

AL-6XN PLUS[®]

Stainless Steel: Superaustenitic

(UNS N08367)

INTRODUCTION

AL-6XN PLUS[®] alloy is an enhanced version of the standard AL-6XN[®] alloy. Both satisfy the composition requirements of UNS N08367, but the AL-6XN PLUS[®] alloy contains a greater concentration of the alloying elements (Cr, Mo, and N) which promote corrosion resistance.

Resistance to Localized Chloride Attack The relative pitting resistance of a stainless steel can be correlated to alloy composition using the Pitting Resistance Equivalent (PRE_N).

$$(PRE_N) = \%Cr + 3.3 \%Mo + 30 \%N$$

Typically the AL-6XN alloy composition would have a PRE_N of about 47. By increasing the Cr, Mo, and N content of the alloy to near the maximum levels per-mitted by specification, the PRE_N can be increased. This is illustrated in the table below:

UNS N08367 Alloy Modification for Increased PRE_N

Element	Typical Composition AL-6XN [®] Alloy	Typical Composition AL-6XN PLUS [®] Alloy
C	0.02	0.02
Mn	0.40	0.30
P	0.020	0.020
S	<0.001	<0.001
Si	0.40	0.35
Cr	20.5	21.8
Ni	24.0	25.3
Mo	6.2	6.7
N	0.22	0.24
Cu	0.20	0.20
Fe	Balance	Balance
(PRE _N)	47.5	50.0 min.

The PRE_N number is a predictor of potential corrosion resistance, and not a measure of performance. Proper materials processing is required to obtain the maximum corrosion resistance which a given alloy can display. Laboratory data do indicate, however, that the higher alloy content of AL-6XN PLUS[®] alloy does provide increased corrosion resistance. This is shown in the table on the next page:



Technical Data Sheet

Test Method	Test Solution	Test Surface	AL-6XN® Alloy	AL-6XN PLUS® Alloy
ASTM G48 Practice B	Acidified Ferric Chloride	Pickled Mill Surface	CCCT = 110°F (43°C)	CCCT = 131°F (55°C)
ASTM G48 Practice C	Acidified Ferric Chloride	Pickled Mill Surface	CPT = 167°F (75°C)	CPT = 194°F (90°C)
ASTM G48 Practice D	Acidified Ferric Chloride	Pickled Mill Surface	CCCT = 95°F (35°C)	CCCT = 113°F (45°C)
ASTM G150	1M NaCl	Ground Surface	ECPT = 172°F (78°C)	ECPT = 194°F (90°C)

CCCT = Critical Crevice Corrosion Temperature

CPT = Critical Pitting Temperature

ECPT = Electrochemical Critical Pitting Temperature

MECHANICAL PROPERTIES

AL-6XN PLUS® alloy has the same strength and ductility as standard AL-6XN alloy.

Specification Coverage for AL-6XN PLUS® Alloy

Because AL-6XN PLUS alloy falls within the composition range of UNS N08367 and exhibits the same mechanical properties, it meets existing specifications for the UNS N08367 alloy. AL-6XN PLUS alloy can be supplied to any of the specifications for which AL-6XN alloy is supplied. These include the following:

Form	ASME	ASTM
Plate, Sheet and Strip	SA-240	A 240
Bars and Shapes		A 479
Rod, Bar and Wire	SB-691	B 691
Welded Pipe	SB-675	A 358, A 409 A 813, A 814 B 675
Seamless and Welded Pipe	SA-312	A 312
Seamless and Welded Tube		A 269, A 270
Welded Tube	SA-249 SB-676	A 249, A 688 B 676
Seamless Pipe and Tube	SB-690	B 690
Billets and Bars for Reforging		B 472
Forged Pipe Flanges Fittings and Valves	SB-462	B 462
Wrought Nickel Alloy Welded Fittings	SB-366	B 366
Nickel Alloy Forgings	SB-564	B 564
Pipe Welded with Filler	SB-804	B 804

Technical Data Sheet**HEAT TREATMENT**

The minimum annealing temperature was established for AL-6XN[®] alloy based upon testing of material of compositions representing the upper and lower specification limits of alloy content. This testing showed that short-term heating to 1950°F (1065°C) dissolved sigma phase precipitates in AL-6XN alloy containing 22% Cr and 7% Mo. Since the composition of AL-6XN PLUS alloy is within this limit, the 2025°F (1107°C) minimum annealing treatment commonly specified is more than adequate for this alloy.

AL-6XN PLUS[®] alloy may have slightly higher strength than the conventional AL-6XN alloy, but its formability and weldability are unchanged. The maximum service temperature (800°F) for AL-6XN alloy in pressure vessel service is administratively mandated. The embrittlement processes observed above 1000°F are diffusion controlled, and the minor compositional differences between AL-6XN PLUS alloy and the AL-6XN alloy will have no influence upon embrittlement susceptibility, etc.