, sharp edges and corners, and other irregularities

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or detrimental defects that could affect their serviceability.

10 QUALITY ASSURANCE PROVISIONS

Unless otherwise specified by the purchaser, acceptability of rivets shall be based on conformance with the requirements specified in ASME B18.18.1M.

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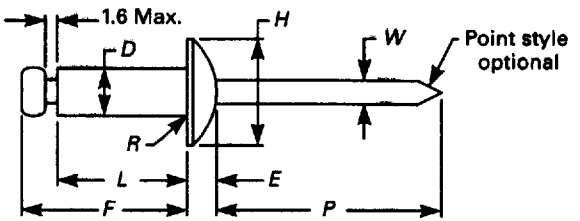

TABLE 1 DIMENSIONS OF REGULAR AND LARGE PROTRUDING HEAD STYLE BREAK MANDREL BLIND RIVETS

Nominal Rivet Size	Body Diameter, *D*		Style 1: Regular Head			Style 2: Large Head			Max. Radius of Fillet, *R* [Note (1)]	Nominal Mandrel Diameter, *W*	Min. Mandrel Protrusion, *P*	Max. Blind Side Protrusion, *F* [Note (2)]
			Head Diameter, *H*		Head Height, *E*	Head Diameter, *H*		Head Height, *E*				
	Max.	Min.	Max.	Min.	Max.	Max.	Min.	Max.				
2.4	2.44	2.29	5.03	4.52	0.81	7.44	6.83	1.02	0.4	1.45	25	L + 2.5
3.2	3.25	3.10	6.65	6.05	1.02	9.91	9.14	1.65	0.5	1.93	25	L + 3.0
4.0	4.04	3.89	8.33	7.52	1.27	12.40	11.38	1.90	0.5	2.41	25	L + 3.5
4.8	4.85	4.65	10.01	9.04	1.52	16.51	15.24	2.34	0.7	2.90	25	L + 4.0
6.3	6.48	6.25	13.33	12.07	2.03	19.81	18.29	2.72	0.8	3.84	25	L + 4.5

GENERAL NOTES:
(a) All dimensions are in millimeters (mm).
(b) For application data, see Table 3.

NOTES:
(1) The junction of head and shank shall have a fillet with a maximum radius as shown. For Grades 40, 50, 51, and 52 rivets, the maximum fillet radius for 4.8 mm rivets shall be 0.9 mm, and for 6.3 mm rivets shall be 1.5 mm.
(2) When computing the blind side protrusion, *F*, the maximum length of rivet, *L*, as given in Table 3 for the applicable grip shall be used. Minimum blind side clearance may be calculated by subtracting the actual grip, *G* (i.e., total thickness of the material to be joined), from the specified blind side protrusion, *F*. (Example: To join two plates, each 2.5 mm thick with a 4.0 mm rivet the minimum blind side clearance necessary to permit proper rivet setting would be *L* + 4.0 – *G*, which is 10.8 + 3.5 – 5.0, and equals 9.3 mm.)

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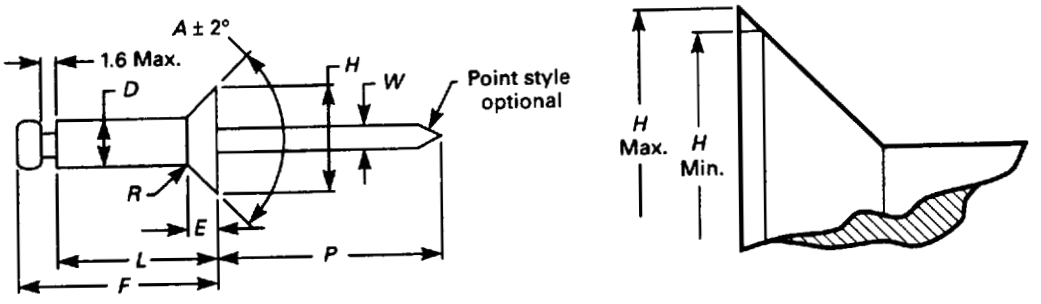

