



ATI 13-8 Supertough® Alloy

(UNS S13800)

INTRODUCTION

ATI 13-8 Supertough® Alloy (UNS S13800) is a modification of the standard ATI 13-8 alloy, and has superior fracture toughness and Charpy impact energies, even at cryogenic temperatures. These improvements have been achieved with tighter chemistry controls and thermo-mechanical processing practices. This improved alloy is a martensitic precipitation-hardening stainless steel that has excellent strength, high hardness, and good corrosion resistance. Transverse fracture toughness properties of 120 ksi/in. minimum in the H1000 condition is achieved by tight chemical composition control, low carbon content, and double vacuum melting. The alloy is produced by vacuum induction melting (VIM), followed by vacuum arc remelting (VAR). This melt practice ensures excellent macro and micro-cleanliness, and tight compositional control. The strengthening mechanism (precipitation hardening in a martensitic matrix) makes it possible to achieve uniform strengthening in heavy sections. Strength and ductility levels can be tailored to the application by varying the aging temperature. ATI 13-8 Supertough® Alloy is available as ingot, billet, block, round bar, rolled shapes and rectangles, rolled and drawn rod, and wire. Typical applications are large airframe structural components.

SPECIFICATIONS

- AMS 5934 - Bars, forgings, rings, and extrusions
- AMS 5629 - Bars, forgings, rings, and extrusions
- AMS 5864 - Plate

PHYSICAL PROPERTIES

Melting Range: 2,560 to 2,680°F (1,404 to 1,471°C)
Density: 0.279 lbs/in³ (7.76 gm/cc)

HEAT TREATMENT

Solution treatment from 1,675 to 1,725°F (913 to 941°C) for 15 to 30 minutes at temperature. Air cool or oil quench to below 60°F (15°C) to ensure complete transformation to martensite. Aging is normally carried out from 950 to 1,150°F (510 to 621°C), depending upon the desired final properties. Heat treatment is usually performed in air. Heat treatment of brazed components may be done in inert atmospheres. Reducing atmospheres should not be used because of the potential for nitrogen contamination.

HARDNESS

Hardness in the solution annealed condition is approximately Rockwell C 33. See the attached table for hardness in the various aged conditions.

OXIDATION RESISTANCE



Technical Data Sheet

ATI 13-8 Supertough® Alloy has excellent oxidation resistance up to 1,500°F (816°C). Resistance to stress corrosion improves as aging temperature increases. Experimental data demonstrate that the stress corrosion resistance is significantly better than that of 'standard' 13-8 alloy. This alloy has the best resistance to stress corrosion cracking of all of the precipitation hardenable stainless steels. Its resistance to general corrosion is greatest in the fully-hardened condition. The alloy shows very little rusting when exposed to a 5 percent salt fog at 95°F (35°C).

FORGEABILITY/ FORMABILITY

ATI 13-8 Supertough® Alloy has good hot working characteristics, and can be forged over a wide temperature range. Temperatures up to 2,200°F (1,204°C) may be used. For optimum properties, forging temperature should not exceed 1,900°F (1,038°C). Hot working should not be done below 1,700°F (927°C). After forging, parts should be cooled to room temperature, then solution treated prior to aging. The alloy can be cold formed in the annealed condition, utilizing conventional cold forming techniques.

MACHINABILITY

ATI 13-8 Supertough® Alloy can be machined in both the annealed and hardened conditions. In the annealed condition, use machine speeds 20 to 30 percent lower than those used on 304 stainless steel.

WELDABILITY

ATI 13-8 Supertough® Alloy is normally welded using inert gas tungsten arc techniques, although most other welding processes may be used. These include plasma arc, electron beam, gas metal arc, and shielded metal arc processes. Helium is the preferred shielding gas.

SPECIAL PRECAUTIONS

All lubricants and coolants, particularly sulfur-bearing, should be removed prior to heat treatment, brazing and pickling.

Technical Data Sheet

Chemical Composition											
	C	Mn	Si	P	S	Cr	Ni	Mo	Al	N	Fe
Wt. %, min.	-	-	-	-	-	12.25	7.50	2.00	0.90	-	Bal.
Wt. %, max.	0.05	0.10	0.10	0.010	0.008	13.25	8.50	2.50	1.35	0.002	Bal.

