Technical Data Sheet

ATI 430™

Stainless Steel: Ferritic

(UNS S43000)

INTRODUCTION

ATI 430 low carbon ferritic stainless steel which, in mildly corrosive environments or atmospheric exposures, has corrosion resistance approaching that of some nickel-bearing stainless steels. This alloy is oxidation resistant at elevated temperatures. ATI 430 alloy is ductile, does not work harden readily, and can be formed using a variety of roll forming or mild stretch bending operations as well as the more common drawing and bending processes.

STRUCTURE

At temperatures below about 1650°F (900°C), this alloy has a ferritic structure with randomly dispersed chromium carbides. When heated above 1650°F, small amounts of austenite form on the grain boundaries and within the grains. Depending on the cooling rate, this austenite transforms to martensite or ferrite and carbides. Martensite may be found in weld zones and in base metal heat affected zones. Martensite is transformed to ferrite and carbides by annealing.

PRODUCT FORMS

ATI 430 alloy is available as plates, sheets, strip, and foil. In strip and sheet forms from ATI Allegheny Ludlum. This alloy is produced in a variety of finishes ranging from a non-directional pickled finish, to several highly directional polished finishes, to a mirror-like bright annealed product.

TYPICAL COMPOSITION

TYPICAL ANALYSIS	
Element	Weight Percent
Carbon	.12 max
Manganese	1.00 max
Phosphorus	0.040 max
Sulfur	0.030 max
Silicon	1.00 max
Chromium	16.0 to 18.0
Molybdenum	0.50 max
Iron	Balance

POTENTIAL APPLICATIONS

This alloy is used in a variety of interior and exterior trim applications where economy plus corrosion resistance is more important than high strength. Typical applications are sinks, sink rims, appliance trim, counter tops, dish washers, range hoods, and flatware. Other commercial applications include architectural uses, roofing, siding, and restaurant equipment.

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CORROSION RESISTANCE

This alloy is resistant to attack in a wide variety of corrosive media, including nitric acid, and many organic acids. This alloy is most corrosion resistant when polished or rolled to a mirror-like finish and bright annealed.

OXIDATION RESISTANCE

ATI 430 alloy resists oxidation at temperatures up to 1600°F (870°C) for intermittent service, and from 1450 - 1500°F (790 - 815°C) for continuous service. The scale formed is tightly adherent and not easily shed during sudden temperature changes. Since the rate of oxidation is highly dependent on atmosphere involved, heating and cooling cycles, and structural design, no actual data can be presented which would apply to all conditions.

Coefficient of Linear Thermal Expansion

Weight Change (mg/cm²) at various temperatures and times.				
	1200°F (650°C)	1400°F (760°C)	1600°F (870°C)	1800°F (980°C)
100 hours	0.0012	0.061	0.315	0.554
500 hours	0.009	0.146	0.737	2.00

PHYSICAL PROPERTIES

The various physical properties of ATI 430 ferritic stainless steel are as follows:

Melting Range	2600 °F - 2750 °F (1425°C - 1510°C)
Density	0.278 lbs / in³ - 7.70 g / cm³
Specific Gravity	7.70

LINEAR COEFFICIENT OF EXPANSION			
Temperature Range		Coefficients	
°C	°F	$°C^{-1}$	$°F^{-1}$
20-100	68-212	10.3×10^{6}	5.7×10^{6}
20-500	68-932	11.2×10^{6}	6.2×10^{6}
20-787	68-1450	11.9×10^{6}	6.6×10^{6}

THERMAL CONDUCTIVITY			
Temperature Range			
°C	°F	W/m•K	BTU/°F•hr•ft
20-100	68-212	23.86	13.8
20-500	68-932	25.96	15.0

SPECIFIC HEAT			
Temperature Range			
°C	°F	J/kg •K	BTU/lb•°F
0-100	32-212	460	0.11

