

ASTM A193 B7 Stud Bolts & ASTM A194 Grade 2H Hex Nuts Datasheet

This datasheet provides complete technical specifications for ASTM A193 Grade B7 stud bolts used with ASTM A194 Grade 2H heavy hex nuts, including dimensional standards, chemical composition, mechanical properties, heat treatment, inspection, and surface finish.

1. Applicable Standards

ASTM A193 / ASME SA193 – Alloy steel bolting for high temperature or high pressure service

ASTM A194 / ASME SA194 – Carbon and alloy steel nuts for bolts

ASTM A962/A962M – Common requirements for bolting

ASME B1.1 – Unified Inch Screw Threads

2. Dimensional Standards

ASTM A193 B7 stud bolts and ASTM A194 Grade 2H hex nuts are manufactured in accordance with recognized dimensional standards to ensure full interchangeability and proper fit in flanged joints.

Stud Bolts:

- ASME B16.5 – Stud bolt lengths for flanged joints
- ASME B18.31.2 – Continuous thread studs (fully threaded)
- ASME B1.1 – Thread form and tolerances (UNC / UNF)

Hex Nuts:

- ASME B18.2.2 – Heavy hex nuts
- ASME B18.2.4.6 – Metric heavy hex nuts (if applicable)

3. Size Range

Stud Bolts Diameter: 1/4 inch to 4 inch

Stud Bolts Length: As per ASME B16.5 or customer requirement

Hex Nuts Size: 1/4 inch to 4 inch

Thread Type: UNC / UNF / Metric

4. Chemical Composition – ASTM A193 Grade B7

Element	Composition (%)
Carbon (C)	0.37 – 0.49
Manganese (Mn)	0.65 – 1.10
Phosphorus (P)	≤ 0.035
Sulfur (S)	≤ 0.040
Silicon (Si)	0.15 – 0.35
Chromium (Cr)	0.75 – 1.20
Molybdenum (Mo)	0.15 – 0.25
Iron (Fe)	Balance

5. Chemical Composition – ASTM A194 Grade 2H

Element	Composition (%)
Carbon (C)	≤ 0.40

Element	Composition (%)
Manganese (Mn)	0.60 – 1.00
Phosphorus (P)	≤ 0.035
Sulfur (S)	≤ 0.040
Silicon (Si)	0.15 – 0.35
Chromium (Cr)	0.40 – 1.00
Molybdenum (Mo)	0.15 – 0.30
Iron (Fe)	Balance

6. Mechanical Properties & Heat Treatment

ASTM A193 Grade B7 stud bolts are quenched and tempered to achieve a minimum tensile strength of 125 ksi (860 MPa) and a minimum yield strength of 105 ksi (725 MPa), with a maximum hardness of 35 HRC. ASTM A194 Grade 2H hex nuts are also quenched and tempered and must have a hardness range of 24 – 35 HRC.

7. Surface Finish Options

Plain (Self Color), Black Oxide, Zinc Plated, Hot-Dip Galvanized (HDG), PTFE / Xylan / Fluoropolymer Coated, Phosphate Coated.

8. Inspection & Certification

Mandatory inspection includes chemical analysis, tensile testing, hardness testing, and dimensional inspection. Optional PMI, UT, and MT are available upon request. All products are supplied with EN 10204 3.1 Mill Test Certificates and full heat number traceability.

9. Typical Applications

Oil & gas pipelines, refineries, petrochemical plants, pressure vessels, heat exchangers, valves, flanged joints, and power generation equipment.

Keywords: ASTM A193 B7 Stud Bolts, ASTM A194 2H Hex Nuts, ASTM A193 B7 A194 2H Specification, High Temperature Stud Bolts, Alloy Steel Stud Bolts

ASTM A193 Grade B7 stud bolts are high-strength chromium-molybdenum alloy steel fasteners designed for high-temperature and high-pressure applications. They are widely used in flanged joints, pressure vessels, valves, and piping systems in oil & gas, petrochemical, refinery, and power generation industries.

ASTM A193 B7 stud bolts are heat treated to achieve excellent tensile strength, creep resistance, and mechanical stability, making them one of the most commonly specified bolting grades worldwide.



