

ASME B18.31.2-2008

# Continuous and Double-End Studs (Inch Series)

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**AN AMERICAN NATIONAL STANDARD**



The American Society of  
Mechanical Engineers



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# CONTENTS

Foreword .....	iv
Committee Roster .....	v
Correspondence With the B18 Committee .....	vi
<b>1 Introduction</b> .....	1
<b>2 Comparison With ISO Documents</b> .....	1
<b>3 Referenced Standards</b> .....	1
<b>4 Terminology</b> .....	1
<b>5 Dimensions</b> .....	1
<b>6 Body Diameter</b> .....	3
<b>7 Length</b> .....	3
<b>8 Points</b> .....	3
<b>9 Thread Length</b> .....	3
<b>10 Screw Threads</b> .....	3
<b>11 Materials and Mechanical Properties</b> .....	7
<b>12 Identification Symbols</b> .....	7
<b>13 Finish</b> .....	7
<b>14 Workmanship</b> .....	7
<b>15 Straightness</b> .....	7
<b>16 Inspection and Quality Assurance</b> .....	7
<b>17 Dimensional Conformance</b> .....	7
<b>18 Clearance Holes</b> .....	8
<b>19 Designation</b> .....	8
<b>Tables</b>	
1 Dimensions for Continuous Thread Studs .....	2
2 Dimensions for Clamping Type Studs .....	4
3 Dimensions for Tap End Studs (1.5 <i>D</i> Engagement) .....	5
4 Body Diameters for Double End Studs .....	6
5 Length Tolerances for Studs .....	7
<b>Mandatory Appendix</b>	
I Stud Straightness, Referee Gage, and Gaging Procedures .....	9

# 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.) with the Society of Automotive Engineers and the American Society of Mechanical Engineers 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.

This edition was approved by the American National Standards Institute on August 4, 2008.

# 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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	<b>C. B. Williamson</b> , Fastenal Co.
	<b>C. J. Wilson</b> , Industrial Fasteners Institute

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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  
Three Park Avenue  
New York, NY 10016-5990

**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, 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 Standards 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.

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, which 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, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B18 Standards Committee.

# CONTINUOUS AND DOUBLE-END STUDS (INCH SERIES)

## 1 INTRODUCTION

### 1.1 Scope

**1.1.1** This Standard covers the complete dimensional and general data for continuous thread and double-end inch-dimensioned studs recognized as American National Standard. The following configurations are covered:

*continuous thread stud*: studs that are threaded over their complete length.

*double-end stud (clamping type — identical ends)*: studs 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 stud (tap end type)*: 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)

**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

Inch-dimensioned stud standards have not been issued by ISO.

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

ASME B1.12, Class 5 Interference-Fit Thread

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

ASME B18.12, Glossary of Terms for Mechanical Fasteners

ASME B18.18.2, Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners

ASME B18.24, Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

ASME Y14.5M, Dimensioning and Tolerancing

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2300, Fairfield, NJ 07007-2300

ASTM A 354, Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

ASTM A 380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

ASTM A 449, Quenched and Tempered Steel Bolts and Studs

ASTM F 468, Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

ASTM F 593, Stainless Steel Bolts, Hex Cap Screws, and Studs

ASTM F 788/F 788M, Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series

ASTM F 1941, 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

SAE J429, Mechanical and Material Requirements for Externally Threaded Fasteners

Publisher: Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001

## 4 TERMINOLOGY

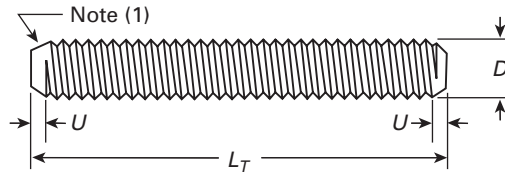
For definitions of terms relating to fasteners or features thereof used in this Standard, refer to ASME B18.12.