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ELECTRICAL RESISTIVITY			
Temperature Range			
°C	°F	Micro•ohm-cm	Micro•ohm-in
20	68-212	60.0	23.6
100	68-932	67.5	26.6
200	392	77.0	30.3
400	752	92.5	36.4
600	1112	105.0	41.3
800	1472	115.0	45.3

MECHANICAL PROPERTIES

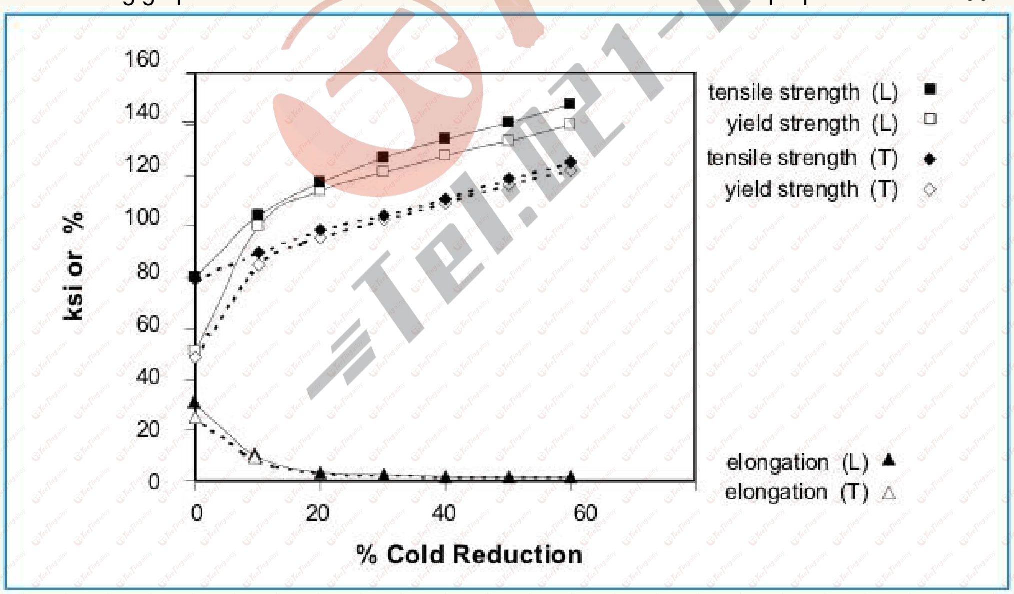
Typical room temperature (summarized longitudinal and transverse) properties of ATI 430™ sheet and strip are as follows.

MECHANICAL PROPERTIES		
Property	Thickness Range	Value
Yield Strength (ksi) 0.2% offset *	0.02 to 0.06" 0.04 to 0.115"	44 to 54 43 to 56
Ultimate Tensile Strength * (ksi)	0.02 to 0.06" 0.04 to 0.115"	70 to 79 66 to 78
Elongation in 2" (%) **	0.02 to 0.06" 0.04 to 0.115"	21 to 34 23 to 37
Hardness ***	0.02 to 0.06" 0.04 to 0.115"	62 to 70 (30 T) 75 to 83 (Rb)
Fatigue Strength (10^7 cycles)		35 to 45% of the Tensile Strength

*These are typical mechanical properties for cold rolled and annealed sheet. The mechanical properties for certain pattern finishes requiring an additional rolling operation will be slightly higher.
**These are typical elongations for cold rolled and annealed materials. The elongation for certain pattern finishes requiring an additional rolling operation would be slightly less.
***Hardness values are reported in the proper scale for (Rockwell 30T or B) respective gages, in part as outlined in ASTM specification #E18.

Effect Of Cold Reduction

The following graphs show the effect of cold reduction on the mechanical properties of ATI 430™ alloy.



Data are typical, are provided for informational purposes, and should not be construed as maximum or minimum values for specification or for final design, or for a particular use or application. The data may be revised anytime without notice. We make no representation or warranty as to its accuracy and assume no duty to update. Actual data on any particular product or material may vary from those shown herein.

