

	SURFACE VEHICLE STANDARD	SAE	J2271 MAY2009
		Issued Revised	1996-06 2009-05
		Superseding	J2271 JAN2009
Ship Systems and Equipment—Part Standard for Studs— Continuous and Double End (Inch Series)			

RATIONALE

This limited scope revision only makes editorial changes and clarifications as to the scope of the document. Technical requirements are not changed. Changes are made to 1.1.b and 1.1.c to indicate that different thread forms can be used on each end of the stud. Changes in the January 2009 revision of this standard are listed below.

Configuration changes include:

- Added UNRF thread configurations for diameters 0.190 inch to 1-1/2 inches. Expanded the size (diameter) range of UNRC and 8UN studs.
- Added NC-5 HF and NC-5 CSF interference threads for use where a larger diameter is required for interference fit in an oversize tapped hole. Added ONF interference fit threads in Appendix B.
- The constant strength (undersize) stud body has been deleted in favor of the more commonly used reduced diameter body. Added Full Diameter Body configuration.
- The tap end thread length dimensions have been revised to minimize variations in thread length.
- Due to configuration changes, the Part Identification Number System has been revised and all part numbers are different from earlier revisions.
- Added Appendix A to provide guidance on the selection and installation of NC-5 Interference-Fit Tap End Studs.

Materials added and other material changes are:

- Titanium alloy 32 (Ti-5-1-1-1) to ASTM F 468.
- Ni-Cr-Mo-Cb (UNS N06625) to ASTM F 468 for high temperature and seawater applications.
- Ni-Cr-Mo-W alloy (UNS N06686) to ASTM F 468.
- Stainless steel B8 and B8M to ASTM A 193.
- Stainless steel 300 series per ASTM F 593 Group 1.
- Carbon Steel Grade B per ASTM A 307.
- Carbon and Alloy Steels - SAE J429 Grades 2, 5 and 8 (Grade 5 replaces ASTM A 449 Type 1 and Grade 8 replaces ASTM A 354 Grade BD for diameters of 1-1/2 inches and less).
- Added note comparing titanium materials and on material selection to minimize galling.
- The Part Identification Number Field for materials was expanded to two characters for all materials.

Changes in coating materials:

- MIL-L-46010 deleted for dry film coatings.
- Adding marking requirements for use of coated B7 material per ASTM A 193.
- Added Zinc/Aluminum Inorganic coatings per ASTM F 1136.
- Substituted ASTM F 1941 for ASTM B 633 and ASTM B 695 for zinc coating requirements.
- Identified recommended coatings for each stud material.
- Added a designator for coatings not covered by SAE J2271.

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Changes in Quality Assurance requirements:

Identified sampling levels for tests and inspections.

Added ASTM F 788/F 788M and SAE J1061 as references for surface defects inspection.

Changed primary inspection method for decarburization/carburization to ASTM F 2328

Deleted several supplementary inspections for ASTM A 193 materials.

1. SCOPE

1.1 Purpose

This SAE Parts Standard provides dimensional and quality assurance requirements for studs in the following configurations in standard materials used for ship system applications:

a. Continuous thread studs in UNRC and 8UNR series in the following threads and diameters:

- UNRC threads (1/4 through 4 inches)
- UNRF threads (1/4 through 1-1/2 inches)
- 8UNR threads (1-1/8 through 4 inches)

b. Double end studs (clamping type) where both ends are of the same minimum thread length in the following threads and diameters:

- UNRC threads (1/4 through 4 inches)
- UNRF threads (1/4 through 1-1/2 inches)
- 8UNR threads (1-1/8 through 4 inches)

Different thread forms on each end are permissible.

c. Double end studs (tap end type) where the tap end thread length is equivalent to 1-1/2 nominal diameters:

Tap End Thread Forms and Diameters

- NC-5 interference-fit tap end threads (1/4 through 1-1/2 inches)
- UNRC threads (1/4 through 4 inches)
- UNRF threads (1/4 through 1-1/2 inches)
- 8UNR threads (1-1/8 through 4 inches)

Nut End Thread Forms and Diameters

- UNRC threads (1/4 through 4 inches)
- UNRF threads (1/4 through 1-1/2 inches)
- 8UNR threads (1-1/8 through 4 Inches)

1.2 Field of Application

These studs are primarily for use in ship systems and equipment. The continuous thread studs and the reduced body diameter double end studs are configurations particularly suited to applications that are subject to high impact (H.I.) shock requirements.

1.3 Configurations and Part Identification Numbers

Figure 1 identifies the type and body configurations of the studs covered by the document. Figure 1 also provides a part numbering system with a unique part identification number for each stud. Table 1 is a listing of the materials covered by this standard. The part identification number identifies thread type, diameter, type of stud, body diameter, length of the stud, and material (including coating, where applicable). See 6.9 for change in Part Identification Numbers from the previous issue.

Part Numbering System for Studs

1	2	3	4	5	6	7	8
J2271	CC	025	T	X	450	F5	-Z

Field (Description)

Coating Designator (When applicable – See 4.10 for designators)**Material Designator** – See Table 1 for material designations)**Length** (3 digits in hundredths of an inch for lengths under 10 inches and 4 digits for longer lengths) See 4.4.2 for permitted length increments**Stud Body Configurations** (See 4.2 and Table 5)**F** – Double End Stud – Full Diameter Body (See 4.2.2)**R** – Double End Stud – Reduced Diameter Body (See 4.2.1)**S** – Double End Stud – (Body diameter Optional – See 6.9.2)**X** – No body (continuous thread)**Stud Type****C** – Double End Clamping Type (See 4.1.2, Table 3 and Figure 3)**D** – Double End With Tap End (See 4.1.2, Table 4 and Figure 4)**T** – Continuous Thread (See 4.1.1, Table 2 and Figure 2)**Nominal Diameter** – 3 digits in hundredths of an inch as shown in Table 2 (See Tables 2 through 5 as applicable)**Type Thread** – First Letter (Nut End). Second Letter (Tap End or other Nut End) – Two letters required**1st and 2nd Letter Designators****C** – UNRC (UNC) thread form (See 4.3)**F** – UNRF (UNF) thread form (See 4.3)**U** – 8UNR (8UN) thread form (See 4.3)**2nd Letter designators only****B** – NC-5 CSF Interference Fit Thread (See 4.3.3)**H** – NC-5 HF Interference Fit Thread (See 4.3.3)**N** – NC-5 ONF (See Appendix B for requirements)**S** – NC-5 HFS Interference Fit Thread (See 4.3.3)

See 4.3.3 for additional Navy Developed NC-5 Interference Fit Thread Designators for improved performance

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The part number example shown above, J2271CC025TX450F5-Z is for a continuously threaded stud with 1/4-20 UNRC threads with a length of 4-1/2 inches manufactured of carbon steel per SAE J429 Grade 5 and zinc plated.

FIGURE 1 - PART IDENTIFICATION NUMBERS (PIN'S) FOR CONTINUOUS AND DOUBLE END STUDS (INCH SERIES)