## 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



**Table 1 Dimensions for Continuous Thread Studs**



Nominal Size	Diameter, $D$	Threads Per Inch [Note (2)]			$U_{max} = 2 \text{ Thread Pitches} = 2P$		
		UNC	UNF	8UN	UNC Threads	UNF Threads	8UN Threads
$1/4$	0.2500	20	28	...	0.100	0.071	...
$5/16$	0.3125	18	24	...	0.111	0.083	...
$3/8$	0.3750	16	24	...	0.125	0.083	...
$7/16$	0.4375	14	20	...	0.143	0.100	...
$1/2$	0.5000	13	20	...	0.154	0.100	...
$9/16$ [Note (3)]	0.5625	12	18	...	0.167	0.111	...
$5/8$	0.6250	11	18	...	0.182	0.111	...
$3/4$	0.7500	10	16	...	0.200	0.125	...
$7/8$	0.8750	9	14	...	0.222	0.143	...
1	1.0000	8	12	...	0.250	0.167	...
$1 1/8$	1.1250	7	12	8	0.286	0.167	0.250
$1 1/4$	1.2500	7	12	8	0.286	0.167	0.250
$1 3/8$	1.3750	6	12	8	0.333	0.167	0.250
$1 1/2$	1.5000	6	12	8	0.333	0.167	0.250
$1 5/8$	1.6250	...	...	8	...	...	0.250
$1 3/4$	1.7500	5	...	8	0.400	...	0.250
$1 7/8$	1.8750	...	...	8	...	...	0.250
2	2.0000	$4 1/2$	...	8	0.444	...	0.250
$2 1/4$	2.2500	$4 1/2$	...	8	0.444	...	0.250
$2 1/2$	2.5000	4	...	8	0.500	...	0.250
$2 3/4$	2.7500	4	...	8	0.500	...	0.250
3	3.0000	4	...	8	0.500	...	0.250
$3 1/4$	3.2500	4	...	8	0.500	...	0.250
$3 1/2$	3.5000	4	...	8	0.500	...	0.250
$3 3/4$	3.7500	4	...	8	0.500	...	0.250
4	4.0000	4	...	8	0.500	...	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.

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 Y14.5M.

## 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 LENGTH

### 7.1 Overall Length

The overall length,  $L_T$ , of the stud 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. Tolerances for overall stud lengths are given in Table 5.

### 7.2 Nominal Length

For both continuous and double-end type studs, the nominal length is the same as the overall length without tolerances.

### 7.3 Length Increments

Stud lengths shall be in whole inches and 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 POINTS

Unless otherwise specified, studs with either pointed or unpointed ends may be provided. The ends shall be suitable for marking.

### 8.1 Pointed Ends

Pointed ends shall be chamfered from a diameter equal to or slightly less than the thread root diameter. The length of the point to the first full formed thread at major diameter, as determined by the distance the point enters into a cylindrical NOT GO major diameter ring gage, shall not exceed  $U_{\max}$ .  $U_{\max}$  is equal to two thread pitches. 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.

### 8.2 Unpointed Ends

Unpointed ends may be plain sheared or cut ends, and the slight rim or cup resulting from manufacturing shall be permissible.

## 9 THREAD LENGTH

(a) For continuously threaded 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).

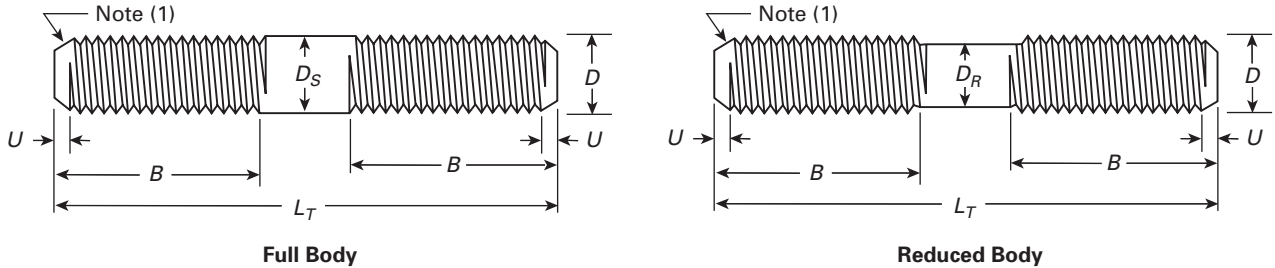
### 10.2 Class 5 Interference-Fit Threads (For Tap End Studs)

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 as specified by the purchaser.

