ASME B18.31.2-2014

(Revision of ASME B18.31.2-2008)

Continuous Thread Stud, Double-End Stud, and Flange Bolting Stud (Stud Bolt) (Inch Series)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Two Park Avenue • New York, NY • 10016 USA

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The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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FOREWORD

ASME Standards Committee B18 for the Standardization of Bolts, Nuts, Rivets, Screws, Washers, and Similar Fasteners (formerly American National Standards Committee B18) was organized in March 1922 as Sectional Committee B18 under the aegis of the American Engineering Standards Committee (later the American Standards Association, then the United States of America Standards Institute, and, as of October 6, 1969, the American National Standards Institute, Inc. [ANSI]) with the Society of Automotive Engineers (SAE) and the American Society of Mechanical Engineers (ASME) as joint sponsors.

In 1995, the SAE Ship Systems and Equipment Committee that was preparing fastener part standards for the shipbuilding industry asked ASME Committee B18 if there was an interest in developing dimensional standards for studs. At the December 1995 meeting of B18 in Atlanta, it was reported that a survey by ASME showed considerable interest in establishing a subcommittee to develop stud standards, and 11 representatives indicated their willingness to serve on a subcommittee. Subcommittee 31 was established, and draft SAE inch and metric stud standards were distributed for review.

The first meeting of Subcommittee 31 on studs was held in April 1996, in conjunction with the ASME B18 meetings in Chicago. Existing stud standards (IFI 136, Studs and Bolts, and IFI 528, Metric Studs and Bolts) were compared with the draft SAE standards (J2271, Part Standard for Studs — Continuous and Double End [Inch Series], and J2271M, Part Standard for Studs — Continuous and Double End [Metric]). The Subcommittee then identified the configurations to be developed along with thread sizes and diameters to be covered. It was determined to develop both inch and metric standards covering both continuously threaded and double-ended studs. A decision to develop the metric standard first was unanimously passed.

As the metric standard B18.31.1M was developed, little effort was devoted to the inch standard until 2005. In April 2005, the Subcommittee developed basic requirements for the inch studs that were similar to the metric studs, with the addition of interference-fit studs using ASME B1.12 threads. A draft was reviewed at the November 2006 meeting with a number of format changes suggested. How to define the nominal length for tap-end studs was discussed, and a motion was approved to identify the nominal length as the overall length rather than the protrusion length when installed as used in ASME B18.31.1M per ISO 225 requirements.

In November 2006, the Subcommittee decided that diameters from $\frac{1}{4}$ in. to 4 in. would be covered although at the previous meeting it had been agreed to cover diameters down to Size No. 0. The nominal length for tap-end studs was again revisited without a consensus being reached. At the April 2007 meeting, examples of both methods of identifying the nominal length of tap studs were reviewed, and it was determined to use the overall length as the nominal length as this had been the past convention for inch studs in the United States.

A draft was balloted prior to the November 2007 meeting and several disapprovals were resolved at the meeting. It was agreed that the maximum nut-end thread length would be deleted in favor of a total thread length to the last scratch, which would be the minimum thread length plus five thread pitches. As a result, thread gaging is simplified without affecting the overall suitability of the studs.

A reconsideration draft was balloted prior to the April 2008 meeting. The only disapproval was withdrawn prior to the meeting, and the Subcommittee approved several minor editorial corrections at the meeting.

ASME B18.31.2-2008 was approved by the American National Standards Institute on August 4, 2008.

In the fall of 2013, the B18.31 Subcommittee decided it was time to make some minor revisions to B18.31.2 to update its format and content to be consistent with recent revisions of other B18 standards. The technical revisions are to change the pointed ends from optional to mandatory,

and to add a stud type referred to as "flange bolting stud (stud bolt)." This is a stud design that originated in the 1960s by the publication of the ASME B16.5 flange standard wherein it described the continuous-thread stud having a length designation from the first full thread on one end to the first full thread on the other end rather than the length being designated as being from end to end. This description was used for many years in general terms in ASTM A193 and A962, but never thoroughly covered by the ASME B18 standards.

This revision was approved by ANSI on August 1, 2014.

ASME B18 COMMITTEE
Standardization of Bolts, Nuts, Rivets, Screws, Washers, and Similar Fasteners

(The following is the roster of the Committee at the time of approval of this Standard.)

