L.KLEIN SA

PREMIUM STEEL & METALS

SINCE 1946

MP159® ALLOY

Nickel–Cobalt Multiphase Alloy

Distinctive feature and main attributes

MP159® alloy is a nickel–cobalt based multiphase alloy designed to provide an exceptional combination of ultra-high strength, excellent ductility, and outstanding resistance to corrosion. Strength is developed through cold working and optional aging treatments while maintaining good toughness and stability at temperatures up to approximately 593°C (1000°F). In addition it has exceptional corrosion resistance and resistance to crevice and stress corrosion in various hostile environments. The alloy is produced using vacuum induction melting followed by vacuum arc remelting to ensure high cleanliness and consistent properties.

Norms

Material No.	
AMS	AMS 5841, AMS 5842 and AMS 5843
UNS	R30159

For general information and cross reference purposes only since this should not be considered as a complete listing.

Chemical composition (% wt)

Co	Ni	Cr	Fe	Mo	Ti	Cb	Al
35.7	25.5	19.0	9.0	7.0	3.0	0.6	0.2

Physical properties

Properties	Unit	Temperature (°C)		
		25 – 100	25 – 300	25 – 600
Density	8.33 g / cm^3 (0.301 lb / in^3)			
Magnetic Permeability	~1.0 (essentially non-magnetic)			
E modulus				
- solution annelealed	222 Mpa x 10^3 (32.2 ksi x 10^3)			
- cold worked & aged 663°C	243 Mpa x 10^3 (35.3 ksi x 10^3)			
shear modulus				
- solution annelealed	81 Mpa x 10^3 (11.7 ksi x 10^3)			
- cold worked & aged 663°C	78 Mpa x 10^3 (11.3 ksi x 10^3)			
CTE		14.3 mm/mm/°C x 10^{-6} (7.95 in/in/°F x 10^{-6})	14.2 mm/mm/°C x 10^{-6} (7.88 in/in/°F x 10^{-6})	15.1 mm/mm/°C x 10^{-6} (8.39 in/in/°F x 10^{-6})

Typical Mechanical Properties at Room Temperature

Condition	UTS Mpa (ksi)	0.2% YS Mpa (ksi)	Elongation (%)	Reduction of Area (%)
Annealed	850 (123)	400 (58)	60	69
Cold Worked ~48%	1585 (230)	1415 (205)	12	46
Cold Worked + Aged 663°C (1225°F) / 4 h / AC	1895 (275)	1825 (265)	8	35

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Typical Strength Levels vs Percent Cold Work

The table below illustrates the typical increase in room-temperature strength of MP159® alloy as a function of increasing cold work. Values are representative and will vary with product form and processing.

Approx. Cold Work (%)	UTS Mpa (ksi)	0.2% YS Mpa (ksi)	Elongation (%)
0 (Annealed)	850 (123)	400 (58)	60
20%	1127 (160)	863 (125)	35
30%	1277 (185)	1173 (170)	25
40%	1449 (210)	1345 (195)	18
48%	1585 (230)	1415 (205)	12

Effect of Aging After Cold Work

Following cold work, MP159® alloy may be aged to further increase strength. Aging treatments typically produce a substantial increase in yield and tensile strength with a corresponding reduction in ductility.

Processing Condition	UTS Mpa (ksi)	0.2% YS Mpa (ksi)	Elongation (%)
Cold Worked ~48%	1585 (230)	1415 (205)	12
Cold Worked ~48% + Aged 663°C (1225°F) / 4 h / AC	1895 (275)	1825 (265)	8

Creep Data

After 48% Cold Work + 663°C (1225°F) / 4 h / AC:

Test temp	Load	Life (h)	Elastic deformation (%)
593°C (1100°F)	1035 Mpa (150ksi)	100 h	< 0.02 Not measurable

Heat Treatment

Solution Annealing: MP159® should be solution annealed 1038 / 1052°C (1900 – 1925°F) for 4 h followed by water quench

Age: After work hardening, MP159® can be aged in the temperature range 663°C (1225°F) for increased strength. The alloy only responds to aging after work strengthening.No increase in strength will result from aging annealed material. For optimum mechanical properties, cold worked MP159® should be aged at 663°C (1225°F) for 4 h, followed by air cool

Typical Applications

Some typical applications are aerospace fasteners, jet engine components, marine and offshore equipment, chemical processing components, power generation equipment.

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