Hardness Data					
Condition	H 950	H 1000	H 1050	H 1100	H 1150
Hardness Rockwell C	47	44	43	35	33

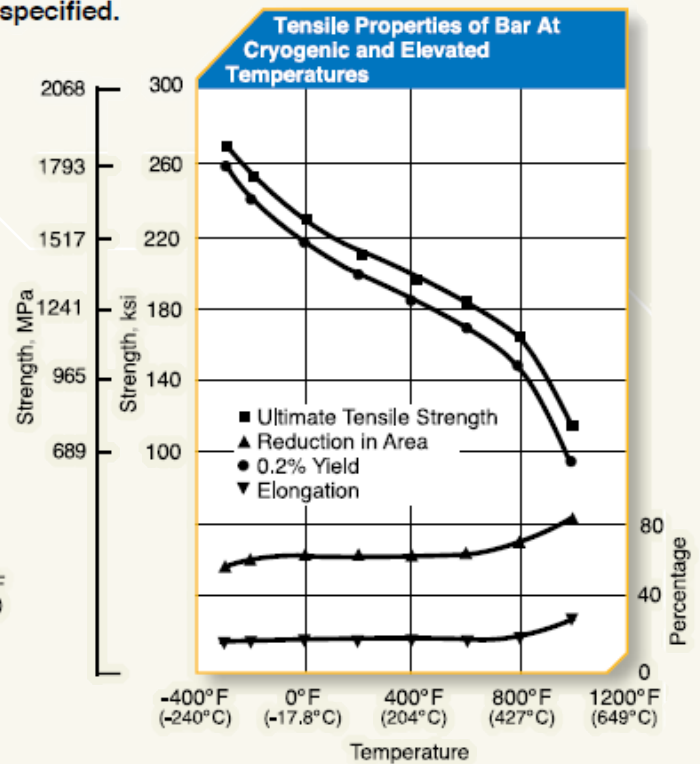
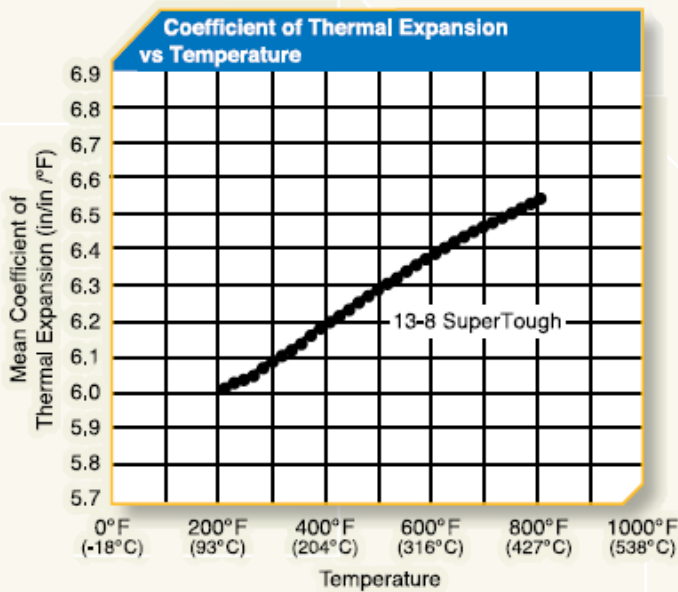
Corrosion Data			
	H1000	H1100	15-5PH
Corrosion Rate ¹	0.11 $\mu\text{m}/\text{yr}$	0.009 $\mu\text{m}/\text{yr}$	0.0254 $\mu\text{m}/\text{yr}$
Pitting potential ²	109 V vs E _{ref}	122 V vs E _{ref}	31 V vs E _{ref}