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B18 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard and the paragraph, figure, or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Interpretations. Upon request, the B18 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B18 Standards Committee at go.asme.org/Inquiry.

The request for an interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

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 that are necessary to explain the question; however, they should not contain proprietary names or information.

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

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B18 Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the B18 Standards Committee. Future Committee meeting dates and locations can be found on the Committee Page at go.asme.org/B18Committee.

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CONTINUOUS THREAD STUD, DOUBLE-END STUD, AND FLANGE BOLTING STUD (STUD BOLT) (INCH SERIES)

1 INTRODUCTION

1.1 Scope

1.1.1 This Standard covers the complete dimensional and general data for the following types of studs in inch dimensions:

(a) continuous thread studs

(b) double-end studs

(c) flange bolting studs (stud bolts)

These studs are recognized as American National Standard. The following configurations are covered:

continuous thread stud: a stud that is threaded over its complete length.

double-end (clamping type — identical ends) stud: a stud with screw threads of the same length and configuration on each end. This type of stud serves the function of clamping two bodies together with a nut on each end.

double-end (tap-end type) stud: a stud designed to be installed in a tapped hole and usually with different threaded lengths on each end. For the tap end of the studs, both regular unified threads and interference-fit threads are covered.

Double-end studs of the following body diameters are covered:

(a) reduced-diameter body (see para. 6.1 for dimensions)

(b) full body (see para. 6.2 for dimensions)

flange bolting stud (stud bolt): a threaded stud used primarily in applications with flanges covered by ASME B16.5, and made using ASTM A01 bolting materials.

1.1.2 The inclusion of dimensional data in this Standard is not intended to imply that all products described are stock production items. Consumers should consult with suppliers concerning availability of products.

2 COMPARISON WITH ISO DOCUMENTS

There is no comparable ISO standard.

3 REFERENCED STANDARDS

The following is a list of publications referenced in this Standard. Unless otherwise specified, the reference shall be to the most recent issue at the time of order placement.

ASME B1.1, Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B1.3, Screw Thread Gaging Systems for Acceptability — Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ)

ASME B1.12, Class 5 Interference-Fit Thread

ASME B16.5, Pipe and Flange Fittings

ASME B18.2.8, Clearance Holes for Bolts, Screws, and Studs

ASME B18.2.9, Straightness Gage and Gaging for Bolts and Screws

ASME B18.12, Glossary of Terms for Mechanical Fasteners

ASME B18.18, Quality Assurance for Fasteners

ASME Y14.5, Dimensioning and Tolerancing

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM A193/A193M, Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A320/A320M, Alloy Steel Bolting Materials for Low-Temperature Service

ASTM A354, Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

ASTM A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

ASTM A437/A437M, Alloy-Steel Turbine-Type Bolting Material Specially Heat Treated for High-Temperature Service

ASTM A449, Quenched and Tempered Steel Bolts and Studs

ASTM A453/A453M, High-Temperature Bolting Materials With Expansion Coefficients Comparable to Austenitic Stainless Steels

ASTM A540/A540M, Alloy-Steel Bolting Materials for Special Applications

ASTM A1014/A1014M, Precipitation-Hardening Bolting Material (UNS N07718) for High Temperature Service

ASTM F468, Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

ASTM F593, Stainless Steel Bolts, Hex Cap Screws, and Studs

ASTM F788/F788M, Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series

ASTM F1941, Electrodeposited Coatings on Threaded Fasteners [Unified Inch Screw Threads (UN/UNR)]

Publisher: ASTM International (ASTM), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

SAE J429, Mechanical and Material Requirements for Externally Threaded Fasteners

SAE J2271, Ship Systems and Equipment — Part Standard for Studs — Continuous and Double-End (Inch Series)

Publisher: SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001 (www.sae.org)

4 TERMINOLOGY

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

5 DIMENSIONS

(a) All dimensions in this Standard are given in inches, and apply before coating, unless otherwise specified. Table 1 contains the dimensions for continuous thread studs. Table 2 contains the thread length dimensions for double-end (clamping type) studs. Table 3 contains the thread length requirements for tap end studs. Table 4 contains the body diameters for double-end (clamping type) studs and tap-end studs.

(b) Symbols specifying geometric characteristics are in accordance with ASME Y14.5.

