

Chemical Requirements

Bolting Materials, High-Temperature, 50 to 120 ksi (345 to 827 Mpa) Yield Strength, With Expansion Coefficients comparable to Austenitic Steels.

ASTM Designation A 453

Type	Grade Symbol	Material	Carbon %	Manganese %	Phosphorus %	Sulfur %	Silicon %	Chromium %	Nikel %	Molydenum %	Titanium %	Columbium & Tantalum %	Vanadium %	Copper %	Tungsten %	Aluminium %	Boron %
ASTM A453	660	AISI 660	0.08 max.	2.00 max.	0.040 max.	0.030 max.	1.00 max.	13.50 ~16.00	24.00 ~ 27.00	1.00 ~ 1.50	1.90 ~ 2.35		0.10 ~ 0.50			0.35 max.	0.0010 ~ 0.010
	651	AISI 651	0.28 ~ 0.35	0.75 ~ 1.50	0.040 max.	0.030 max.	0.30 ~ 0.80	18.00 ~ 21.00	8.00 ~ 11.00	1.00 ~ 1.75	0.10 ~ 0.35	0.25 ~ 0.60		0.50 max.	1.00 ~ 1.75		
	662	AISI 662	0.08 max.	0.40 ~ 1.00	0.040 max.	0.030 max.	0.40 ~ 1.00	12.00 ~ 15.00	24.00 ~ 28.00	2.00 ~ 3.50	1.80 ~ 2.10			0.50 max.		0.35 max.	0.0010 ~ 0.010
	665	AISI 665	0.08 max.	1.25 ~ 2.00	0.040 max.	0.030 max.	0.10 ~ 0.80	12.00 ~ 15.00	24.00 ~ 28.00	1.25 ~ 2.25	2.70 ~ 3.30			0.25 max.		0.25 max.	0.01 ~ 0.07

Mechanical Requirements

Bolting Materials, High-Temperature, 50 to 120 ksi (345 to 827 Mpa) Yield Strength, With Expansion Coefficients comparable to Austenitic Steels.

ASTM Designation A 453

Type	Grade Symbol	Class	Tensile Strength, min., ksi (Mpa)	Yield Strength, min., 0.2 % offset, ksi (Mpa)	Elongation in 4 D, min., %	Reduction of Area, min., %	Brinell Hardnes	Rockwell Hardness B & C	
								min.	Max.
ASTM A453	660	A, B & C	130 (895)	85 (585)	15	18	248 ~ 341	99 HRB ³	37 HRC
	651	A	100 (690)	70 (485) ¹ 60 (415) ²	18	35	217 ~ 277	95 HRB	29 HRC
		B	95 (655)	60 (415) ¹ 50 (345) ²	18	35	212 ~ 269	93 HRB	28 HRC ⁹
	662	A	130 (895)	85 (585)	15	18	255 ~ 321	100 HRB ³	35 HRC ⁹
		B	125 (860)	80 (550)	15	18	248 ~ 321	99 HRB	35 HRC
	665	A	170 (1,170)	120 (830)	12	15	311 ~ 388	32 HRC	41 HRC
		B	155 (1,070)	120 (830)	12	15	311 ~ 388	32 HRC	41 HRC

¹ Material sizes 3 in. (76 mm.) and under in diameter.

² Material sizes over 3 in. (76 mm.) in diameter.

³ Conversion number taken from Test Methods and Definitions A 370, Table 3D.

⁹ Conversion number taken from Specification ASTM A193/A193M, Table 2 (Austenitic Steels), Other by interpolation.