

# SA 453M 651

# NICKEL ALLOY

## CLASS B

BOLTING MATERIAL FOR HIGH TEMPERATURE SERVICE

SA 453M covers five grades of bolting materials such as grade 660, 651, 662, 665 & 668 with Twelve classes of yield strength ranging from 50 to 120 ksi for use in high-temperature service such as fasteners for pressure vessel and valve flanges. The term "bolting material" as used in SA 453M 651 Class B, covers rolled, forged, or hot-extruded bars; bolts, nuts, screws, washers, studs and stud bolts. SA 453M 651 Class B expressed in both inch-pound units and in SI units. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

### Chemical Properties

C	Mn	P	S	Si	Cr	Mo	Ni	Cu	Cb	Ti	W
0.28-0.35	0.75-1.50	0.040 Max	0.030 Max	0.30-0.80	18.0-21.0	1.00-1.75	8.0-11.0	0.50 Max	0.25-0.6	0.1-0.35	1.00-1.75

### Mechanical Properties

Yield strength	Tensile strength	Elongation	Reduction	Hardness		
Mpa	Mpa	%	%	BHN	HRB	HRC
min	min	min	min			
415	655	18	35	212-269	93	28

### STREE RUPTURE REQUIREMENTS

Grade	Class	Test Temperature	Stress, Min		Time to Rupture	Elongation
		Deg F [ Deg C ]	Ksi	Mpa	Min, h*	Min %
651	B	1200 [650]	40	275	100	5

### Heat Treatment

Hardened hot-cold worked at 1200°F(650°C) min with 15% min reduction in cross-sectional area, stress-relief anneal at 1350°F (730°C) min for 4 h, min

### Equivalent Designation

UNS S63198

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