6 BODY DIAMETER

The diameter of the body on studs that are not threaded the full length shall be within the limits for D_S specified for the applicable configuration. Unless otherwise specified by the purchaser, the reduced-diameter body or full body may be supplied at the option of the supplier.

6.1 Reduced Diameter Body

The maximum body diameter is the minimum major diameter of the thread as defined in ASME B1.1. The minimum body diameter is the minimum pitch diameter of the thread as defined in ASME B1.1. Dimensions are provided in Table 4.

6.2 Full Body

The maximum body diameter is the same as the nominal diameter of the fastener. The minimum body diameter is the minimum major diameter for the applicable threads as shown in ASME B1.1, Table 3A. These dimensions are provided in Table 4.

NOTE: If the two ends of a stud have different threads, the minimum body diameter will be based on the thread with smaller minimum major diameter.

7 STUD LENGTH

The difference between "continuous thread stud" and "flange bolting stud (stud bolt)" is that the length of continuous thread stud is defined by the overall length from end to end while the flange bolting stud length is defined from the first full thread on one end to the first full thread on the other end.

7.1 Overall Length of Continuous and Double-End Studs

The overall length, L_T, of the continuous and double-end type studs is the distance, parallel to the axis of the stud from one end to the other end, measured to the extreme condition on each end. The length tolerances in Table 5 are applied to this dimension.

7.2 Nominal Length for Flange Bolting Studs (Stud Bolts)

The nominal length, L, on flange bolting studs (see Fig. 1) is the distance parallel to the axis of the stud from the first full thread on one end to the first full

Fig. 1 Relationship of Dimensions, *L* and *U*, on Flange Bolting Studs (Stud Bolts)

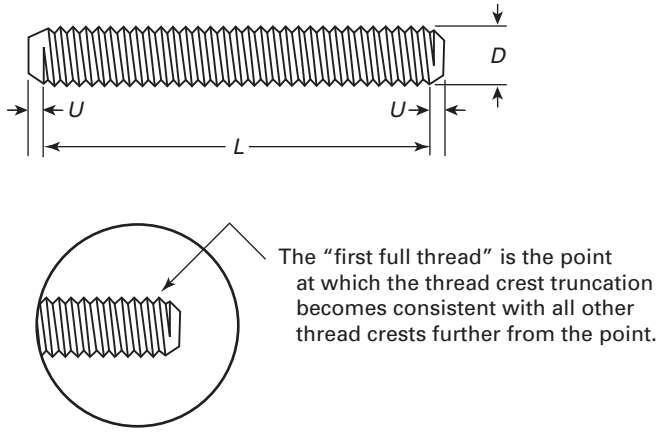
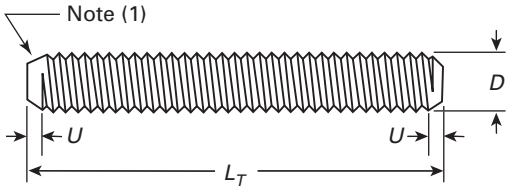


Table 1 Dimensions for Continuous Thread Studs



Nominal Size	Diameter, *D*	Threads Per Inch [Note (2)]			Chamfered Thread Distance, *U*					
					UNC Threads		UNF Threads		8UN Threads	
		UNC	UNF	8UN	Min.	Max.	Min.	Max.	Min.	Max.
1/4	0.2500	20	28	...	0.050	0.100	0.036	0.071	...	...
5/16	0.3125	18	24	...	0.056	0.111	0.042	0.083	...	...
3/8	0.3750	16	24	...	0.063	0.125	0.042	0.083	...	...
7/16	0.4375	14	20	...	0.072	0.143	0.050	0.100	...	...
1/2	0.5000	13	20	...	0.077	0.154	0.050	0.100	...	...
9/16 [Note (3)]	0.5625	12	18	...	0.084	0.167	0.056	0.111	...	...
5/8	0.6250	11	18	...	0.091	0.182	0.056	0.111	...	...
3/4	0.7500	10	16	...	0.100	0.200	0.063	0.125	...	...
7/8	0.8750	9	14	...	0.111	0.222	0.072	0.143	...	...
1	1.0000	8	12	...	0.125	0.250	0.084	0.167	...	...
1 1/8	1.1250	7	12	8	0.143	0.286	0.084	0.167	0.125	0.250
1 1/4	1.2500	7	12	8	0.143	0.286	0.084	0.167	0.125	0.250
1 3/8	1.3750	6	12	8	0.167	0.333	0.084	0.167	0.125	0.250
1 1/2	1.5000	6	12	8	0.167	0.333	0.084	0.167	0.125	0.250
1 5/8	1.6250	...	...	8	...	...	...	...	0.125	0.250
1 3/4	1.7500	5	...	8	0.200	0.400	...	...	0.125	0.250
1 7/8	1.8750	...	...	8	...	...	...	...	0.125	0.250
2	2.0000	4 1/2	...	8	0.222	0.444	...	...	0.125	0.250
2 1/4	2.2500	4 1/2	...	8	0.222	0.444	...	...	0.125	0.250
2 1/2	2.5000	4	...	8	0.250	0.500	...	...	0.125	0.250
2 3/4	2.7500	4	...	8	0.250	0.500	...	...	0.125	0.250
3	3.0000	4	...	8	0.250	0.500	...	...	0.125	0.250
3 1/4	3.2500	4	...	8	0.250	0.500	...	...	0.125	0.250
3 1/2	3.5000	4	...	8	0.250	0.500	...	...	0.125	0.250
3 3/4	3.7500	4	...	8	0.250	0.500	...	...	0.125	0.250
4	4.0000	4	...	8	0.250	0.500	...	...	0.125	0.250

