

A/SA 193 Gr.B16

Cr-Mo-V ALLOY

BOLTING MATERIAL FOR HIGH TEMPERATURE SERVICE

Alloy ASTM A193 Grade B16 is a bolting specification for high temperature service. It is a heat treated Chromium-Molybdenum-Vanadium steel. The specification calls for minimum strength and maximum hardness levels. It is considered to be most suitable for bolts used at temperatures below 840°F or 450° C. Being a Chromium, molybdenum, Vanadium steel, It has the same physicals as B7. Added vanadium allows it to hold it's strength to 1100 degrees Fahrenheit. B16 fall under the ASTM A193 and ASME SA193 specs. It is one of the most common fasteners specs for heavy industry, especially in the the petroleum and chemical industries. High temperature pressure flange joints are one of the main applications for B16 fasteners. Typically ASTM A194 Grade 4 Heavy Hex Nuts are specified with B16 studs & bolts, although Grade 7 is also fairly common.

Chemical Properties

C	Mn	P	S	Si	Cr	Mo	V	Al
0.36-0.47	0.45-0.70	0.04 Max	0.04 Max	0.15-0.35	0.80-1.15	0.5-0.65	0.50-0.65	0.015

Mechanical Properties

Size	Yield strength	Tensile strength	Elongation	Reduction	Hardness		
	Mpa	Mpa	%	%	BHN	HRB	HRC
	min	min	min	min			
Up to 2-1/2	725	860	18	50		321 Max	35 Max
2-5/8 - 4	655	760	17	45		302 Max	33 Max
4-1/8 - 7	585	690	16	45		227 Max	29 Max

Mechanical, Oxidation & Embrittlement Properties

Temperature (°C)	Stress to produce Rupture (N/MM ²)			Temp (°C)	Stress to produce Rupture (N/MM ²)			Temp (°C)	Residual Stress (N/MM ²)		
	10,000 h	100,000 h	200,000 h		1,000 h	10,000 h	100,000 h		1,000 h	10,000 h	30,000 h
450	513	463	446	450	-	578	452	400	234	215	192
500	321	210	187	500	510	360	221	450	188	157	141
550	137	-	-	550	295	143	-	500	136	83	47

Physical Properties

	Temperature (°C)							
	20	100	200	300	400	500	600	700
Density (kg/m ³)	7810	-	-	-	-	-	-	-
Electrical Resistivity (nom)	273	320	390	465	560	660	785	955
Thermal Expansion (K ⁻¹ x 10 ⁻⁵)	-	11.1	12.1	12.9	13.5	13.9	14.1	-
Thermal conductivity (w/mk)	42	41	40	39	36	34	-	-
specific Heat (J/kgK)	420	449	487	525	546	567	621	651
Heat Content (kj/kg)	0	33.6	86.1	147	107	273	349	441
Modules of Elasticity (kN/mm ²)	211	207	198	190	183	174	165	-

Heat Treatment

Quenched @ 925°C & Tempered @ 650°C

Equivalent Designation

EN No. 40CrMoV4-6
BS 4882
W.Nr. 1.7711

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