### 10.3 Thread Gaging

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

**Table 2 Dimensions for Clamping Type Studs**

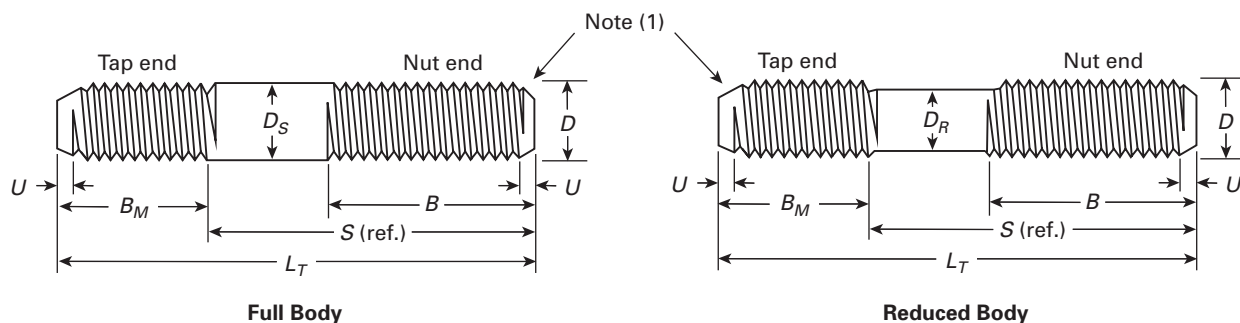


Nominal Size	Diameter, <i>D</i> [Note (2)]	Nut End Minimum Full Thread Length, <i>B</i> <sub>min</sub> [Note (3)]			<i>U</i> <sub>max</sub> = 2 Thread Pitches [Note (4)]		
		<i>L</i> ≤ 10	10 < <i>L</i> ≤ 16	<i>L</i> > 16	UNC Threads	UNF Threads	8UN Threads
1/4	0.2500	0.750	1.000	1.500	0.100	0.071	...
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) Total thread length to the last scratch shall not exceed *B*<sub>min</sub> plus five thread pitches.
- (3) See Table 4 for body diameters for full body or reduced body studs.
- (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 (1.5D Engagement)**



Nominal Size Diameter, <i>D</i> [Note (2)]	Tap End Full Thread Length, <i>B<sub>M</sub></i>			<i>U<sub>max</sub> = 2P</i>			Minimum Nut End Full Thread Length, <i>B<sub>min</sub></i> [Note (3)]		
	Nominal	Min.	Max.	UNC & NC-5 Thread			<i>L</i> ≤ 10	10 < <i>L</i> ≤ 16	<i>L</i> > 16
				UNF Thread	8UN Thread				
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<sub>M</sub>* = tap end thread length (full threads)
- L<sub>T</sub>* = 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<sub>T</sub>* - *B<sub>M</sub>*
- U* = length to first full form thread

**NOTES:**

- (1) See section 8 for end requirements.
- (2) Total thread length to the last scratch shall not exceed *B<sub>min</sub>* plus five thread pitches.
- (3) See Table 4 for body diameters for full body or reduced body studs.
- (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 Diameter, $D_s$ [Note (1)]	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	UNF Threads	8UN Threads	UNC and NC-5 HF Threads	UNF Threads	8UN Threads
$\frac{1}{4}$	0.2500	0.241	0.243	...	0.213	0.223	...
$\frac{5}{16}$	0.3125	0.303	0.304	...	0.271	0.281	...
$\frac{3}{8}$	0.3750	0.364	0.367	...	0.329	0.343	...
$\frac{7}{16}$	0.4375	0.426	0.428	...	0.385	0.400	...
$\frac{1}{2}$	0.5000	0.488	0.491	...	0.444	0.462	...
$\frac{9}{16}$ [Note (2)]	0.5625	0.550	0.552	...	0.502	0.521	...
$\frac{5}{8}$	0.6250	0.611	0.615	...	0.559	0.583	...
$\frac{3}{4}$	0.7500	0.735	0.739	...	0.677	0.703	...
$\frac{7}{8}$	0.8750	0.859	0.863	...	0.795	0.822	...
1	1.0000	0.983	0.987	...	0.910	0.938	...
$1\frac{1}{8}$	1.1250	1.106	1.112	1.108	1.023	1.063	1.035
$1\frac{1}{4}$	1.2500	1.231	1.237	1.233	1.148	1.188	1.160
$1\frac{3}{8}$	1.3750	1.354	1.362	1.358	1.256	1.313	1.284
$1\frac{1}{2}$	1.5000	1.479	1.487	1.483	1.381	1.438	1.409
$1\frac{5}{8}$	1.6250	...	...	1.608	...	...	1.534
$1\frac{3}{4}$	1.7500	1.727 [Note (3)]	...	1.733	1.609 [Note (3)]	...	1.659
$1\frac{7}{8}$	1.8750	...	...	1.858	...	...	1.784
2	2.0000	1.975 [Note (3)]	...	1.983	1.843 [Note (3)]	...	1.909
$2\frac{1}{4}$	2.2500	2.225 [Note (3)]	...	2.233	2.093 [Note (3)]	...	2.158
$2\frac{1}{2}$	2.5000	2.473 [Note (3)]	...	2.483	2.324 [Note (3)]	...	2.408
$2\frac{3}{4}$	2.7500	2.723 [Note (3)]	...	2.733	2.574 [Note (3)]	...	2.658
3	3.0000	2.973 [Note (3)]	...	2.982	2.824 [Note (3)]	...	2.908
$3\frac{1}{4}$	3.2500	3.223 [Note (3)]	...	3.232	3.073 [Note (3)]	...	3.158
$3\frac{1}{2}$	3.5000	3.473 [Note (3)]	...	3.482	3.323 [Note (3)]	...	3.407
$3\frac{3}{4}$	3.7500	3.723 [Note (3)]	...	3.732	3.573 [Note (3)]	...	3.657
4	4.0000	3.973 [Note (3)]	...	3.982	3.823 [Note (3)]	...	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) Minimum and maximum body dimensions apply before coating. See para. 5(a).
- (2) Nonpreferred size; not recommended for new design due to limited availability.
- (3) UNC threads only.