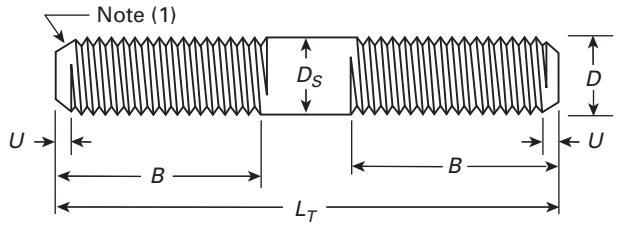
NOTES:

(1) See section 8 for end requirements.

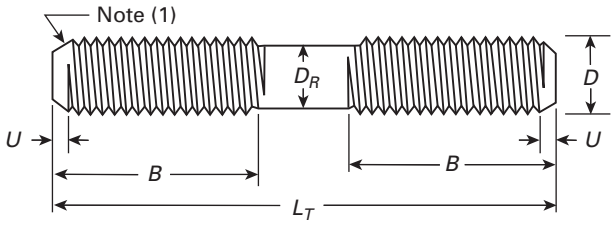
(2) See section 7 for requirements on stud lengths.

(3) Nonpreferred size; not recommended for new design due to limited availability.

Table 2 Dimensions for Clamping Type Studs



Full Body



Reduced Body

Nominal Size	Diameter, *D* [Note (2)]	Nut End Minimum Full Thread Length, B_{min} [Note (3)]			U_{max} = 2 Thread Pitches [Note (4)]		
		$L \leq 10$	$10 < L \leq 16$	$L > 16$	UNC Threads	UNF Threads	8UN Threads
1/4	0.2500	0.750	1.000	1.500	0.100	0.071	...
5/16	0.3125	0.875	1.125	1.625	0.111	0.083	...
3/8	0.3750	1.000	1.250	1.750	0.125	0.083	...
7/16	0.4375	1.125	1.375	1.875	0.143	0.100	...
1/2	0.5000	1.250	1.500	2.000	0.154	0.100	...
9/16 [Note (5)]	0.5625	1.375	1.625	2.125	0.167	0.111	...
5/8	0.6250	1.500	1.750	2.250	0.182	0.111	...
3/4	0.7500	1.750	2.000	2.500	0.200	0.125	...
7/8	0.8750	2.000	2.250	2.750	0.222	0.143	...
1	1.0000	2.250	2.500	3.000	0.250	0.167	...
1 1/8	1.1250	2.500	2.750	3.250	0.286	0.167	0.250
1 1/4	1.2500	2.750	3.000	3.500	0.286	0.167	0.250
1 3/8	1.3750	3.000	3.250	3.750	0.333	0.167	0.250
1 1/2	1.5000	3.250	3.500	4.000	0.333	0.167	0.250
1 5/8	1.6250	3.500	3.750	4.250	...	...	0.250
1 3/4	1.7500	3.750	4.000	4.500	0.400	...	0.250
1 7/8	1.8750	4.000	4.250	4.750	...	...	0.250
2	2.0000	4.250	4.500	5.000	0.444	...	0.250
2 1/4	2.2500	4.750	5.000	5.500	0.444	...	0.250
2 1/2	2.5000	5.250	5.500	6.000	0.500	...	0.250
2 3/4	2.7500	5.750	6.000	6.500	0.500	...	0.250
3	3.0000	...	6.500	7.000	0.500	...	0.250
3 1/4	3.2500	...	7.000	7.500	0.500	...	0.250
3 1/2	3.5000	...	7.500	8.000	0.500	...	0.250
3 3/4	3.7500	...	8.000	8.500	0.500	...	0.250
4	4.0000	...	8.500	9.000	0.500	...	0.250

