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Alloy Technical Data Sheet
Type 17-7 Precipitation Hardening Alloy
UNS Designation: S17700

GENERAL PROPERTIES
17-7 Precipitation Hardening Alloy (S17700) is a chromium-nickel-aluminum precipitation hardening stainless steel used for applications requiring high strength and a moderate level of corrosion resistance. Such applications include aerospace and spring type applications.

17-7 precipitation hardening alloy may be formed in a soft austenitic condition and hardened to a high strength level by low temperature heat treatments. The low temperature allows minimum distortion compared to conventional quench and temper hardening processes. In addition to material produced by the standard refining procedures, material which has been vacuum arc or electroslag remelted is available for further increase in resistance to fatigue, for those applications subject to cyclic stresses.

CHEMICAL COMPOSITION
Chemistries represented by ASTM A693

Element	Percent by Weight Maximum Unless Range is Specified
Carbon	0.09 maximum
Manganese	1.00 maximum
Phosphorus	0.040 maximum
Sulfur	0.030 maximum
Silicon	1.00 maximum
Chromium	16.00-18.00
Nickel	6.5-7.7
Aluminum	0.75-1.50
Iron	Balance

RESISTANCE TO CORROSION
Tests have shown that the corrosion resistance of 17-7 alloy is comparable to that of Type 304 stainless steel in most media. In general, the corrosion resistance of 17-7 alloy is superior to that of the hardenable 400 series stainless steels.

HEAT TREATMENT
To develop the high precipitation hardened strength of the alloy by heat treatment, starting from Condition A, heat treatments are done to accomplish two necessary steps. The first is a heat treatment which allows the relatively stable austenite of Condition A to transform to martensite (Austenite Conditioning and Transformation). The second is a precipitation hardening heat treatment to further strengthen the material. The austenite is easier to transform to martensite using a lower temperature heat treatment. For this reason, Condition TH 1050 uses a 1400°F (760°C) heat treatment to produce a martensite transformation around room temperature, and this is followed by a precipitation hardening heat treatment at 1050°F (565°C). If Condition RH 950 is desired, the austenite conditioning heat treatment is conducted at 1750° (955°C). In this case, the martensite transformation is not complete until the material is held for some time at -100°F (-73°C). When the transformation is complete, the material is precipitation hardened at 950°F (510°C) to Condition RH 950. Because the precipitation hardening reaction can be driven past peak strength by high temperature or excessive time at the aging temperature, higher temperature or longer time precipitation hardening heat treatments produce lower strength levels.

When AL 17-7 precipitation hardening alloy with an austenitic structure is cold worked by substantial deformation, a transformation to martensitic structure results from the deformation. In this condition, Condition C, the material may be precipitation hardened directly by heat treatment at 900°F (482°C) to condition CH 900.

LINEAR COEFFICIENT OF THERMAL EXPANSION

Temperature	Condition Annealed	Condition RH 950	Condition TH 1050
70-200 °F	8.5 x 10^{-6} in/in/°F	5.7 x 10^{-6} in/in/°F	5.6 x 10^{-6} in/in/°F
21-93 °C	15.3 x 10-6 cm/cm/°C	10.3 x 10^{-6} cm/cm/°C	10.1 x 10^{-6} cm/cm/°C

THERMAL CONDUCTIVITY
Approximately 9.5 Btu-ft/hr-ft2-°F (16.5 W/m-K) in the hardened conditions in the range 70-300°F (20-150°C)

SPECIFIC HEAT

°C	°F	J/kg °K	Btu/lb/°F
0-100	32-212	500	0.12

MAGNETIC PERMEABILITY

Condition Annealed	Condition RH 950	Condition TH 1050
Weakly Ferromagnetic	Strongly Ferromagnetic	Strongly Ferromagnetic

ELECTRICAL RESISTIVITY
Approximately 80 microhm-cm in annealed or hardened Conditions.

MECHANICAL PROPERTIES (Condition Annealed)

Room Temperature Properties Typical Values for Sheet and Strip*		Condition Annealed	Condition RH 950	Condition TH 1050
Ultimate Tensile Strength	psi (MPa)	130,000 (900)	220,000 (1520)	190,000 (1310)
0.2% Yield Strength	psi (MPa)	45,000 (310)	200,000 (1380)	160,000 (1100)
Elongation		30%	9%	10%
Hardness		B 85	C 46	C 42

* Data is typical and does not necessarily represent a minimum or maximum value requirement. Each lot may vary from these results.

MECHANICAL PROPERTIES (Condition "C")

Room Temperature Properties Typical Values for Sheet and Strip*		Condition "C"	Condition CH 900
Ultimate Tensile Strength	psi (MPa)	200,000 (1380)	240,000 (1655)
0.2% Yield Strength	psi (MPa)	175,000 (1205)	230,000 (1585)

* Data is typical and does not necessarily represent a minimum or maximum value requirement. Each lot may vary from these results.

PHYSICAL PROPERTIES
The values reported below are representative for average composition in the annealed condition.

Melting Range	2560-2625ºF (1404-1440ºC)
Density	0.282 lb/in^3 (7.80g/cm^3)
Specific Gravity	7.81
Modulus of Elasticity in Tension	29 x 10^6 (200 GPa)