TABLE 1 - MATERIALS

Fig 1 PIN – Field 7 Material Designator		Material Standard	Grade or Alloy	Diam. (Inches)	Marking	Tensile Strength ksi (min) ⁽¹⁾	Yield Strength (min ksi) ⁽¹⁾	Fig. 1 PIN – Field 8 Coatings ⁽²⁾ (When Applicable)
New	Old							
A1	A	ASTM A 193 Chrome- molybdenum- vanadium steel for high temperature	B16	2-1/2 and <	B16	125	105	None
				> 2-1/2	B16	110	95	
B7	B	ASTM A 193 Chrome-molybdenum steel for high temperature	B7	2-1/2 and <	B7	125	105	None
				> 2-1/2	B7	115	95	
		Same as above – temperature limited by coating (See 6.7)	B7	2-1/2 and <	B7 CTD	125	105	–D, –V, –W, –X, –Y, –Z
				> 2-1/2		115	95	
		Stainless Steel						
B8		ASTM A 193	B8 (304)	> 1-1/2	B8	75	30	None
C8		ASTM A 193	B8M (316)	> 1-1/2	B8M	75	30	None
CA		ASTM F 593 Stainless Steel Annealed	316 or 316L	¼ to 1-1/2	F593B	75 – 100	30	–D
CW	C	ASTM F 593 Stainless Steel Cold Worked		< ¾ in	F593G	100-150	65	–D
CS		ASTM F 593 Stainless Steel Strain Hardened	Group 2 Alloys	¾ to 1-1/2	F593H	85-140	45	
				¼ to 5/8	F593E	120 - 160	95	–D
				¾ to 1	F593F	110 - 150	75	
				1-1/8, 1-1/4	F593G	100 - 140	60	
				1-3/8, 1-1/2	F593H	95 - 130	45	
HA		ASTM F 593 Stainless Steel Annealed	Group 1 Alloys 304, 304L, 18-9LW, 302HQ, 305 or 384 (Group 2 Alloys may be provided, See 6.6)	¼ to 1-1/2	F593B	75 - 100	30	–D
HW	ASTM F593 Stainless Steel Cold Worked	< ¾ in		F593C	100 - 150	65	–D	
		¾ to 1-1/2		F593D	85 - 140	45		
HS		ASTM F593 Stainless Steel Strain Hardened		¼ to 5/8	F593A	120 - 180	95	–D
				¾ to 1	F593B	110 - 150	75	
				1-1/8, 1-1/4	F593C	100 - 140	60	
				1-3/8, 1-1/2	F593D	95 - 130	45	

TABLE 1 - MATERIALS (CONTINUED)

Fig 1 PIN – Field 7 Material Designator		Material Standard	Grade or Alloy	Diam. (Inches)	Marking	Tensile Strength ksi (min) ⁽¹⁾	Yield Strength (min ksi) ⁽¹⁾	Fig. 1 PIN – Field 8 Coatings ⁽²⁾ (When Applicable)
New	Old							
Steel								
D8		SAE J429 (See 6.9.4)	Grade 8	¼ to 1-1/2	6 radial lines @ 60°	150	130	–D, –V, –W, –X, –Y,
BD	D	ASTM A354 (See 6.9.4)	Grade BD	> 1-1/2 to 2-1/2	BD ⁽⁴⁾	150	130	–D, –V, –W, –X, –Y,
				Over 2-1/2		140	115	
EA	E	ASTM A 307	Gr A or B	¼ to 4	307A or 307B	60 60 – 100	– –	–D, –V, –W, –X, –Y, –Z
F2		SAE J429 (Caution: See 6.4)	Grade 2	¼ to ¾	None	74	57	
				7/8 – 1-1/2		60	36	
F5		SAE J 429 (See 6.9.3)	Grade 5	¼ to 1	3 radial lines @ 120°	120	92	–D, –V, –W, –X, –Y, –Z
				1-1/8 to 1-1/2		105	81	
F9	F	ASTM A 449 (See 6.9.3)	Type 1	1-5/8 to 3	A449 ⁽⁵⁾	90	58	
Nickel Alloys								
AC		ASTM F 468 UNS 06625	Ni 625	¼ - 4	F468AC ⁽³⁾	120	60	–D
BN		ASTM F 468 Ni-Cr-Mo-W Alloy 686 UNS 06686 Caution (See 6.5.1)	Grade 1	¼ to 4 in.	F468BN ⁽³⁾	120 – 165	85	–D
CN			Grade 2		F468CN ⁽³⁾	135 – 185	125	
DN			Grade 3		F468DN ⁽³⁾	160 - 200	150	
EN			Grade 4		F468EN ⁽³⁾	100 – 145	45	
KK	K	QQ-N-286 (See 4.6.1)	Ni-Cu-Al	< 1	●K●	130	90	–D
				1 to 4		130	85	
NC	N	ASTM F 468	Ni-Cu 400	¼ to ¾	F468U ⁽³⁾	80 – 130	40	–D
				7/8 - 4		70 – 130	30	
Titanium Alloys								
TF	T	ASTM F 468 (See 6.3 for comparison of titanium alloys)	Alloy 19	¼ - 1-1/2	F468FT	115 – 150	115	–D
TH			Ti 5-1-1-1	¼ - 4	F468HT ⁽³⁾	105 – 150	90	–D