NOTES:

(1) See section 8 for end requirements.

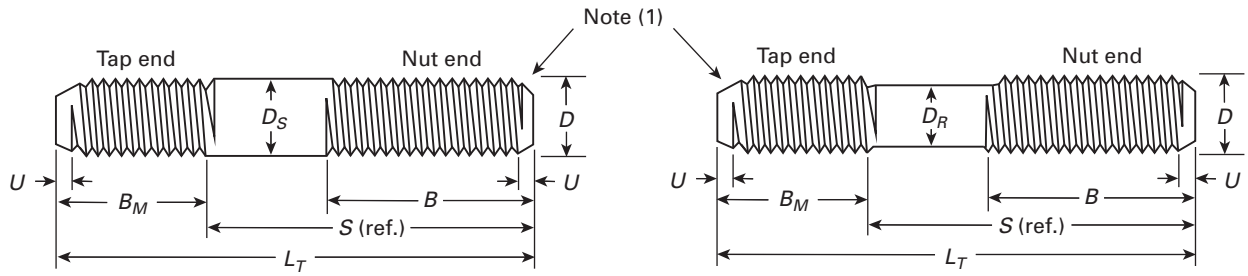
(2) See Table 4 for body diameters for full body or reduced body studs.

(3) Total thread length to the last scratch shall not exceed B_{min} plus five thread pitches.

(4) See Table 5 for tolerances on overall stud lengths.

(5) Nonpreferred size; not recommended for new design due to limited availability.

Table 3 Dimensions for Tap-End Studs (1.5*D* Engagement)



Full Body **Reduced Body**

Nominal Size Diameter, *D* [Note (2)]	Tap-End Full Thread Length, B_M			$U_{max} = 2P$			Minimum Nut-End Full Thread Length, B_{min} [Note (3)]		
	Nominal	Min.	Max.	UNC and NC-5 Thread	UNF Thread	8UN Thread	$L \le 10$	$10 < L \le 16$	$L > 16$
1/4	0.375	0.350	0.400	0.100	0.071	...	0.750	1.000	1.500
5/16	0.469	0.440	0.498	0.111	0.083	...	0.875	1.125	1.625
3/8	0.563	0.532	0.594	0.125	0.083	...	1.000	1.250	1.750
7/16	0.656	0.620	0.692	0.143	0.100	...	1.125	1.375	1.875
1/2	0.750	0.708	0.792	0.154	0.100	...	1.250	1.500	2.000
9/16 [Note (4)]	0.844	0.802	0.896	0.167	0.111	...	1.375	1.625	2.125
5/8	0.938	0.892	0.983	0.182	0.111	...	1.500	1.750	2.250
3/4	1.125	1.075	1.175	0.200	0.125	...	1.750	2.000	2.500
7/8	1.313	1.258	1.368	0.222	0.143	...	2.000	2.250	2.750
1	1.500	1.438	1.562	0.250	0.167	...	2.250	2.500	3.000
1 1/8	1.688	1.625	1.750	0.286	0.167	0.250	2.500	2.750	3.250
1 1/4	1.875	1.813	1.938	0.286	0.167	0.250	2.750	3.000	3.500
1 3/8	2.063	2.000	2.125	0.333	0.167	0.250	3.000	3.250	3.750
1 1/2	2.250	2.188	2.313	0.333	0.167	0.250	3.250	3.500	4.000
1 5/8	2.438	2.375	2.500	...	...	0.250	3.500	3.750	4.250
1 3/4	2.625	2.563	2.688	0.400 [Note (5)]	...	0.250	3.750	4.000	4.500
1 7/8	2.813	2.750	2.875	...	...	0.250	4.000	4.250	4.750
2	3.000	2.925	3.075	0.444 [Note (5)]	...	0.250	4.250	4.500	5.000
2 1/4	3.375	3.300	3.450	0.444 [Note (5)]	...	0.250	4.750	5.000	5.500
2 1/2	3.750	3.675	3.825	0.500 [Note (5)]	...	0.250	5.250	5.500	6.000
2 3/4	4.125	4.050	4.200	0.500 [Note (5)]	...	0.250	5.750	6.000	6.500
3	4.500	4.425	4.575	0.500 [Note (5)]	...	0.250	...	6.500	7.000
3 1/4	4.875	4.775	4.975	0.500 [Note (5)]	...	0.250	...	7.000	7.500
3 1/2	5.250	5.150	5.350	0.500 [Note (5)]	...	0.250	...	7.500	8.000
3 3/4	5.625	5.525	5.725	0.500 [Note (5)]	...	0.250	...	8.000	8.500
4	6.000	5.900	6.100	0.500 [Note (5)]	...	0.250	...	8.500	9.000

