6MO-N

Associated specifications: ASTM A479, ASTM B691, UNS N08367
Plate, sheet, and strip: ASTM 240, ASTM B688

Type analysis

Single figures are nominal except where noted.

Iron	Balance	**Nickel**	23.5–25.5 %	**Chromium**	20.0–22.0 %
Molybdenum	6.0–7.0 %	**Manganese**	Max 2.00 %	**Silicon**	Max 1.00 %
Copper	Max 0.75 %	**Nitrogen**	0.18–0.25 %	**Phosphorus**	Max 0.040 %
Carbon	Max 0.030 %	**Sulfur**	Max 0.030 %		

PREn = (%Cr + 3.3%Mo + 16%N) ≥ 40.0

Forms manufactured

Bar	**Wire**

Description

6Mo-N is a superaustenitic stainless steel to resist pitting and crevice corrosion in acidic or neutral chloride environments. 6Mo-N contains at least 6% molybdenum and has a pitting resistance equivalent number (PREn) of at least 40. The resistance is provided by chromium, molybdenum, and nitrogen. 6Mo-N has better resistance to chloride stress corrosion cracking than 300-series stainless steel, and has suitability for sour gas applications (NACE MR0175/ISO 15156). 6Mo-N has yield strength 50% greater than 300-series austenitic stainless steel, plus good workability and weldability.

Key Properties:

- Pit and crevice corrosion resistance
- Yield/tensile properties
- Stress corrosion resistance

Markets:

- Energy
- Industrial

Applications:

- Offshore oil and gas
- Food processing
- Chemical processing
- Power generation

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Corrosion resistance

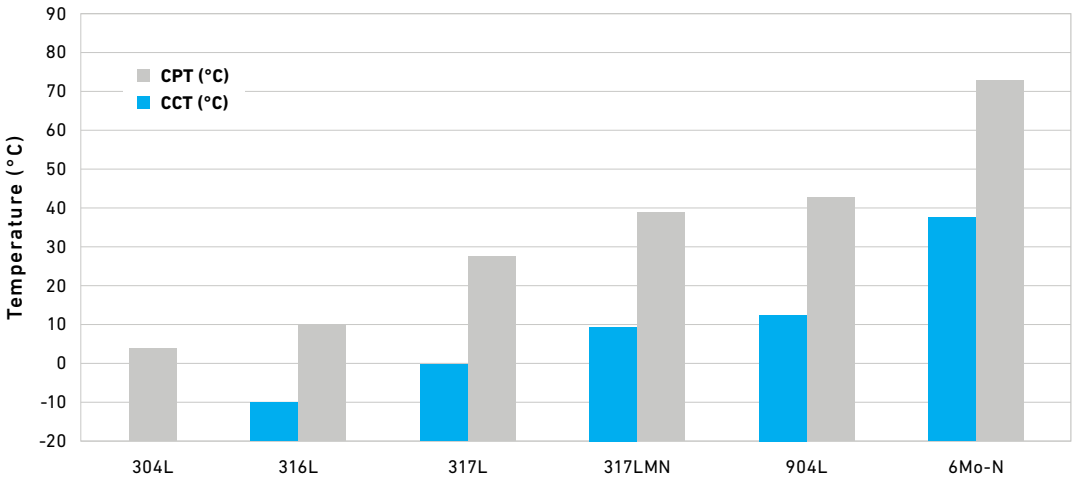
6Mo-N may be considered for applications in mild/moderate sulfuric and phosphoric acid applications and especially in acidic environments containing chloride impurities. The combination of chromium, molybdenum, nitrogen, and nickel are intended to provide resistance to pitting and crevice attack with resistance to stress corrosion cracking in many environments.

IMPORTANT NOTE:
The following 4-level rating scale (Excellent, Good, Moderate, Restricted) is intended for comparative purposes only and is derived from experiences with wrought product. Additive manufactured material may perform differently; corrosion testing is recommended. Factors that affect corrosion resistance include temperature, concentration, pH, impurities, aeration, velocity, crevices, deposits, metallurgical condition, stress, surface finish, and dissimilar metal contact.

Nitric Acid	Good	**Sulfuric Acid**	Moderate
Phosphoric Acid	Good	**Acetic Acid**	Good
Sodium Hydroxide	Good	**Salt Spray (NaCl)**	Excellent
Sea Water	Excellent	**Sour Oil/Gas**	Good
Humidity	Excellent		

CRITICAL PITTING TEMPERATURE (CPT) VS. CRITICAL CREVICE TEMPERATURE (CCT)

Measured by ASTM G48 in 10% ferric chloride.



Source: Practical Guidelines for the Fabrication of Duplex Stainless Steels, International Molybdenum Association, 2001.