1. Stud mechanical properties are listed primarily for information and shall be in accordance with referenced product standards. Mechanical properties shall comply with this standard for sizes not listed in referenced product standards.
2. See 4.10 for coating requirements.
3. ASTM F 468 requirements normally apply to diameters 1/4 through 1-1/2 inches. However, the ASTM F 468 requirements and marking are being applied for diameters 0.190 through 4 inches for SAE J2271
4. May also be marked with 6 radial lines 60° apart if alloy steel meeting specific requirements.
5. May also be marked with 3 radial lines 120° apart if meeting SAE J429 Grade 5.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this publication to the extent specified herein. Unless otherwise specified, the latest issue of all publications shall apply.

NOTE: Contracts invoking this document may establish an effectivity date for referenced documents.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE AMS2487	Anodic Treatment of Titanium and Titanium Alloys Solution pH 12.4 Maximum
SAE AS1701	Lubricant, Solid Film
SAE J123	Surface Discontinuities on Bolts, Screws, and Studs in Fatigue Applications
SAE J429	Mechanical and Material requirements for Externally Threaded Fasteners
SAE J1061	Surface Discontinuities on General Application Bolts, Screws and Studs
SAEJ2270	Ship Systems and Equipment-Threaded Fasteners—Inspection, Test, and Installation Requirements

2.1.2 ASME Publications

Available from the American Society of Mechanical Engineers, 22 Law Drive, PO Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Forms)
ASME B1.3	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 B18.18.1	Inspection and Quality Assurance for General Purpose Fasteners

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A 193/A 193M	Alloy Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and other Special Service Applications
ASTM A 307	Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 354	Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners
ASTM A 380	Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A 449	Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 KSI Minimum Tensile Strength, General Use

ASTM A 967	Chemical Passivation Treatments for Stainless Steel Parts
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 1136	Zinc/Aluminum Corrosion Protective Coatings for Fasteners
ASTM F 1470	Standard Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection
ASTM F 1941	Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR)
ASTM F 2328	Standard Test Method for Determining Decarburization and Carburization In Hardened and Tempered Threaded Steel Bolts, Screws and Studs
ASTM G 98	Test Method for Galling Resistance of Materials

2.1.4 U.S. Government Publications

Available from Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, <http://assist.daps.dla.mil/quicksearch/>.

QQ-N-286	Nickel-Copper-Aluminum Alloy, Wrought (UNS N05500)
CID A-A-59004	Anti-Galling Compound, Thread Lubricating, Seizing Resistant, and Calcium Hydroxide Containing

3. DEFINITIONS

3.1 Body Bound Studs

Studs whose body is manufactured to specific tolerances to ensure a tight or interference fit with the equipment being secured. They may also be identified as finished, close body studs. Body bound studs are not covered by this document.

3.2 Reduced Diameter Body Studs

Studs whose body diameter may range from the minimum pitch diameter of the thread and does not exceed the minimum major thread diameter. The reduced diameter body studs replace the previously covered constant strength studs. (See 6.9.1.)

3.3 Double End Studs

Double end studs have threads on each end, typically with an unthreaded body in between.