GENERAL NOTE:
- B = full nut-end thread length
- B_M = tap-end thread length (full threads)
- L_T = overall length (nominal length). See para. 7.3 for length increments and Table 5 for tolerances on overall stud lengths.
- S = standoff (when installed) = $L_T - B_M$
- U = length to first full form thread

NOTES:
(1) See section 8 for end requirements.
(2) See Table 4 for body diameters for full body or reduced-body studs.
(3) Total thread length to the last scratch shall not exceed B_{min} plus five thread pitches.
(4) Nonpreferred size; not recommended for new design due to limited availability.
(5) UNC only.

Table 4 Body Diameters for Double-End Studs

Nominal Size	Nominal Diameter, D, and Maximum Full Body [Note (1)] Diameter, D_s	Minimum Body Diameter, D_S, for Full Body Studs and Maximum Body Diameter, D_R, for Reduced-Body Studs [Note (1)]			Minimum Body Diameter, D_R, for Reduced-Body Studs [Note (1)]		
		UNC and NC-5 HF Threads [Note (2)]	UNF Threads	8UN Threads	UNC and NC-5 HF Threads [Note (2)]	UNF Threads	8UN Threads
1/4	0.2500	0.241	0.243	...	0.213	0.223	...
5/16	0.3125	0.303	0.304	...	0.271	0.281	...
3/8	0.3750	0.364	0.367	...	0.329	0.343	...
7/16	0.4375	0.426	0.428	...	0.385	0.400	...
1/2	0.5000	0.488	0.491	...	0.444	0.462	...
9/16 [Note (3)]	0.5625	0.550	0.552	...	0.502	0.521	
5/8	0.6250	0.611	0.615	...	0.559	0.583	...
3/4	0.7500	0.735	0.739	...	0.677	0.703	...
7/8	0.8750	0.859	0.863	...	0.795	0.822	...
1	1.0000	0.983	0.987	...	0.910	0.938	...
1 1/8	1.1250	1.106	1.112	1.108	1.023	1.063	1.035
1 1/4	1.2500	1.231	1.237	1.233	1.148	1.188	1.160
1 3/8	1.3750	1.354	1.362	1.358	1.256	1.313	1.284
1 1/2	1.5000	1.479	1.487	1.483	1.381	1.438	1.409
1 5/8	1.6250	...	...	1.608	...	...	1.534
1 3/4	1.7500	1.727 [Note (4)]	...	1.733	1.609 [Note (4)]	...	1.659
1 7/8	1.8750	...	...	1.858	...		1.784
2	2.0000	1.975 [Note (4)]	...	1.983	1.843 [Note (4)]	...	1.909
2 1/4	2.2500	2.225 [Note (4)]	...	2.233	2.093 [Note (4)]	...	2.158
2 1/2	2.5000	2.473 [Note (4)]	...	2.483	2.324 [Note (4)]	...	2.408
2 3/4	2.7500	2.723 [Note (4)]	...	2.733	2.574 [Note (4)]	...	2.658
3	3.0000	2.973 [Note (4)]	...	2.982	2.824 [Note (4)]	...	2.908
3 1/4	3.2500	3.223 [Note (4)]	...	3.232	3.073 [Note (4)]	...	3.158
3 1/2	3.5000	3.473 [Note (4)]	...	3.482	3.323 [Note (4)]	...	3.407
3 3/4	3.7500	3.723 [Note (4)]	...	3.732	3.573 [Note (4)]	...	3.657
4	4.0000	3.973 [Note (4)]	...	3.982	3.823 [Note (4)]	...	3.907

GENERAL NOTE: See Table 2 for figures of double-end (clamping type) studs and Table 3 for figures of double-end (tap-end type) studs.

