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**PRODUCT DATA SHEET**
**ALLOY 17-4PH**
**Stainless Steels**

UNS S17400

Also known as AISI Grade 630

**Chemical Composition**

Element	Composition %	Element	Composition %
<b>Chromium</b>	15.00 – 17.50	<b>Carbon</b>	0.07 max
<b>Nickel</b>	3.00 – 5.00	<b>Manganese</b>	1.00 max
<b>Copper</b>	3.00 – 5.00	<b>Silicon</b>	1.00 max
<b>Niobium + Tantalum</b>	0.14 – 0.45	<b>Phosphorus</b>	0.040
		<b>Sulphur</b>	0.030
		<b>Iron</b>	Remainder

Grade 17-4PH is a precipitation hardening stainless steel which has extremely high strength and hardness, combined with good ductility and toughness. It has excellent corrosion resistance, approaching that of stainless steel grade 304. Designers and engineers often choose the alloy for its high strength, with corrosion resistance superior to most other high strength steels.

**Typical Applications** High strength bolting and fasteners in aerospace and chemical plant applications. The alloy has been used in the petrochemical, petroleum, paper and food processing industries and has performed well. The alloy is also used for boat propeller shafts, where it is supplied as precision straightened, centreless ground shafting. It is also available as investment castings for uses such as boat fittings.

**Description** Alloy 17-4PH is a martensitic stainless steel alloyed with copper and niobium, which can be precipitation hardened by a simple heat treatment. Solution annealing gives a relatively soft low carbon martensite. Tempering in the range 480°C - 620°C precipitates an intermetallic compound based on copper, which gives high strength and hardness. Because the precipitation hardening temperature is relatively low little or no scale is formed, and it is easy to restore the corrosion resistance of the part. The hardening is accompanied by a small distortion.

The alloy is readily welded, formed and forged. Machining is carried out in the solution annealed condition and then precipitation hardened. As the hardening takes place over a range of temperatures, it is possible to vary the strength and ductility to achieve a range of mechanical properties.

**Availability** Austral Wright Metals can supply this alloy as fasteners, bar, wire, billet, welding consumables and forgings.

**Equivalent Specifications**

Country	Specification	Product Form	Steel
<b>Europe</b>	EN10088		X5CrNiCuNb16-4 1.4542
<b>USA</b>	ASTM A693	Plate, sheet & strip	UNS S17400 AISI 630
	ASTM A564	Bar	
	ASTM A705	Forgings	
	ASTM A747	Castings	CB-7Cu-1
<b>Japan</b>	JIS G4305		SUS 630

**Temper Condition** This steel is normally supplied in the solution annealed condition. It can also be supplied after a range of precipitation hardening treatments. The temper designation of the hardened material is Hxxxx, where xxxx is the precipitation heat treatment temperature in °F.

**Mechanical Properties** (ASTM A564, Bar & shapes)

Condition	Heat Treatment (all air cooled)	0.2% Proof Stress MPa (min)	Tensile Strength MPa (min)	Elongation %	Reduction Of Area %	Hardness		Impact Charpy V J (min)
						Rockwell C (min)	Brinell (min)	
Annealed	1040°C +/- 15			–	–	38 (max)	363 (max)	–
H900	480°C, 1 hr	1170	1310	10	40 (<= 75mm) 35 (75 – 200 mm)	40	388	–
H925	495°C, 4 hrs	1070	1170	10	44	38	375	6.8
H1025	550°C, 4 hrs	1000	1070	12	45	35	331	20
H1075	580°C, 4 hrs	860	1000	13	45	32	311	27
H1100	595°C, 4 hrs	790	965	14	45	31	302	34
H1150	620°C, 4 hrs	725	930	16	50	28	277	41
H1400	760°C +/- 5, 2 hrs 620°C +/- 5, 4 hrs	515	795	18	55	24	255	75

**Corrosion Resistance** 17-4PH has excellent corrosion resistance. It withstands corrosive attack better than any of the standard hardenable alloys and approaches the corrosion resistance of the standard austenitic stainless steel grade 304 in most media.

In rural and mild industrial atmospheres 17-4PH has excellent corrosion resistance. When exposed to sea coast atmospheres 17-4PH will slowly develop an overall light rusting and pitting. It is used successfully in salt water as boat shafting, with cathodic protection.

**Fabrication** 17-4PH can be cold formed to a limited extent in the annealed condition. Severe cold working should be done in the H1150 condition to reduce the possibility of cracking. The steel should be re-aged after cold forming to restore the best combination of properties.

17-4PH is readily hot forged. During heat treatment or forging, protective atmospheres containing carbon or nitrogen should be avoided. These elements can be absorbed into the steel surface and give soft austenitic skin. If a protective atmosphere is required argon or helium is recommended.

**Machinability** 17-4PH can be machined in both the solution annealed condition and the precipitation hardened condition. Because the final heat treatment temperature is low, 17-4PH can be machined to final dimension in the annealed condition and then aged without significant dimensional change or scaling unless the component is large, when allowance should be made for contraction on aging.

In the annealed condition machining is only marginally different from 300 series austenitic stainless steels. In the H900 condition the machining rate is 60% of that for annealed material.

**Welding** 17-4PH has excellent weldability under production conditions, with procedures similar to 300 series stainless steels. All welding methods can be applied. 17-4PH does not require pre-heat up to 100mm section.

AWS A5.4 E630 Covered Electrodes and AWS A5.9 ER630 filler metals are used for welds of matching strength. For matching corrosion resistance, grade 308 or 309 consumables may be used.

Weld metal properties approach those of the parent metal. Post weld heat treatment is required to achieve full strength. Single pass welds are precipitation hardened, multipass welds must be solution annealed first.

**Heat Treatment** The material is usually supplied solution annealed. It can be heat treated to a range of combinations of strength & ductility. Please ask Austral Wright Metals for advice.

Physical Properties	Property	Range	Annealed	H900	H1075	H1150	Unit
	Density		7,750	7,810	7,830	7,860	Kg / m <sup>3</sup>
	Specific Heat		23.0	23.0	–	–	W / m.°C
	Melting Range		1400 – 1440				°C
	Coefficient of Thermal Expansion	-100 – 20°C	–	10.4	–	–	x 10 <sup>-6</sup> / °C
		20 – 200°C	10.8	10.8	11.7	12.4	
	Thermal conductivity	20 – 425°C	11.3	11.7	12.2	13.0	W/m.°C
		100°C		18.3			
		500°C		23.0			
	Electrical resistivity		100	80	80	–	Microhm.cm
	Magnetic permeability		Approx 95 (ferromagnetic)				
	Modulus of Elasticity	Tension	–	200	–	201	GPa
		Torsion	–	77.2	69.0	69.0	

**Castings** 17-4PH can be cast readily by most processes. The cast equivalent to 17-4PH is CB-7Cu-1, as specified in ASTM A747. The properties are slightly inferior to those of wrought material.