**Table 5 Length Tolerances for Studs**

Nominal Length [Note (1)]		Length Tolerances	
		Tap End Studs	Clamping and Continuous Thread Studs
Over	Through		
1/2	2 1/2	±0.03	±0.04
2 1/2	4	±0.05	±0.08
4	8	±0.08	±0.10
8	16	±0.10	±0.12
16	...	±0.12	±0.18

NOTE:

(1) Nominal length,  $L_T$ , is overall length for all types of studs.**11 MATERIALS AND MECHANICAL PROPERTIES****11.1 Steel**

Unless otherwise specified, steel studs shall conform to the requirements of ASTM A 354, SAE J429, or ASTM A 449, as identified by the purchaser.

**11.2 Corrosion-Resistant Steels**

Unless otherwise specified, studs of corrosion-resistant steels shall conform to the requirements of ASTM F 593, including passivation in accordance with ASTM A 380.

**11.3 Nonferrous Metals**

Unless otherwise specified, nonferrous studs shall conform to the requirements of ASTM F 468.

**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 shall be marked to identify its source (manufacturer or private label distributor).

**13 FINISH**

Unless otherwise specified, studs shall be supplied with a natural (as processed) finish, unplated or uncoated, in a clean condition, and lightly oiled. Platings and coatings are not recommended for interference-fit studs. Requirements for zinc plating are contained in ASTM F 1941.

**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. When control of surface discontinuities is required, the purchaser shall specify conformance to ASTM F 788/F 788M.

**15 STRAIGHTNESS**

At maximum material limit, studs must be straight within the limit established by the straightness or camber tolerance value,  $T$ , based on the overall length,  $L_T$ , of the stud as identified below and expressed as a two-place decimal. The referee gage and gaging procedure for checking straightness are provided in Mandatory Appendix I.

(a)  $T = 0.006 L_T$ , where  $L_T \leq 6$  in. (for fractional inches, round to next larger full inch)

(b)  $T = 0.008 L_T$ , where  $L_T > 6$  in. (for fractional inches, round to next larger full inch)

**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 B18.18.2 shall apply.

**17 DIMENSIONAL CONFORMANCE****17.1 Designated Characteristics**

(a) Unless otherwise specified, the characteristics designated below shall be inspected for conformance using the sampling plan in ASME B18.18.2.

(b) If a documented, statistically based, in-process inspection system that assures quality equivalent to ASME B18.18.2 or better using sample sizes in the inspection system, inspections may be conducted at any

point after which that characteristic will not be altered.

Characteristic	Inspection Level
Thread acceptability	C
Stud overall length	C
Full thread length	C
Straightness	B

### 17.2 Nondesigned Characteristics

For nondesignated characteristics, in event of dispute as to conformance, the inspection levels and sample sizes in ASME B18.18.2 shall be used.

### 17.3 Reporting of Inspection Results

The reporting of inspection results shall be agreed upon between the purchaser and supplier in the inquiry, purchase order, and/or contract.

