

ASTM A193 Grade B7 Stud Bolt Chart

Thread × tensile area × 50 % yield preload × dry torque × ASME B16.5 / EN 1092-1 flange pairing

ASTM A193 Grade B7 is the default flange stud in the ASME B16.5 / B16.47 range — an alloy-steel bolt in the 4140/4142 family, quench-and-tempered to 105 ksi (724 MPa) tensile strength and 105 ksi (724 MPa) yield up to 2 in, dropping to 100 / 95 / 75 ksi as the diameter steps up. The stud is threaded to Class 2A UN across the whole length and used with two ASTM A194 Grade 2H heavy-hex nuts. The chart lists the standard stud sizes with the tensile stress area, the recommended preload (50 % of specified minimum yield), the dry torque needed to reach that preload (K = 0.20, clean lubricated threads at K = 0.16 hit the same preload at 80 % of these figures) and the flange class × NPS the stud pairs with per ASME B16.5.

Stud	Pitch	Tensile A (in ²)	50 % Fy (kN)	Torque dry (Nm)	Flange pairing (ASME B16.5)
1/2 in	13 UNC	0.1419	45	140	ASME 150 NPS 3-8, EN PN10 DN15-100
5/8 in	11 UNC	0.226	71	270	ASME 150 NPS 4-10, ASME 300 NPS 1-6
3/4 in	10 UNC	0.3345	106	475	ASME 150 NPS 6-24, ASME 300 NPS 2-10, ASME 600 NPS 1-8
7/8 in	9 UNC	0.4617	146	760	ASME 300 NPS 4-12, ASME 600 NPS 3-10
1 in	8 UNC	0.6057	191	1130	ASME 300 NPS 8-16, ASME 600 NPS 5-14, ASME 900 NPS 2-8
1-1/8 in	8 UN	0.7906	249	1580	ASME 300 NPS 12-24, ASME 600 NPS 8-18, ASME 900 NPS 1-14
1-1/4 in	8 UN	0.9691	305	2140	ASME 300 NPS 14-24, ASME 600 NPS 10-24, ASME 900 NPS 6-16
1-3/8 in	8 UN	1.173	370	2830	ASME 600 NPS 14-24, ASME 900 NPS 8-20
1-1/2 in	8 UN	1.403	442	3670	ASME 600 NPS 16-24, ASME 900 NPS 10-24, ASME 1500 NPS 3-8
1-5/8 in	8 UN	1.66	523	4660	ASME 600 NPS 18-24, ASME 900 NPS 12-24
1-3/4 in	8 UN	1.943	612	5810	ASME 900 NPS 16-24, ASME 1500 NPS 8-14
1-7/8 in	8 UN	2.25	709	7130	ASME 600 NPS 24, ASME 900 NPS 20-24
2 in	8 UN	2.58	813	8640	ASME 1500 NPS 10-18
2-1/4 in	8 UN	3.25	1020	12200	ASME 1500 NPS 14-24
2-1/2 in	8 UN	4	1260	16800	ASME 1500 NPS 16-24, ASME 2500 NPS 6-12

Reading the chart

- Thread + pitch — 1/2 in and 5/8 in use standard UNC; 3/4 in and 7/8 in use UNC; from 1 in in up ASTM A193 uses 8 UN (constant 8 threads per inch), which is finer than UNC above 1 in and gives more consistent preload.
- Tensile stress area — the effective cross-section that carries load. Multiply by the yield stress (724 MPa for B7 up to 2 in, 724 / 655 MPa above) to get the yield load.
- 50 % Fy (kN) — the recommended preload for a flange stud, 50 % of the minimum specified yield. Higher preload gives a tighter joint but leaves less margin against thermal or external load.
- Torque dry (Nm) — the torque needed to reach 50 % Fy on a dry, clean stud (nut factor K = 0.20). Lubricated with anti-seize or Molykote: multiply by 0.75. Never re-use B7 studs at 50 % Fy — the elastic history changes the K factor.
- Flange pairing — the ASME B16.5 class and NPS range for which the stud is the standard. A single class + NPS combination often falls in more than one stud size bracket because B16.5 does not fix the stud size at every combination.

Reference compiled by cBallast from ASTM A193/A193M (Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service, current edition), ASME B18.31.3 stud sizes, ASME B16.5 flange bolt tables and Cameron hydraulic bolt-torque tables. Torque values are for K = 0.20 dry, room-temperature ambient; for a hot bolt-up, a re-torqued stud or lubricated threads consult the flange OEM procedure. Values are nominal and provided for identification and cross-reference; confirm against the controlling standard and the flange maker's current bolt-up procedure before manufacture or installation. All trademarks are the property of their respective owners.

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