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Physical properties

PROPERTY	At or From	English Units	Metric Units
DENSITY	Room temperature	0.291 lb/in^3	8.06 kg/m^3
MEAN SPECIFIC HEAT	Room temperature	0.11 Btu/lb/°F	500 J/kg·K
MEAN COEFFICIENT OF THERMAL EXPANSION	68 to 212°F (20 to 100°C)	8.5 x 10^{-6} length/length/°F	15.3 x 10^{-6} length/length/°C
THERMAL CONDUCTIVITY	From 68 to 212°F	6.8 Btu-in/hr/ft^2/°F	11.8 W/m·K
MODULUS OF ELASTICITY (E)	Room temperature	28300 ksi	195000 MPa
ELECTRICAL RESISTIVITY	68°F (20°C)	535 ohm-cir-mil/ft	0.89 microohm·cm

Typical mechanical properties

PROCESS / CONDITION:								
FORM, GAUGE, HEAT TREATMENT OR TEMP	ORIENTATION	0.2% YIELD STRENGTH		ULTIMATE TENSILE STRENGTH		ELONGATION IN 4D	REDUCTION OF AREA	HARDNESS
		ksi	MPa	ksi	MPa	%	%	
Annealed condition	Z	48	331	103	710	57	83	176 HB
Strain harden condition	Z	119	820	136	938	28	78	30 HRC

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Heat treatment

Heat treatment	6Mo-N cannot be hardened by heat treatment. Solution annealing is required to be carried out at temperature of 2025°F (1105°C) minimum with soak time appropriate to the size of the bars and followed by water quenching. 6Mo-N should never be heated above 2350°F (1290°C) to avoid the risk of incipient melting. Annealing below 2025°F (1105°C) can cause the formation of deleterious phases/carbides, which can reduce corrosion resistance. Excessive time at the annealing temperature can cause increased oxidation.

Workability

Cold working	6Mo-N cold works well with a work hardening rate similar to or somewhat greater than that of Type 316 stainless steel.
Hot working	Hot working is generally conducted between 1830°F and 2300°F (1000°C and 1260°C). Annealing is suggested after hot working.
Weldability	6Mo-N can be welded using gas-metal-arc (GMAW), gas-tungsten-arc (GTAW) or other conventional welding techniques. For best corrosion resistance, an over-matched filler metal, such as 9% molybdenum Pyromet® 625 is suggested.

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Typical feeds and speeds

The feeds and speeds in the following charts are conservative recommendations for initial setup. Higher feeds and speeds may be attainable depending on machining environment.

TURNING — SINGLE-POINT AND BOX TOOLS

DEPTH OF CUT, IN	HIGH-SPEED TOOLS			CARBIDE TOOLS			
	SPEED, FPM	FEED, IPR	TOOL MATERIAL	SPEED, FPM		FEED, IPR	TOOL MATERIAL
				BRAZED	THROW AWAY		
.150	66	.015	M-48, T-15	250	300	.015	C-6
.025	84	.007	M-48, T-15	300	350	.007	C-7

TURNING — CUT-OFF AND FORM TOOLS

SPEED, FPM	FEED, IPR							TOOL MATERIAL	
	CUT-OFF TOOL WIDTH, IN			FORM TOOL WIDTH, IN				HIGH-SPEED TOOLS	CARBIDE TOOLS
	1/16	*1/8*	*1/4*	*1/2*	*1*	*1-1/2*	*2*		
48	.001	.001	.0015	.0015	.001	.0007	.0007	M-48, T-15	
168	.004	.0055	.0045	.004	.003	.002	.002		C-6

ROUGH REAMING

HIGH-SPEED TOOLS		CARBIDE TOOLS		FEED, IPR, REAMER DIAMETER, IN`					
SPEED, FPM	TOOL MATERIAL	SPEED, FPM	TOOL MATERIAL	*1/8*	*1/4*	*1/2*	*1*	*1-1/2*	*2*
72	M-48, T-15	80	C-2	.003	.005	.008	.012	.015	.018

DRILLING — HIGH-SPEED TOOLS

SPEED, FPM	FEED, IPR								TOOL MATERIAL
	NOMINAL HOLE DIAMETER, IN								
	1/16	*1/8*	*1/4*	*1/2*	*3/4*	*1*	*1-1/2*	*2*	
45–50	.001	.002	.004	.007	.010	.012	.015	.018	M-42
150	.0005	.002	.004	.006	.0077	.0088	.0098	.0098	C-2 Coated

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TAPPING — HIGH-SPEED TOOLS

SPEED, FPM	TOOL MATERIAL
12–25	M-7, M-10

DIE THREADING — HIGH-SPEED TOOLS

SPEED, FPM				TOOL MATERIAL
7 OR LESS, TPI	8 TO 15, TPI	16 TO 24, TPI	25 AND UP, TPI	
4–8	6–10	8–12	10–15	T-15, M-42

MILLING — END PERIPHERAL

DEPTH OF CUT, IN	HIGH-SPEED TOOLS						CARBIDE TOOLS					
	SPEED, FPM	FEED, IN PER TOOTH / CUTTER DIAMETER, IN				TOOL MATERIAL	SPEED, FPM	FEED, IPT / CUTTER DIAMETER, IN PER TOOTH				TOOL MATERIAL
		1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2	
.050	78	.001	.002	.003	.004	M-8, T-15	254	.001	.002	.003	.005	C-2

BROACHING — HIGH-SPEED TOOLS

SPEED, FPM	CHIP LOAD, IPT	TOOL MATERIAL
12	.0030	M-48, T-15

For additional information, please contact your nearest sales office:
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