

**HEAT-TREATED ALLOY STUDS, BOLTS
AND THREADED BARS**

Chemical Composition, heat-treated, alloy steel studs

Elements	A354 Grades BC, BD		A193 Grade B7	
	† See note below		Chromium-Molybdenum (AISI 4140, 4142, 4145)	
	Range Percent	Check variation over percent	Range Percent	Check variation over or under percent
Carbon	—	—	• 0.38-0.48	0.02
Manganese	—	—	0.75-1.00	0.04
Phosphorus, max	0.04	0.005	0.04	0.005 over
Sulphur, max	0.04	0.005	0.04	0.005 over
Silicon	—	—	0.20-0.35	0.02
Chromium	—	—	0.80-1.10	0.05
Molybdenum	—	—	0.15-0.25	0.02

Elements	A193 Grade B16 Chromium- Molybdenum- Vanadium	
	Range Percent	Check variation over or under percent
Carbon	0.35-0.44	0.02
Manganese	0.45-0.70	0.03
Phosphorus, max	0.04	0.005 over
Sulphur, max	0.04	0.005 over
Silicon	0.20-0.35	0.02
Chromium	0.80-1.15	0.05
Molybdenum	0.50-0.65	0.03
Vanadium	0.25-0.35	0.03

Elements	A320 Grade L7		A320 Grade L43	
	Chromium-Molybdenum (AISI 4140, 4142, 4145)		Nickel-Chromium-Molybdenum (AISI 4340)	
	Range Percent	Check variation over or under percent	Range Percent	Check variation over or under percent
Carbon	• 0.38-0.48	0.02	0.38-0.43	0.02
Manganese	0.75-1.00	0.04	0.60-0.85	0.03
Phosphorus, max	0.04	0.005 over	0.04	0.005 over
Sulphur, max	0.04	0.005 over	0.04	0.005 over
Silicon	0.20-0.35	0.02	0.20-0.35	0.02
Nickel	—	—	1.65-2.00	0.05
Chromium	0.80-1.10	0.05	0.70-0.90	0.03
Molybdenum	0.15-0.25	0.02	0.20-0.30	0.02

• For bar sizes over 3 1/2" to 4" inclusive, the carbon content may be 0.50 pct. max.
† Any alloy steel capable of meeting the tensile requirements of specification A354 may be used.

Tensile Requirements, heat-treated, alloy steel studs

Grade	Diameter Inches	Min tempering temp F	Tensile strength min psi	Yield point min psi	Elong- ation in 2" min pct	Reduc- tion of area min pct
A354 Grade BC	2 1/2 and under	850	125,000	109,000	16	50
	Over 2 1/2 to 4 incl	850	115,000	99,000	16	45
A354 Grade BD	1 1/2 and under	850	150,000	125,000	14	35
A193 Grade B7 Chromium- Molybdenum	2 1/2 and under	1100	125,000	105,000	16	50
	Over 2 1/2 to 4 incl	1100	115,000	95,000	16	50
	Over 4 to 7 incl	1100	100,000	75,000	18	50
A193 Grade B16 Chromium- Molybdenum- Vanadium	2 1/2 and under	1200	125,000	105,000	18	50
	Over 2 1/2 to 4 incl	1200	110,000	95,000	17	45
	Over 4 to 7 incl	1200	100,000	85,000	16	45
A320 Grade L7 Chromium- Molybdenum	2 1/2 and under	—	125,000	105,000	16	50
A320 Grade L43 Nickel- Chromium- Molybdenum	4 and under	—	125,000	105,000	16	50

Commonly used are the following grades of heat-treated alloy steel for high pressure or extreme temperature service in diameters of 1/2" to 2", inclusive. Other grades and other diameters are available on special order.

ASTM A354, Grades BC and BD— heat-treated alloy steels for applications at normal atmospheric temperatures where high strength is required.

ASTM A193, Grade B7— a heat-treated chromium-molybdenum steel widely used for medium high temperature service.

ASTM A193, Grade B16— a heat-treated chromium molybdenum-vanadium steel for high-pressure, high-temperature service.

ASTM A320, Grade L7— This grade is intended for low-temperature service down to minus 150°F and has a minimum Charpy impact value of 15 ft-lb at this temperature. Sizes 2 1/2" and under.

ASTM A320, Grade L43— The same properties offered by Grade L7 in sizes up to 2 1/2" are obtainable up to 4" in Grade L43.

Heat-treated alloy steel bolts and threaded bars are also available from Bethlehem in the grades listed above-bolts in diameters of 3/8" to 1 1/4", inclusive; bars in diameters of 1/2" to 2", inclusive. These are available only on special order.