TABLE 2 DIMENSIONS OF 100 deg AND 120 deg COUNTERSUNK HEAD STYLE BREAK MANDREL BLIND RIVETS

Nominal Rivet Size	Body Diameter, D		Style 3: 100 deg Head				Style 4: 120 deg Head				Max. Radius of Fillet, R	Nominal Mandrel Diameter, W	Min. Mandrel Protrusion, P	Max. Blind Side Protrusion, F [Note (3)]
			Nominal Head Angle, A	Head Diameter, H [Note (1)]		Head Height, E [Note (2)]	Nominal Head Angle, A	Head Diameter, H [Note (1)]		Head Height, E [Note (2)]				
	Max.	Min.	deg	Max.	Min.	Ref.	deg	Max.	Min.	Ref.				
2.4	2.44	2.29	100	4.75	4.09	0.99	120	4.75	4.09	0.69	0.5	1.45	25	L + 2.5
3.2	3.25	3.10	100	5.92	5.26	1.14	120	5.92	5.26	0.79	0.7	1.93	25	L + 3.0
4.0	4.04	3.89	100	7.47	6.81	1.47	120	7.47	6.81	1.02	0.8	2.41	25	L + 3.5
4.8	4.85	4.65	100	9.17	8.51	1.85	120	9.17	8.51	1.27	0.9	2.90	25	L + 4.0
6.3	6.48	6.25	100	12.30	11.60	2.50	120	12.30	11.60	1.50	1.0	3.84	25	L + 4.5

GENERAL NOTES:
(a) All dimensions are in millimeters (mm).
(b) For application data, see Table 4.

NOTES:
(1) Maximum head diameter is calculated on normal rivet diameter and nominal head angle extended to sharp corner. Minimum head diameter is absolute.
(2) Head height is given for reference purposes only. Variations in this dimension are controlled by the diameter, *H* and *D*, and the included angle of the head.
(3) When computing the blind side protrusion, *F*, the maximum length of rivet, *L*, as given in Table 4 for the applicable grip shall be used. Minimum blind side clearance may be calculated by subtracting the actual grip, *G* (i.e., total thickness of the material to be joined), from the specified blind side protrusion, *F*. (Example: To join two plates, each 4.7 mm thick with a 4.8 mm rivet, the minimum blind side clearance necessary to permit proper rivet setting would be *L* + 4.5 – *G*, which is 14.6 + 4.0 – 9.4, and equals 9.2 mm.)

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TABLE 3 APPLICATION DATA FOR PROTRUDING HEAD STYLE BREAK MANDREL BLIND RIVETS

Nominal Rivet Size	Recommended Metric Drill Size [Note (1)]	Recommended Hole Size		Grip Range	Max. Rivet Length, *L*
		Min.	Max.		
2.4	2.5	2.46	2.54	0.5 to 3.2	6.4
				3.3 to 6.4	9.5
				6.5 to 9.5	12.7
				9.6 to 12.7	15.9
				12.8 to 15.9	19.1
3.2	3.3	3.28	3.38	0.5 to 1.6	5.4
				1.7 to 3.2	7.0
				3.3 to 4.8	8.6
				4.9 to 6.4	10.2
				6.5 to 7.9	11.7
				8.0 to 9.5	13.4
				9.6 to 12.7	16.5
				12.8 to 15.9	19.7
				16.0 to 19.1	22.9
				19.2 to 22.2	26.0
4.0	4.1	4.06	4.16	0.5 to 3.2	7.6
				3.3 to 4.8	9.2
				4.9 to 6.4	10.8
				6.5 to 9.5	14.0
				9.6 to 12.7	17.2
				12.8 to 15.9	20.3
				16.0 to 19.1	23.5
				19.2 to 22.2	26.7
4.8	4.9	4.88	4.98	0.5 to 3.2	8.3
				3.3 to 4.8	9.8
				4.9 to 6.4	11.5
				6.5 to 9.5	14.6
				9.6 to 12.7	17.8
				12.8 to 15.9	21.0
				16.0 to 19.1	24.2
				19.2 to 22.2	27.3
				22.3 to 25.4	30.5
				25.5 to 28.6	33.7
				28.7 to 31.8	36.7
				31.9 to 34.8	40.8
6.3	6.5	6.53	6.63	0.5 to 3.2	9.5
				3.3 to 6.4	12.7
				6.5 to 9.5	15.9
				9.6 to 12.7	19.1
				12.8 to 15.9	22.2
				16.0 to 19.1	25.4
				19.2 to 22.2	28.6
				22.3 to 25.4	31.8
				25.5 to 28.6	34.9
				28.7 to 31.8	38.1
				31.9 to 34.8	41.3
				34.9 to 38.0	44.5

