416 (MX, MF, MH,) 4MX

Type 416MX – This grade, with a typical sulphur content of .33, possesses excellent machinability, provides a fine surface finish on machined parts, has uniform hardness in the "as supplied" condition and can be hardened to 35Rc minimum… characteristics that make this grade particularly suited for use in automatic screw machining operations. Machinability Rating (B1212) 90%

Type 416MH – A modification of Type **416MX**, with a typical sulphur content of .29, combining the capacity of being heat treated to 40Rc minimum with excellent machinability. Machinability Rating (B1212) 85%

Type 416MF – A second modification of Type **416MX** having a typical sulphur content of .20 and combining formability and response to heat treatment with good machinability. Machinability Rating (B1212) 80%

Type 416R – Developed to provide the ultimate in free machining, this grade is custom melted to meet specific application requirements. Machinability Rating (B1212) 95%

Corrosion Resistance: Good resistance to dry atmospheres, fresh water and milk alkalies and acids, but less resistant than the 300 Series grades. Maximum resistance in the hardened and tempered condition.

Heat Resistance: Fair resistance to scaling in intermittent service to 1400^{0}F and to 1250^{0}F in continuous service.

Heat Treatment: Annealing – Heat to 1500 - 1650^{0}F for ½ hour per inch of thickness. Cool at 50^{0}F per hour maximum to 1100^{0}F and air cool. Hardening – Hardened by heating to 1700 - 1850^{0}F, quenching in oil, and tempering to suit the mechanical requirements. See accompanying table and chart.
Note: The tempering range 750 - 1075^{0}F should be avoided.

Welding: If welding is necessary…. Use Type 410 low hydrogen electrodes. Pre-heat to 400 - 600^{0}F. Follow immediately with annealing or re-hardening…. Or a stress relief at 1200 - 1250^{0}F.

Typical Applications:

- automatic screw machined parts
- valve parts
- bolts, nuts, studs, gears
- motor shafts
- washing machines

TYPICAL ANALYSIS AND PROPERTIES FOR TYPE 416 FREE MACHINING GRADES

A.I.S.I. Analysis	C	Mn	P	S	Si	Cr	Mo
416 MX	0.15 max	1.25 max	0.06 max	0.33*	1.0 max	12.0 to 14.0	0.60 max ***
416MF	0.15 max	1.25 max	0.06 max	0.20*	1.0 max	12.0 to 14.0	0.60 max ***
416MH	0.15 max	1.25 max	0.06 max	0.29*	1.0 max	12.0 to 14.0	0.60 max ***
416R	0.15 max	1.25 max	0.06 max	0.40**	1.0 max	12.0 to 14.0	0.60 max ***
A.I.S.I. 416	0.15 max	1.25 max	0.06 max	0.15 Min	1.0 max	12.0 to 14.0	0.60 max ***

Typical Mechanical Properties - Annealed	Yield Strength .2% Offset psi	Ultimate Strength psi	Elongation % in 2"	Hardness		Impact Charpy ft. – lbs.	Modules of Elasticity in Tension - psi
				Rb	BHN		
	83,000	105,000	20	97	225	21	29.0 x 10^6

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Other Properties	Creep Strength 1% Flow in 10,000 hrs at 1,000^{0}F psi	Coefficient of Thermal Expansion (In/In/^{0}F x 10^{-6}) 32^0 - 212^0F	Electrical Resistivity Microhm – Cm at 68^{0}F	Thermal Conductivity BTU/Ft.2/Hr./^{0}F/Ft.	
				at 212^{0}F	at 932^{0}F
	9,000	5.5	57	14.4	16.6

* Typical sulphur analysis ** or as required *** optional