Table 1 Dimensions for Continuous Thread Studs

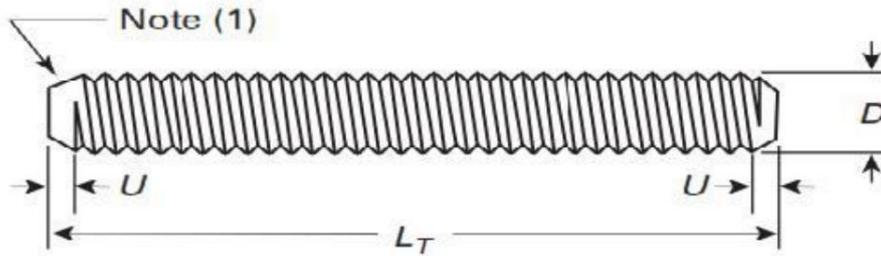


Table 1 Dimensions for Continuous Thread Studs

Nominal Size	Diameter, D	Threads Per Inch [Note (2)]			Chamfered Thread Distance, U					
		UNC / UNF / 8UN			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	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	4½		8	0.222	0.444			0.125	0.250
2-1/4	2.2500	4½		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

Torque-Tension Relationship for ASTM A193 B7 Bolts and Studs

Nominal Dia. (in.)	Threads Per Inch	Minimum Tensile Strength (lbs.)	Minimum Yield Strength (lbs.)	Est. Shear Strength (lbs.)	Clamp Load (lbs)	Tightening Torque		
						K = 0.12 (ft-lbs)	K = 0.15 (ft-lbs)	K = 0.20 (ft-lbs)
1/4	20	3978	3341	2016	2506	6	8	10
1/4	28	4547	3819	2441	2864	7	9	12
5/16	18	6554	5505	3401	4129	13	16	22
5/16	24	7258	6097	3931	4573	14	18	24
3/8	16	9686	8136	5083	6102	23	29	38
3/8	24	10979	9222	6063	6916	26	32	43
7/16	14	13289	11162	6997	8372	37	46	61
7/16	20	14840	12465	8173	9349	41	51	68
1/2	13	17737	14899	9425	11175	56	70	93
1/2	20	19994	16795	11146	12596	63	79	105
9/16	12	22743	19104	12150	14328	81	101	134
9/16	18	25373	21313	14159	15985	90	112	150
5/8	11	28250	23730	15131	17798	111	139	185
5/8	18	31995	26876	17999	20157	126	157	210
3/4	10	41808	35118	22643	26339	198	247	329
3/4	16	46620	39161	26344	29371	220	275	367
7/8	9	57717	48482	31438	36362	318	398	530
7/8	14	63684	53495	36035	40121	351	439	585
1	8	75718	63603	41316	47702	477	596	795
1	14	84986	71388	48473	53541	535	669	892
1 1/8	7	95409	80144	51969	60108	676	845	1127
1 1/8	8	98807	82998	54570	62248	700	875	1167
1 1/4	7	121139	101757	66722	76318	954	1192	1590
1 1/4	8	124963	104969	69664	78727	984	1230	1640
1 1/2	8	186480	156644	105376	117483	1762	2203	2937
1 1/2	6	175657	147551	97013	110664	1660	2075	2767
1 5/8	8	221841	186346	125992	139760	2271	2839	3785
1 3/4	8	260269	218626	148450	163970	2869	3587	4782
1 7/8	8	301766	253483	172748	190112	3565	4456	5941
2	8	346330	290917	198887	218188	4364	5455	7273
2 1/4	8	444663	373517	256688	280138	6303	7879	10505
2 1/2	8	555267	466425	321851	349819	8745	10932	14576

The torque values can only be achieved if nut (or tapped hole) has a proof load greater than or equal to the bolt's minimum ultimate tensile strength.

Clamp load calculated as 75% of the yield strength for the B7 specified in ASTM A193.

Torque values calculated from formula $T=KDF$, where

Coatings such as Teflon or Xylan offer extremely low coefficients of friction. Often we will experience K values around 0.12 or even lower.

K = 0.15 for "lubricated" conditions and K = 0.20 for "dry" conditions

D = Nominal Diameter

F = Clamp Load

Tensile and Yield strengths in accordance with ASTM A193

Minimum ultimate tensile strength: 125,000 PSI (up through 2-1/2") and 115,000 PSI (over 2-1/2 through 4)

Minimum yield strength: 105,000 PSI (up through 2-1/2") and 95,000 PSI (over 2-1/2 through 4)

Estimated Shear Strength based off of 60% of minimum tensile strength using the thread root area. It is not part of the ASTM A193 specification.