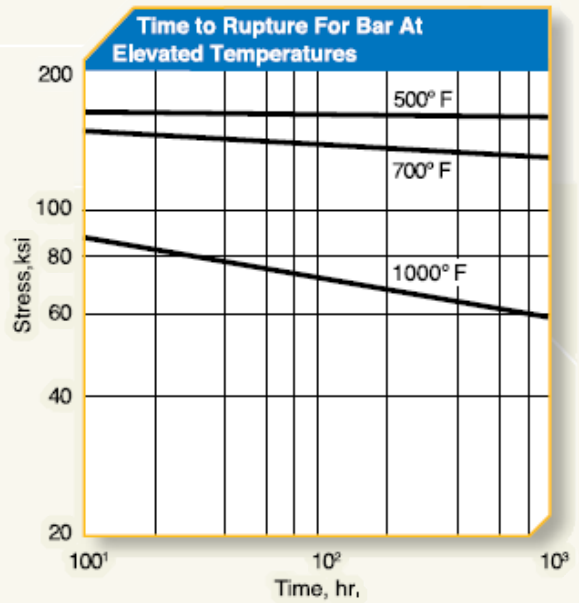
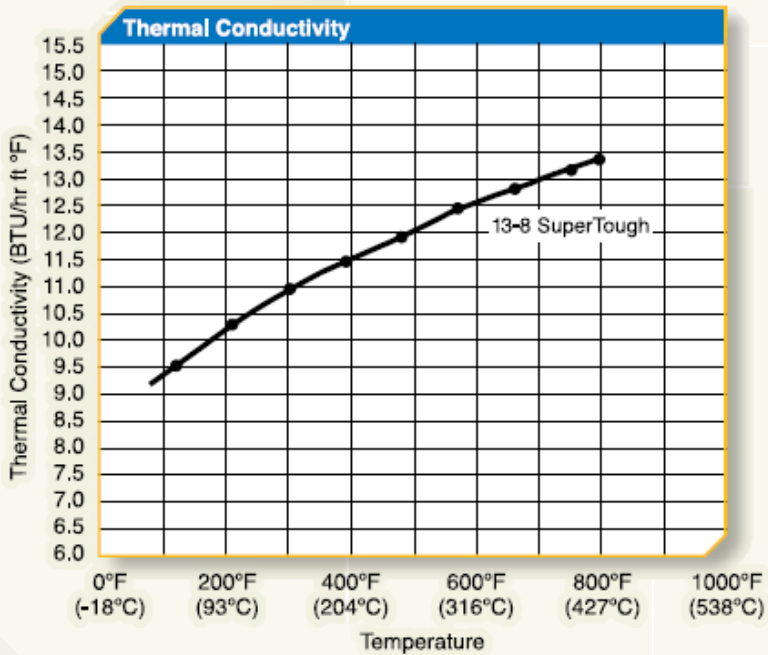
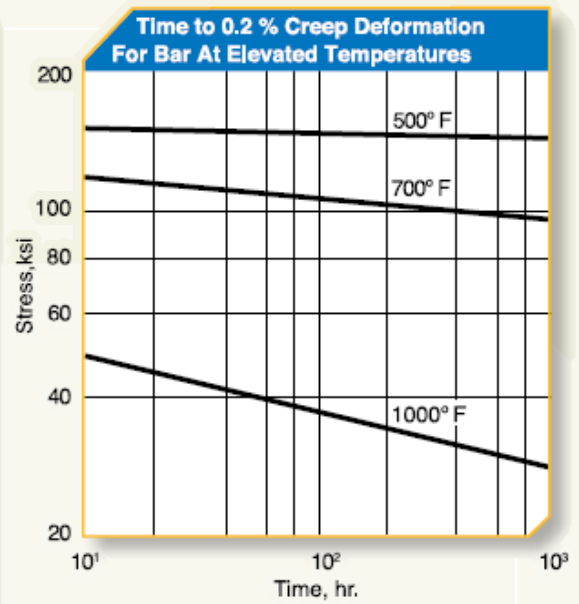
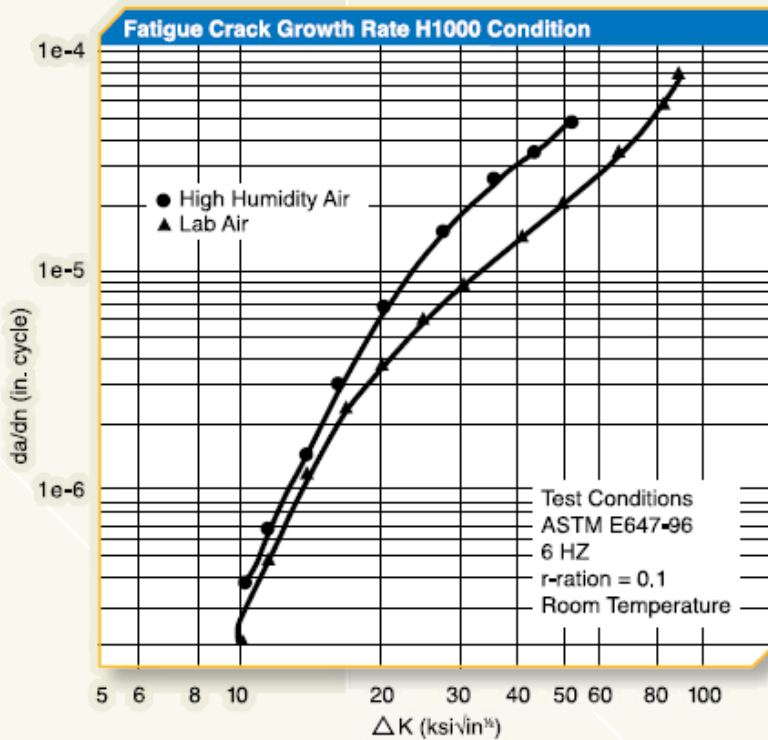
ASTM D1141 synthetic seawater at room temperature