NOTES:

(1) All dimensions are before plating.

(2) See SAE J2271 for complete thread description for NC-5 interference threads.

(3) Nonpreferred size; not recommended for new design.

(4) UNC threads only.

Table 5 Continuous Thread and Double-End Stud Length Tolerances

Range, L_T	Double-End Studs	Clamping and Continuous-Thread Studs
From $\frac{3}{4}$ through $2\frac{1}{2}$	±0.03	±0.04
Over $2\frac{1}{2}$ through 4	±0.05	±0.08
Over 4 through 8	±0.08	±0.10
Over 8 through 16	±0.10	±0.12
Over 16	±0.12	±0.18

Table 6 Flange Bolting Stud (Stud Bolt) Length Tolerances

Range, L	Flange Bolting Stud (Stud Bolt)
From $\frac{3}{4}$ through 12	±0.062
Over 12 through 18	±0.125
Over 18	±0.250

thread on the other end. Dimensions for U are the same as those in Table 1. The length tolerances in Table 6 are applied to the L dimension.

Flange bolting studs (stud bolts) can be made as continuous thread (Table 1) or double-end (Table 2) with the only difference being that nominal length, L, applies to flange bolting studs and overall length, L_T, applies to all other stud types.

7.3 Length Increments

The overall length of continuous thread and double-end studs and the nominal length of flange bolting studs shall be in one-quarter inch increments for lengths through 10 in. For stud lengths greater than 10 in., lengths shall be in whole inches and one-half inch increments.

8 STUD ENDS

Stud ends shall be chamfered from the major diameter to a diameter equal to or less than the thread root diameter. The length of the chamfered end to the first full formed thread at major diameter, as determined by the distance the chamfered end enters into a cylindrical NOT GO major diameter ring gage, shall be one to two thread pitches on each end. The ends of the stud shall be reasonably square with the axis of the stud, but the slight rim or cup resulting from manufacturing shall be permissible.

The ends shall be suitable for marking.

9 THREAD LENGTH

(a) For continuously threaded studs and flange bolting studs, the entire length of the stud shall be threaded except for the ends, as denoted by dimension, U, in Table 1.

(b) For double-end studs, full threads are required for the lengths B and B_M, except for the ends, as denoted by dimension, U, in Tables 2 and 3.

(c) The transition from full thread to incomplete thread shall be smooth and uniform. The major diameter for incomplete threads shall not exceed the actual diameter of the complete (full form) threads.

(d) For the nut ends of studs, the transition from full thread to no thread shall be within five thread pitches from the minimum full thread length, B.

10 SCREW THREADS

10.1 UNC, UNF, and 8UN Thread Series and Tolerance Class

Threads shall be unified inch coarse, fine, or 8-thread series Class 2A in accordance with ASME B1.1. Unless otherwise specified by the purchaser, coated and plated threads shall conform to the maximum limit of Class 3A (GO) and the minimum limit of Class 2A (NOT GO).

10.2 Class 5 Interference-Fit Threads (for Tap-End Studs)

In addition to the threads identified in para. 10.1, interference-fit threads may be ordered for the tap end of tap-end type studs. These threads shall be interference fit (Class 5) of the modified National thread form in the coarse thread series (NC) in sizes 0.250 in. through 1.500 in. in accordance with ASME B1.12.

NOTE: To achieve the desired performance from an NC-5 thread, the indication of the proper suffix indicating the size of the major diameter is critical. The designation of an NC-5 thread is not complete without the inclusion of the suffix. To select the appropriate suffix for a specific application, the user should consult Appendices B and C in ASME B1.12. Additional information on NC-5 thread applications is available in SAE J2271.

10.3 Thread Gaging

Unless otherwise specified, dimensional acceptability of screw threads shall be determined based on System 21 of ASME B1.3.