GENERAL NOTE: All dimensions are in millimeters (mm).

NOTE:

(1) Recommended drill sizes are those that normally produce holes within the recommended hole size limits.

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TABLE 4 APPLICATION DATA FOR COUNTERSUNK HEAD STYLE BREAK MANDREL BLIND RIVETS

Nominal Rivet Size	Recommended Metric Drill Size [Note (1)]	Recommended Hole Size		Grip Range	Max. Rivet Length, *L*
		Min.	Max.		
2.4	2.5	2.46	2.54	2.0 to 3.2	6.4
				3.3 to 6.4	9.5
3.2	3.3	3.28	3.38	2.3 to 3.2	7.0
				3.3 to 4.8	8.6
				4.9 to 6.4	10.2
				6.5 to 7.9	11.7
				8.0 to 9.5	13.4
				9.6 to 12.7	16.5
4.0	4.1	4.06	4.16	3.0 to 4.8	9.2
				4.9 to 6.4	10.8
				6.5 to 9.5	14.0
				9.6 to 12.7	17.2
4.8	4.9	4.88	4.98	3.8 to 4.8	9.8
				4.9 to 6.4	11.5
				6.5 to 9.5	14.6
				9.6 to 12.7	17.8
				12.8 to 15.9	21.0
6.3	6.5	6.53	6.63	3.3 to 6.4	12.7
				6.5 to 9.5	15.9
				9.6 to 12.7	19.1

GENERAL NOTE: All dimensions are in millimeters (mm).

NOTE:

(1) Recommended drill sizes are those that normally produce holes within the recommended hole size limits.

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TABLE 5 GRADES OF BREAK MANDREL BLIND RIVETS

Grade Designation	Rivet Body Material (Referenced Standard)	Mandrel Material (Referenced Standard)
10	Aluminum Alloy 5050 (1.5% Mg) UNS A95050 Aluminum Alloy 6061 UNS A96061 (ASTM B211M)	Aluminum Alloy [Note (1)] (ASTM B316M)
11	Aluminum Alloy 5052 (2.5% Mg) UNS A95052 (ASTM B316M)	Aluminum Alloy [Note (1)] (ASTM B316M)
16	Aluminum Alloy 5154 (3.5% Mg) UNS A95154 (ASTM B221M)	Carbon Steel [Note (1)] (ASTM A853)
18	Aluminum Alloy 5052 (2.5% Mg) UNS A95052 (ASTM B316/B316M)	Carbon Steel [Note (1)] (ASTM A853)
19	Aluminum Alloy 5056 (5.0% Mg) UNS A95056 (ASTM B316/B316M)	Carbon Steel [Note (1)] (ASTM A853)
20	Copper Alloy UNS C11000 (ASTM B152M)	Carbon Steel [Note (1)] (ASTM A853)
26	Aluminum Alloy 5052 (2.5% Mg) UNS A95052 (ASTM B316/B316M)	Stainless Steel [Note (1)] (400 Series) (ASTM A493)
30	Carbon Steel [Note (1)] (ASTM A853)	Carbon Steel [Note (1)] (ASTM A853)
40	Nickel-Copper Alloy UNS N04400 (ASTM B127 or B164)	Carbon Steel [Note (1)] (ASTM A853)
50	Stainless Steel [Note (2)] 302 CRES/UNS S30200 302-HQ-CRES/UNS S30430 304 CRES/UNS S30400 305 CRES/UNS S30500 (ASTM A167 or A493)	Carbon Steel [Note (1)] (ASTM A853)
51	Stainless Steel [Note (2)] 302 CRES/UNS S30200 302-HQ-CRES/UNS S30430 304 CRES/UNS S30400 305 CRES/UNS S30500 (ASTM A167 or A493 or A580/A580M)	Stainless Steel [Note (1)] (300 Series) (ASTM A493)
52	Stainless Steel [Note (2)] 302 CRES/UNS S30200 302-HQ-CRES/UNS S30430 304 CRES/UNS S30400 305 CRES/UNs S30500 (ASTM A167M or A493 or A580/A580M)	A286 UNS S66286 (ASTM A638/A638M)