3.3.1 Clamping Type

Has conventional threads on both ends and serves the function of clamping two bodies together with a nut on either end.

3.3.2 Interference Thread Type

Has conventional threads on the nut end and threads on the tap end that will give an interference fit in the hole in which it is installed.

3.4 Full Diameter Body Studs

Studs whose body diameter is within the dimensional limits of the major diameter of the thread.

3.5 Lot

A lot of fasteners shall consist of one heat of material, of one type and style, of the same nominal diameter, and fabricated and heat treated in the same batch or by a continuous process under the same conditions of time and temperature.

3.6 Nut End

The end or end(s) of the stud to be mated with a nut. (In some cases, double end clamping type studs that are designed for nuts on each end may be installed with the nut end acting as a set end.)

3.7 Part Identification Number (PIN)

A succinct format of data fields that identify a stud by the following: Type Thread, Nominal Diameter, Stud Type, Stud Body Configuration, Length, Material, and Coating

3.8 Set End

The end of the stud that is not for use with a nut but is threaded into a piece of material or component. The set end is often secured with an anaerobic compound or by interference fit threads (see tap end).

3.9 Stud Bolt (Standing Bolt)

A stud with threads on both ends or a continuous thread stud that is screwed permanently into a fixed part at one end and a nut on the other end.

3.10 Tap End

The end of the stud not intended for use with a nut. Particularly, an end with interference fit threads.

3.11 Total Thread

This dimension includes the complete or effective thread and all the incomplete thread. This length is determined by measuring the distance from the extreme end of the stud to the last scratch made by the run-out of the thread on the part.

4. TECHNICAL REQUIREMENTS

4.1 Configurations

4.1.1 Continuous Thread Studs

Studs that are continuously threaded over the entire length with a single thread configuration as shown in Figure 2. Dimensional requirements for continuous thread studs are shown in Table 2.

4.1.2 Double End Studs

This document defines the following types:

Type C—Double End Clamping Type Stud with equal thread lengths on each end (see Figure 3 and Table 3)

Type D—Double End Stud with shorter Tap End threads (see Figure 4 and Table 4)

4.2 Body Diameter Configurations and Dimensions

This document covers the following body diameter configurations and dimensions.