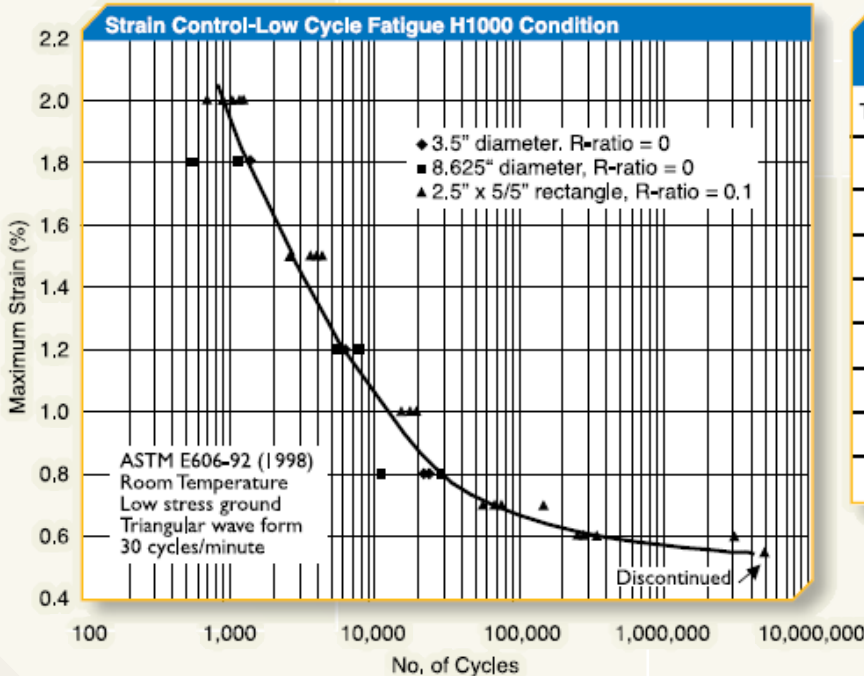
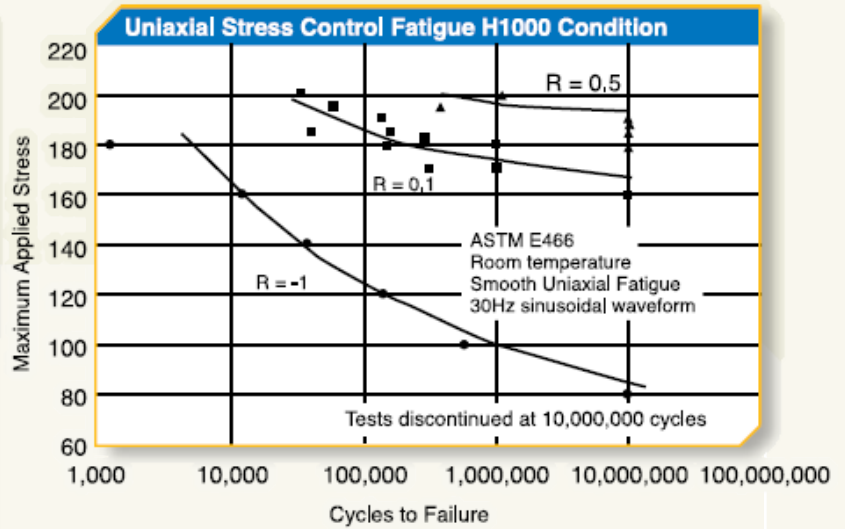
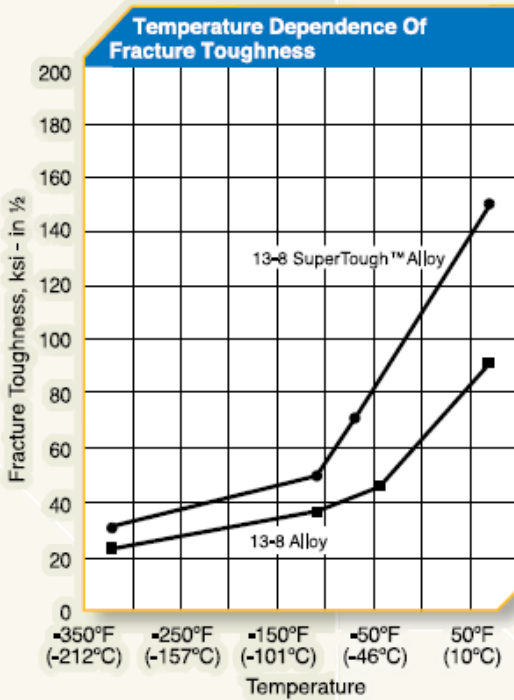
¹ ASTM G59-97

² ASTM G5-94

All data is from material in the H1000 temper unless specified.



Technical Data Sheet


Technical Data Sheet


Compression and Tensile Modulus vs Temperature

Test Temperature		Elastic Modulus (Msi)	
°F	°C	Tension	Compression
-100	-73	28.3	—
-40	-40	28.1	—
70	21	28.2	29.4
200	93	27.7	30.6
400	204	27.5	29.3
600	315	23.2	28.4
800	426	24.1	27.9

ASTM E111-97 and ASTM E8-04