11 MATERIALS AND MECHANICAL PROPERTIES

11.1 Materials for Continuous Thread Studs, Double-End Studs, and Clamping Studs

Unless otherwise specified, steel studs shall conform to the requirements of ASTM A354, SAE J429, or ASTM A449, as identified by the purchaser.

Unless otherwise specified, studs of corrosion resistant stainless steels shall conform to the requirements of a specified group and condition designated in ASTM F593.

Unless otherwise specified, nonferrous studs shall conform to the requirements of a designated alloy in ASTM F468.

11.2 Materials for Flange Bolting Studs (Stud Bolts)

Flange bolting studs may be supplied to any grade covered by the following ASTM material standards: A193/A193M, A320/A320M, A437/A437M, A453/A453M, A540/A540M, or A1014/A1014M.

12 IDENTIFICATION SYMBOLS

Markings shall be located on either the ends or the bodies of the studs unless otherwise specified.

12.1 Property Class Symbol

Each stud shall be marked in accordance with the requirements of the applicable specification (see section 11) for its chemical and mechanical requirements. For tap-end studs, the material property class symbol shall be marked on the nut end or the body.

12.2 Source Symbols

Each stud of a size requiring marking, based on its specified material standard, shall be marked to identify its source (manufacturer or private label distributor).

13 FINISH

Unless otherwise specified, studs other than corrosion-resistant stainless steels shall be supplied with a natural (as-processed) finish, unplated or uncoated, in a clean condition, and lightly oiled. Studs produced from corrosion-resistant stainless steels shall be passivated in accordance with ASTM A380.

Platings and coatings are not recommended for interference-fit studs.

Requirements for zinc plating are contained in ASTM F1941.

14 WORKMANSHIP

Unless otherwise specified, studs shall be free from surface imperfections such as burrs, seams, laps, loose scale, or other irregularities that could affect serviceability. Surface discontinuities shall comply with the requirements of ASTM F788/F788M.

15 STRAIGHTNESS

Straightness shall conform to the requirements of ASME B18.2.9.

16 INSPECTION AND QUALITY ASSURANCE

Studs shall be inspected to determine conformance with this Standard. Inspection procedures may be specified by the purchaser on the inquiry, purchase order, or the engineering drawings, or shall be as agreed upon between the purchaser and supplier prior to acceptance of the order. In the absence of a defined agreement, the requirements of ASME B18.18 shall apply.

17 CLEARANCE HOLES

The recommended sizes of clearance holes in material to be assembled using inch studs are those listed in ASME B18.2.8 for inch fasteners.

18 STUD DESIGNATION

(a) Description: Studs shall be designated by the following data, preferably in the sequence shown:

(1) product name

(2) product standard (ASME B18.31.2)

(3) nominal diameter and thread pitch for Class 2A screw threads

(4) nominal diameter, thread pitch, and major diameter thread suffix from ASME B1.12 (including Appendices B and C) for NC-5 interference threads, when specified

(5) nominal length

(6) material (applicable standard and grade or alloy)

(7) protective coating, if required

For tap-end studs, show tap-end thread type from ASME B1.12, length, and nut-end thread, as shown in Example (3) below.

EXAMPLES:

(1) Continuous thread stud, ASME B18.31.2, $\frac{1}{2}$-13 × 4, SAE J429 Grade 5, zinc plated per ASTM F1941 Classification Code Fe/Zn 5A

(2) Clamping type stud, reduced-diameter body, ASME B18.31.2, $\frac{3}{8}$-16 × 2, ASTM F468 nickel-copper alloy 400

(3) Tap-end stud, full body, ASME B18.31.2, $1\frac{1}{8}$ NC-5 HFS× $6\frac{1}{2}$ × $1\frac{1}{8}$-8UN, ASTM F593 Alloy Group 2, Cold Worked Condition

(4) Continuous thread flange bolting stud, ASME B18.31.2, $\frac{3}{4}$-10 UNC× 6, ASTM A193, Grade B7

(b) Part Identification Number (PIN): Refer to SAE J2271 PIN for all stud types covered in this Standard except flange bolting studs (stud bolts).

NOTE: SAE J2271 contains part identification numbers for interference-fit tap-end studs with eight different suffixes for tap-end thread major diameters and guidance on selecting the appropriate thread configurations for both the tap-end and internal thread for the material into which the interference-fit stud is installed.

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