Elgiloy Specialty Metals
Hampshire Mill

Alloy 17-7PH Stainless Steel

UNS: S17700
EN-DIN: 1.4568

17-7 PH is a precipitation-hardening stainless steel that provides high strength and hardness, excellent fatigue properties, good corrosion resistance, good formability, and minimum distortion upon heat treatment. The alloy provides valuable property combinations particularly well suited for aerospace applications. This special alloy also provides benefits for other applications requiring high strength and good corrosion resistance, as well as excellent properties for flat springs at temperatures up to 600°F (316°C)

Nominal Composition

	C	Mn	P	S	Si	Cr	Ni	Al	N	Fe	
min	-	-	-	-	-	16.0	6.5	0.75	-	-	
max	0.09	1.00	0.040	0.030	1.00	18.0	7.75	1.50	0.10	BAL	

Standard Heat Treatments

This material requires three essential steps in heat treating:
1) Austenite conditioning.
2) Cooling to transform the austenite to martensite.
3) Precipitation hardening to Condition TH 1050 or RH 950.
To obtain the highest mechanical properties from the alloy, Condition A material is transformed to martensite at the mill by cold reduction to Condition C. Hardening to Condition CH 900 is accomplished with a single, low-temperature heat treatment.

Typical Mechanical Properties – Typical Room Temperature Mechanical Properties

Condition	Tensile Strength (UTS)* ksi (MPa)	0.2% YS* ksi (MPa)	Elongation% in 2" (50.8 mm)	Hardness Rockwell
A	130 (896)	40 (276)	35%	85 HRBW
TH 1050	200 (1379)	185 (1276)	9%	43 HRCW
RH 950	235 (1620)	220 (1517)	6%	48 HRCW
C	220 (1517)	190 (1310)	5%	43 HRCW
CH 900	265 (1827)	260 (1793)	2%	49 HRCW

Typical mechanical properties are based, AK source on ASTM A693

Applicable Specifications

AMS 5528, AMS 5529, MIL-S-25043, ASTM A693 (Listed as Grade 631-UNS S17700)

Physical Properties

	Condition A	Condition TH 1050	Condition RH 950
Density lbs/in$_3$ (g/cm$_3$)	0.282 (7.81)	0.276 (7.65)	0.276 (7.65)
Modulus of Elasticity (E) ksi (Gpa)	–	29.0 x 10$_3$ (200)	29.0 x 10$_3$ (200)
Electrical Resistivity microhm-cm	80	82	83
Magnetic Permeability @ 50 oersteds	1.4 - 3.6	120 - 167	113 - 130
Magnetic Permeability @ 200 oersteds Maximum	1.4 - 3.2 1.4 - 3.6	46 – 55 134 - 208	44 – 52 119 - 135
Thermal Conductivity BTU/hr/ft$_2$/in/°F (W/m•K) 300°F (149°C)	–	117 (16.87)	117 (est) (16.87)
500°F (260°C)	–	128 (18.46)	128 (est) (18.46)
900°F (482°C)	–	146 (21.05)	146 (est) (21.05)
Coefficient of Expansion 70 - 200°F (21 - 193°C)	8.5 x 10^{-6} (15.3)	5.6 x 10^{-6} (10.1)	5.7 x 10^{-6} (10.3)
70 - 400°F (21 - 204°C)	9.0 x 10^{-6} (16.2)	6.1 x 10^{-6} (11.0)	6.6 x 10^{-6} (11.9)
70 - 800°F (21 - 427°C)	9.6 x 10^{-6} (16.0)	6.6 x 10^{-6} (11.9)	6.9 x 10^{-6} (12.4)

Corrosion Resistance

Corrosion resistance in Conditions TH 1050 and RH 950 is generally superior to that of the standard hardenable chromium types of stainless steels such as Types 410, 420 and 431, but is not quite as good as chromium-nickel Type 304. Corrosion resistance in Condition CH 900 approaches that of Type 304 in most environments.

Formability

In Condition A, the alloy can be formed comparably to Type 301. It work-hardens rapidly and may require intermediate annealing in deep drawing or in forming intricate parts. Springback is similar to that of Type 301. This alloy is extremely hard and strong in Condition C. Therefore, fabrication techniques for such materials must be used.

Weldability

The precipitation hardening class of stainless steels is generally considered to be weldable by the common fusion and resistance techniques. Special consideration is required to achieve optimum mechanical properties by considering the best heat-treated conditions in which to weld and which heat treatments should follow welding. This particular alloy is generally considered to have poorer weldability compared to the most common alloy of this stainless class, 17-4PH Stainless Steel. A major difference is the high Al content of this alloy, which degrades penetration and enhances weld slag formation during arc welding. Also, the austenite conditioning and precipitation hardening heat treatments are both required after welding to achieve high strength levels. When a weld filler is needed, W 17-7 PH is most often specified.

For further information email:
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