## 18 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.

## 19 DESIGNATION

(a) 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
- (4) nominal length
- (5) material (applicable standard and grade or alloy)
- (6) protective coating, if required

In addition, pointed ends must be specified, or unpointed ends may be provided. 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  $\times$  4, SAE J429 Grade 5, zinc plated per ASTM F 1941 Classification Code Fe/Zn 5A, pointed ends
- (2) Clamping type stud, reduced diameter body, ASME B18.31.2,  $\frac{3}{8}$ -16  $\times$  2, ASTM F 468 nickel-copper alloy 400, pointed ends
- (3) Tap end stud, full body, ASME B18.31.2,  $1\frac{1}{8}$  NC-5 HF  $\times$   $6\frac{1}{2}$   $\times$   $1\frac{1}{8}$ -8UN, ASTM F 593 Alloy Group 2, Cold Worked Condition, pointed ends

Optionally, studs may be designated by a part identifying number when defined in ASME B18.24.

## MANDATORY APPENDIX I STUD STRAIGHTNESS, REFEREE GAGE, AND GAGING PROCEDURES

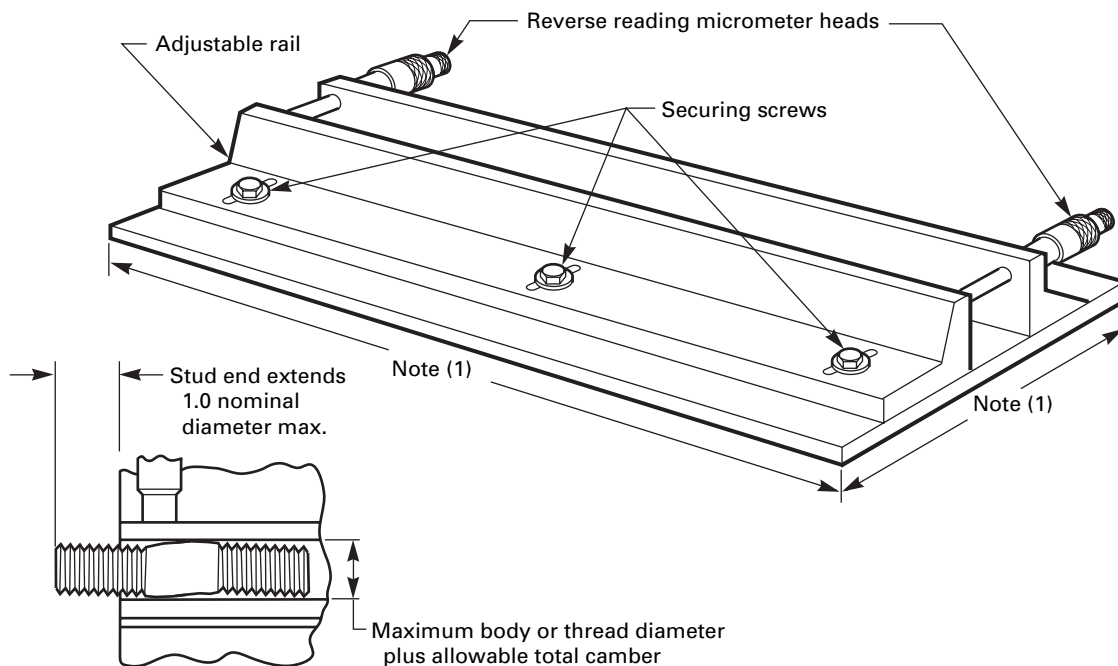
The conformance of stud straightness or camber limitations set forth in the product standards shall be checked using the gage illustrated in Fig. I-1, in accordance with the following procedure.

Allowable total camber on the stud to be inspected shall be calculated in accordance with the product standard by multiplying the specified permissible camber by the overall length of the stud and expressing the result as a two-place decimal. The total camber thus calculated shall be added to the specified maximum body diameter or thread major diameter, whichever is larger, and the adjustable rail of gage shall be adjusted

to provide a parallel space between the rails equal to this distance by obtaining common readings on both micrometer heads. The adjustable rail shall then be locked in place by tightening securing screws.

The stud shall then be placed between the rails so that a length not to exceed one nominal diameter extends out of the gage. The stud shall be considered acceptable for straightness if it can be rotated a full 360 deg by hand. Any interference occurring between the stud and gage that is sufficient to prevent rotation shall indicate excessive camber.

**Fig. I-1 Typical Straightness Gage**



**NOTE:**

- (1) Gage must be of sufficient width and length to accommodate the diameter and entire length of the stud being gaged.



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