NOTES:
(1) Referenced ASTM Standards cover most frequently used alloys, however manufacturers may use alternate alloys with permission of purchaser.
(2) Alternate alloys can be substituted with agreement between manufacturer and purchaser.

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TABLE 6 ULTIMATE SHEAR AND TENSILE STRENGTHS OF BREAK MANDREL BLIND RIVETS

Nominal Rivet Size, mm	Min. Ultimate Shear Strength, *N*						Min. Ultimate Tensile Strength, *N*					
	Grades 10, 11, 18	Grades 16, 19	Grade 26	Grade 30	Grade 40	Grades 50, 51, 52	Grades 10, 11, 18	Grades 16, 19	Grade 26	Grade 30	Grade 40	Grades 50, 51, 52
2.4	310	400	...	580	890	1,020	360	530	...	760	1,110	1,250
3.2	530	760	690	1,160	1,560	1,870	670	980	940	1,380	2,000	2,360
4.0	850	1,160	1,160	1,650	2,450	2,890	1,020	1,560	1,510	2,090	3,110	3,650
4.8	1,160	1,690	1,340	2,400	3,560	4,230	1,420	2,220	2,070	3,020	4,450	5,340
6.3	2,050	3,110	...	4,450	6,230	7,560	2,490	4,090	...	5,520	8,230	9,340

GENERAL NOTES:
(a) Grade 20 rivets are not subject to shear and tensile testing.
(b) Grades 10 and 11 are averaged mechanical properties and the values recorded here are based on the lower alloy content.

TABLE 7 MANDREL BREAK LOADS OF BREAK MANDREL BLIND RIVETS (NEWTONS)

Nominal Rivet Size, mm	Grades	10, 11	16, 18, 19	20	26	30	40	50	51, 52
	Rivet Body Material	Aluminum	Aluminum	Copper	Aluminum	Steel	Monel	Stainless Steel	Stainless Steel
	Mandrel Material	Aluminum	Steel	Steel	Stainless Steel	Steel	Steel	Steel	Stainless Steel or A286
2.4	Min.	620	780	780	...	1,160	1,330	1,330	1,330
	Max.	1,070	1,220	1,220	...	1,600	2,000	2,220	2,220
3.2	Min.	1,110	1,780	1,780	2,290	2,670	2,890	2,890	2,890
	Max.	1,780	2,670	2,670	2,690	3,560	3,780	4,230	4,230
4.0	Min.	1,890	2,670	2,670	3,200	3,340	4,230	5,120	5,120
	Max.	2,670	3,780	3,780	3,780	4,450	5,340	6,450	6,450
4.8	Min.	2,446	3,340	3,340	4,620	5,120	6,450	6,230	6,230
	Max	3,670	4,670	4,670	5,380	6,450	7,780	8,450	8,450
6.3	Min.	4,004	6,450	6,450	...	8,670	11,100	13,300	13,300
	Max.	6,230	8,230	8,230	...	10,500	12,900	16,000	16,000

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Metric Hex Bolts ..... B18.2.3.5M-1979(R1995)
Metric Heavy Hex Bolts ..... B18.2.3.6M-1979(R1995)
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Cotter Pins (Metric Series) B18.8.6M-1995
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