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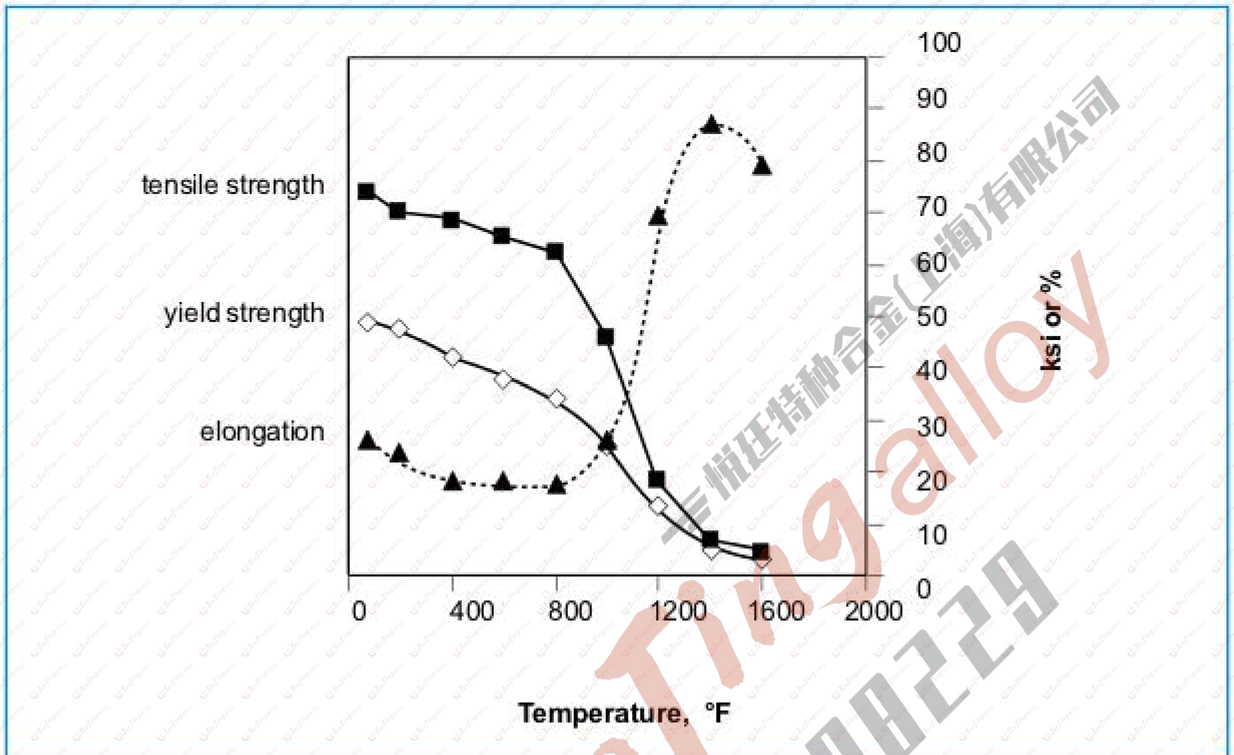
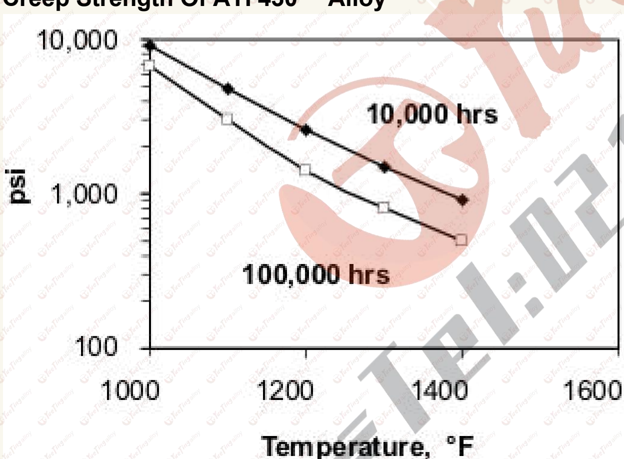
Elevated Temperature Properties

The following data was obtained on annealed .020” (0.5 mm) thick ATI 430™ alloy with 0.07% Carbon, 17.15% Chromium and 0.30% Nickel.