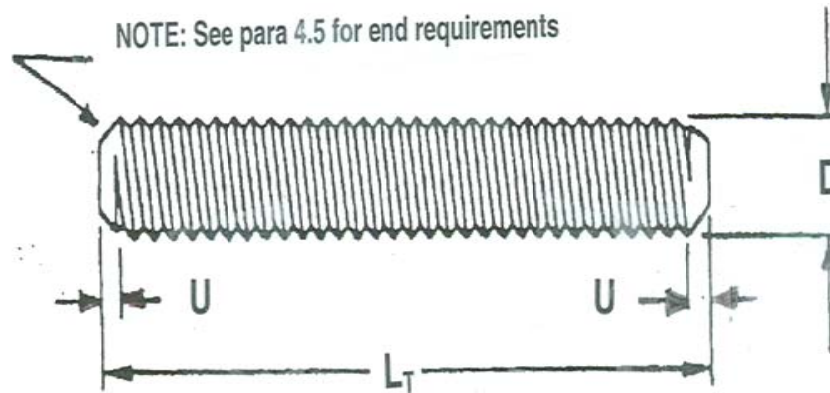


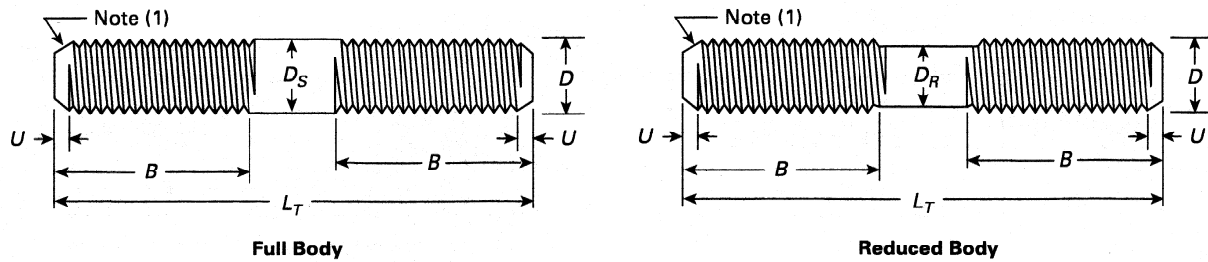
FIGURE 2 - CONTINUOUS THREAD STUD

TABLE 2 - DIMENSIONS⁽¹⁾ OF CONTINUOUS THREAD STUDS

Field 3 PIN	Nom. Size	Diam. (D)	Threads Per Inch			$U_{max} = 2P$		
			UNRC	UNRF	8UNR	(2P for UNRC threads)	(2P for UNRF threads)	(2P for 8UNR threads)
019	#10	0.1900	24	32	-	0.083	0.063	-
025	1/4	0.2500	20	28	-	0.100	0.071	-
031	5/16	0.3125	18	24	-	0.111	0.083	-
038	3/8	0.3750	16	24	-	0.125	0.083	-
044	7/16	0.4375	14	20	-	0.143	0.100	-
050	1/2	0.5000	13	20	-	0.154	0.100	-
056	9/16 ⁽²⁾	0.5625	12	18	-	0.167	0.111	-
063	5/8	0.6250	11	18	-	0.182	0.111	-
075	3/4	0.7500	10	16	-	0.200	0.125	-
088	7/8	0.8750	9	14	-	0.222	0.143	-
100	1	1.0000	8	12	-	0.250	0.167	-
113	1-1/8	1.1250	7	12	8	0.286	0.167	0.250
125	1-1/4	1.2500	7	12	8	0.286	0.167	0.250
138	1-3/8	1.3750	6	12	8	0.333	0.167	0.250
150	1-1/2	1.5000	6	12	8	0.333	0.167	0.250
163	1-5/8	1.6250	-	-	8	-	-	0.250
175	1-3/4	1.7500	5	-	8	0.400	-	0.250
188	1-7/8	1.8750	-	-	8	-	-	0.250
200	2	2.0000	4 1/2	-	8	0.444	-	0.250
225	2-1/4	2.2500	4 1/2	-	8	0.444	-	0.250
250	2-1/2	2.5000	4	-	8	0.500	-	0.250
275	2-3/4	2.7500	4	-	8	0.500	-	0.250
300	3	3.0000	4	-	8	0.500	-	0.250
325	3-1/4	3.2500	4	-	8	0.500	-	0.250
350	3-1/2	3.5000	4	-	8	0.500	-	0.250
375	3-3/4	3.7500	4	-	8	0.500	-	0.250
400	4	4.0000	4	-	8	0.500	-	0.250

1. See Table 7 for tolerances on stud lengths.

2. Non preferred size, not recommended for new design due to limited availability.



NOTE (1): See 4.5 for end requirements.

FIGURE 3 - DOUBLE END - CLAMPING TYPE STUD DIMENSIONS⁽¹⁾

TABLE 3 - NUT END DIMENSIONS FOR CLAMPING TYPE STUDS

Nominal Size		Minimum Nut End Full Thread Length B			2 Thread Pitches (2P) U _{max} equals 2P		
Size	Diam. (D)	L > 10 and ≤ 16			UNRC Threads	UNRF Threads	8UNR Threads
		L ≤ 10	L ≤ 16	L > 16			
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 ⁽²⁾	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	2.7600	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

1. See Table 5 for body diameters for full body or reduced body studs. See Table 7 for tolerances on overall stud lengths.

2. Non preferred size, not recommended for new design due to limited availability.