Creep Strength Of ATI 430™ Alloy



Impact Strength

The range of Izod impact values for these alloys is 3 to 85 foot pounds (4 to 115 J) depending on the final size of the processed material and the heat treatment. Higher impact values can be expected from smaller hot rolled sizes.

Annealing* hot-rolled material at 1450°F (790°C) results in the best impact properties while higher annealing temperatures yield much lower impact properties. Impact properties of these alloys are greatly reduced when they are held in the 800°F to 1000°F (425°C to 540°C) range for several days. Annealing, however, will restore the original impact properties.

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*For specific annealing information see heat treating section.

DEEP DRAWING

These alloys have excellent deep drawing properties and are used to produce many products such as stainless steel sinks. In general, a blank 2.1-2.3 times the final cup diameter can be drawn completely into a cup without fracturing. This is referred to as a limiting drawing ratio. Since ferritic steels are normally anisotropic, some earing of deep drawn parts should be anticipated. ATI 430 alloy also exhibits a relatively low work hardening rate that is reflected in its relatively low (compared to austenitic stainless steels) elongation. Consequently, it is less suitable for stretch forming applications than are the austenitic (200 and 300 series) stainless steels.

MACHINEABILITY

Type 430 should be machined at speeds about 60% of those used for a similar operation on reference type B1112.

WELDABILITY

ATI 430 stainless can be welded by all commercial processes normally used to weld stainless steels. For best results the stainless steel parts to be joined must be completely free of grease, oil or other surface contamination. Satisfactory joints can be made with austenitic weld deposits from 308, 309 or 312 weld wire, or with a ferritic weld deposit of base metal. If the welded structure is to be subjected to thermal cycling, filler wire of the base metal composition should be used to avoid differences in thermal expansion which can cause buckling.

Welding these alloys will cause a decrease in ductility of the weld and heat affected zones due to the formation of martensite during cooling. The weld heat affected zone will also suffer a marked loss of corrosion resistance in some environments. Both ductility and corrosion resistance can be restored by annealing.

Both welding and subsequent annealing will form a scale or heat tint of these alloys. These discolorations must be completely removed to realize maximum corrosion resistance.

HEAT TREATMENT

ATI 430 alloy should be annealed at 1450-1550°F (790- 835°C) and furnace cooled at a rate of 50°F (30°C) per hour to 1100°F (590°C) and air cooled. If the annealing temperature does not exceed 1450°F (790°C), an air cool may be substituted for the furnace cool when annealing thin sections. Annealing these alloys as outlined produces no phase transformations and is used only to impart full softness and maximum ductility. Annealing will produce a heat tint on these materials which must be removed to obtain maximum corrosion resistance.

RESPONSE TO HIGH TEMPERATURE EXPOSURES

ATI 430 alloy becomes susceptible to intergranular corrosion in certain environments when it is air cooled from temperatures above 1500°F (815°C). This sensitivity to intergranular attack may be accompanied by a decrease in ductility. Normal corrosion resistance and ductility are restored by annealing.

RESISTANCE TO ROPING

In certain forming operations requiring a large amount of stretching in the rolling direction this alloy may develop a surface condition known as "rope." This condition manifests itself as striations parallel to the rolling direction. In some instances, these striations are severe enough to be felt by running ones thumb nail across the specimens. In most cases, however, the condition is merely an optical effect which sometimes requires additional finishing to correct.

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For some applications, modifications in processing or chemical composition may be required to minimize this problem.

CLEANING

ATI 430 alloy should be cleaned following accepted procedures for stainless steels. For specific information in regard to heat tint, or welding scale, etc. see ASM Metals Handbook Volume 5, Surface Engineering.

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